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## SEARCH STRATEGY

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S1	american journal of public health	Ebook Central, Public Health Database, Publicly Available Content Database	595021*

\* Duplicates are removed from your search, but included in your result count.

# The Contribution of Criminal Justice Systems to Reproductive Health Disparities

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## ABSTRACT (ENGLISH)

Racial inequities are deeply embedded in the fabric of the United States. Two areas where racial disparities are highly prevalent are in the criminal justice system and in reproductive health outcomes. The United States has the largest incarceration rate in the world and incarcerates Black persons at a rate of nearly five times that of White persons.<sup>1</sup> Millions of persons in the United States also experience contact with law enforcement each year, and Black individuals experience the bulk of unjust and aggressive police encounters. The National Academies of Science, Engineering, and Medicine recently concluded, "There are likely to be large racial disparities in the volume and nature of police-citizen encounters when police target high-risk people or high-risk places, as is common in many proactive policing programs."<sup>2</sup>(p301)

Unfortunately, the racial disparities that disadvantage Black persons in the United States are also present in reproductive health, which is perhaps most clearly seen in the Black-White gap in preterm births.<sup>3</sup> Scholars note that these disparities are "likely largely due to social and physical exposures that vary by race due to enduring inequity in [the] USA."<sup>4</sup>(p934) The role of racially patterned social stressors (e.g., proactive policing) as a contributor to the racial preterm birth gap has gone overlooked, necessitating research to better understand how criminal justice systems contribute to reproductive health disparities.

The study by Jahn et al. (p. S21) in this issue of AJPH forwards research at the intersection of criminal justice and public health in a rigorous analysis that illuminates the unambiguous racial disparities in reproductive health and proactive policing; their study also details how the two intersect. Using data from the New Orleans Police Department and state vital statistics, the authors geocoded records from every birth occurring in New Orleans, Louisiana, from 2018 to 2019 (n = 9102) and linked these records with census tract data on proactive police stops. The findings show that Black birthing persons experience preterm birth at a rate that is nearly twice as high as that of White birthing persons (15.8% vs 8.0%).

## FULL TEXT

acial inequities are deeply embedded in the fabric of the United States. Two areas where racial disparities are highly prevalent are in the criminal justice system and in reproductive health outcomes. The United States has the largest incarceration rate in the world and incarcerates Black persons at a rate of nearly five times that of White persons.<sup>1</sup> Millions of persons in the United States also experience contact with law enforcement each year, and Black individuals experience the bulk of unjust and aggressive police encounters. The National Academies of Science, Engineering, and Medicine recently concluded, "There are likely to be large racial disparities in the volume and nature of police-citizen encounters when police target high-risk people or high-risk places, as is common in many proactive policing programs."<sup>2</sup>(p301)

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Black birthing persons are exposed to an annual average of 43.7 proactive police stops per 100 000 population compared with 30.7 stops on average in neighborhoods where White birthing persons reside. Most strikingly, the core findings detail that as levels of proactive policing in neighborhoods increase, the rate of preterm birth increases for Black birthing persons but actually slightly decreases for White birthing persons. Taken together, these findings demonstrate that policing operates in a blatantly different manner for Black than for White individuals.

The finding that proactive policing increases preterm birth among Black birthing persons clearly illustrates that in Black communities policing is failing to protect and serve the community. This work by Jahn et al. should stand as a clear message to public health scholars that it is imperative to rethink how policing operates in US neighborhoods and to work collaboratively with law enforcement partners toward a model of more equitable policing in Black communities.

This study must also be interpreted in the context of a new era of reproductive health laws in the wake of *Dobbs v. Jackson Women's Health Organization* (June 24, 2022). By barring access to abortion in nearly all circumstances, Louisiana recently enacted one of the most restrictive abortion bans in the country.<sup>5</sup> Among US states, Louisiana has the third highest preterm birth rate,<sup>6</sup> the highest prison rate,<sup>7</sup> and the second highest rate of Black imprisonment.<sup>1</sup> Louisiana also has deep-seated systemic racism in policing that has led to a consent decree for civil rights violations and other misconduct by the New Orleans Police Department.<sup>8</sup>

In an era when both criminal justice and reproductive health have emerged as core political issues at local, state, and national levels, this study serves as a blunt reminder that criminal justice and reproductive health are intricately intertwined. The work of Jahn et al. demonstrates that the current state of criminal justice in Louisiana contributes to harming newborns' health. If policymakers in Louisiana care about the well-being of fetal life, then criminal justice reforms that ensure more equitable policing in Black communities should be at the forefront of policy agendas.

Jahn et al. highlight how criminal justice systems contribute to reproductive health disparities, and their findings point to areas where future research is needed. Currently, research on policing is largely divided into two major areas that are often studied independently. One area focuses on the potential crime reduction benefits attributed to policing; for example, does policing improve or save lives by deterring potential criminal offenders?<sup>9</sup> The other area, which is the focus of the work of Jahn et al., looks at the social and health consequences associated with policing; for example, does proactive policing harm the health of citizens or even cost lives?<sup>10</sup> Moving forward, researchers should be challenged to think about the "social ledger" of policing. In other words, what is the net return of policing on society once policing's positive and negative effects on communities and individuals have been taken into account.<sup>11,12</sup>

To better understand the impacts of policing, enhancing the criminal justice data infrastructure is key. Criminal justice data documenting police-citizen interactions is, unfortunately, lacking in quality. Jahn et al. put forth an impressive effort by linking a wide range of available data sources. Even so, the data from the New Orleans Police Department lacks critical information, including citizens' perspectives of the police encounter, where the stop occurred (e.g., on the streets, in a car, in a dwelling), basic demographic information about the officers and citizens involved, details about what occurred during the stop (e.g., physical or verbal aggression), how procedurally just or unjust the stop was, and how the interaction was resolved. Improving the quality and accessibility of data on police-citizen interactions is fundamental for future research to understand why these events pose a threat to health and what can be done to improve the nature of these interactions.

Jahn et al. focus on the contribution of proactive policing to Black-White health reproductive health disparities in a major metropolitan city. Considering the profound racial disparities in criminal justice and reproductive health, this is undoubtedly a vital focus. Moving forward, research must also consider whether proactive policing negatively affects other racial and ethnic minority groups in the United States, including Hispanic and Native American persons. Relatedly, most existing research on the social consequences of policing focuses on urban areas. However, research on the health impacts of policing in rural communities is likewise an important area of future inquiry. With their novel findings pertaining to the contribution of proactive policing to racial reproductive health disparities, Jahn et al. offer a novel look at the ongoing crisis that criminal justice systems present to the health of Black communities, as well as an important reminder that there is much about the consequences of criminal justice systems that is still not fully understood. These findings offer a clear call to the public health community that to ensure the health of the next generation of children, it is paramount to act toward more equitable policing. Improving police-community relations is good policy overall, but as Jahn et al. have shown us, it may also be good reproductive health policy. >4JPH

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#### PUBLICATION INFORMATION

Full Citation: Testa A. The contribution of criminal justice systems to reproductive health disparities. *Am J Public Health*. 2023;113(S1):S10-S12.

Acceptance Date: September 5, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307119>

#### ACKNOWLEDGMENTS

The author would like to thank Luisa Borrell and Ana Diaz for helpful comments on previous drafts of this editorial.

#### CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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## DETAILS

<b>Subject:</b>	Police departments; Community relations; Reproductive health; Health disparities; Racial differences; Black people; Public health; Neighborhoods; Research; Womens health; Law enforcement; Premature birth; Consent decrees; Inequality; Abortion; Racial inequality; Judicial system; Archives & records; Birth; Reproductive systems; Police; Race factors; Vital statistics; Medicine; Criminal justice; Censuses; Statistical analysis; Imprisonment; Stress
<b>Business indexing term:</b>	Industry: 92212 : Police Protection
<b>Location:</b>	Louisiana; United States--US
<b>Company / organization:</b>	Name: Police Department-New Orleans LA; NAICS: 922120
<b>Classification:</b>	92212: Police Protection
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S10-S12
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal



Language of publication:	English
Document type:	Journal Article
ProQuest document ID:	2770264176
Document URL:	<a href="https://www.proquest.com/scholarly-journals/contribution-criminal-justice-systems/docview/2770264176/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/contribution-criminal-justice-systems/docview/2770264176/se-2?accountid=211160</a>
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Last updated:	2023-08-22
Database:	Public Health Database

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# Dismantling Structural Racism by Advancing Immigrant Health

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## ABSTRACT (ENGLISH)

In "Strategies for Naming and Addressing Structural Racism in Immigrant Mental Health," Cerda et al. (p. S72) make a critical call to bring a structural racism framework into efforts to promote immigrants' mental health. Mounting public health research shows that structures and systems of racism are associated with poor health, yet there have been limited applications of a structural racism framework to immigrant health research or practice.<sup>1</sup> As Cerda et al. highlight, structural racism can harm immigrants' health through processes such as policies, workplace conditions, and treatment in mental health service settings. Building on the work of Cerda et al., we discuss how the US immigration system shapes and is shaped by structural racism. We offer recommendations for dismantling structural racism by going to the sources of racial power in research and practice, addressing the intersecting systems that harm health, and advancing antiracist multisectoral partnerships.

## FULL TEXT

In "Strategies for Naming and Addressing Structural Racism in Immigrant Mental Health," Cerda et al. (p. S72) make a critical call to bring a structural racism framework into efforts to promote immigrants' mental health. Mounting public health research shows that structures and systems of racism are associated with poor health, yet there have been limited applications of a structural racism framework to immigrant health research or practice.<sup>1</sup> As Cerda et al.

highlight, structural racism can harm immigrants' health through processes such as policies, workplace conditions, and treatment in mental health service settings. Building on the work of Cerda et al., we discuss how the US immigration system shapes and is shaped by structural racism. We offer recommendations for dismantling structural racism by going to the sources of racial power in research and practice, addressing the intersecting systems that harm health, and advancing antiracist multisectoral partnerships.

#### STRUCTURAL RACISM THROUGH IMMIGRATION POLICY

Although immigration policy often uses verbiage devoid of race and has been studied on a separate axis from other forms of structural racism,<sup>2</sup> US policy history reinforces that federal immigration policy and other nonfederal immigrant-related policies<sup>3</sup> are mechanisms of structural racism. The US immigration system has been shaped by xenophobic and racist attitudes and has served as a tool of racial control.<sup>4</sup> Immigration policies directly shape the racial composition of the nation and have contributed to the maintenance of a White-dominant society.<sup>5</sup> In some cases, immigration policy has been an explicit manifestation of racist objectives, such as denial of entry into the United States for targeted groups. For example, the Chinese Exclusion Acts of the late-19th century and the Immigration Act of 1924 barred admission to individuals based on their race and country of origin.<sup>6</sup> More recently, the series of "Muslim Ban" executive orders, beginning in 2017 and repealed in 2021, established country of origin-based exclusions rooted in Islamophobia, largely targeting Middle Eastern and African countries ([bit.ly/ 3hxBgAu](https://bit.ly/3hxBgAu)). Racist objectives have also been less overt in the immigration system, instead manifesting through concepts of citizenship (e.g., legal and social belonging), safety and criminality, terrorism and national security, and economic contribution and group deservingness. Citizenship policies determining immigrants' legal status produce subordinate social positions for noncitizens of color, bolster the nation's racial hierarchy, and maintain White political and economic power.<sup>7</sup> For example, the Bracero Program, which employed guest workers from Mexico to fill labor shortages, was terminated in 1964 when Mexican laborers were no longer needed and were viewed as an economic threat to a predominantly White, citizen workforce.<sup>8</sup> Its ending caused cross-border workers to be categorized as "illegal," resulting in a recategorization of Mexican guest workers as "illegal immigrants" undeserving of political or economic benefits.<sup>9</sup> The Personal Responsibility and Work Opportunity Reconciliation Act of 1996, which was aimed at welfare reform, established a five-year waiting period for those who were newly arrived and were predominantly Latinx (a gender-inclusive term we use to describe the population of people born in Latin America or of Latin American background) and Asian documented immigrants to be qualified for nonemergency Medicaid services.<sup>8</sup> The Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA) of 1996 invoked fears about crime and immigrant criminality to authorize collaboration between immigration authorities and local law enforcement and to expand the list of criminal offenses that are grounds for deportation.

Beyond systems explicitly related to migration and citizenship, societal and policy responses to immigrants provide justification for racist policies in other areas: the economic scapegoating of immigrants justifies the curtailment of public benefits, myths of noncitizen voter fraud justify voting restrictions, and concerns about illegal drug trafficking justify punitive domestic drug policies. Immigration policies are the product of racialized attitudes regarding immigrant "legality" and deservingness as well as "color-blind" approaches that reinforce racial/ethnic inequities. Consequently, immigration policies serve as legally and socially acceptable means to exclude individuals seemingly based on legal status while actually reinforcing other mechanisms of structural racism.

#### GOING TO THE SOURCES OF RACIAL POWER

In addressing immigration policy as a mechanism of structural racism, it is critical to go beyond immigrant populations themselves and examine the root sources of racial inequality. The US system of racial hierarchy is created by the power of a White-dominant society.<sup>7</sup> Despite having different histories of migration and trajectories of racialization in the United States, immigrants are "linked by a shared experience of US government oppression."<sup>9</sup>(p51) The public health field should continue to shift its unit of analysis from a focus on racial/ethnic categories to the structures and systems that are the source of power, racialization, and racial inequities.<sup>10</sup> When racial/ethnic categories are used to measure racial/ethnic health inequities, they serve as proxies of racism and experiences of individuals' racialized positions.<sup>10</sup> This may obscure variations within groups and implicitly

reinforce the idea that intrinsic group differences, rather than structures and systems, determine how racism harms health. The public health field can move beyond racial/ethnic categories to measure racialized experiences and inequalities in immigrant populations ([bit.ly/3G62VmG](https://bit.ly/3G62VmG)). For example, a recent study looked at the types of immigration enforcement that Latinx and Asian immigrants experience (e.g., being racially profiled, being deported or knowing someone who was).<sup>11</sup> Not surprisingly, the two groups were found to have distinct patterns of exposure to racialized enforcement encounters, with Latinxs experiencing the greatest extent of enforcement. Yet, the relationship between enforcement encounters and mental health was the same for both groups: each additional enforcement encounter was associated with increased psychological distress for both Latinx and Asian immigrants. Although groups may experience distinct patterns of racialization, it is these experiences of racial discrimination- not intrinsic group differences-that likely drive outcomes. Researchers can shift from solely using racial/ethnic categories to measuring systems, institutions, and manifestations of racism (e.g., enforcement, labor exploitation); practitioners can shift from developing interventions tailored solely to specific racial/ethnic groups to those tailored to address trauma and other harms from racial exclusions (e.g., affected by deportation or workplace abuses). Public health researchers have begun to shift the focus to systems of racism by measuring immigration policies. As Cerda et al. note, there is a growing body of evidence that anti-immigrant policies are associated with worse immigrant health outcomes.<sup>12</sup> Expanding this level of examination and developing policy interventions are central to dismantling structural racism and can involve incorporating other types of public policies that perpetuate structural racism. For example, a recent policy scan identified racism-related state policies that may influence health, including mandatory minimum sentencing laws, stand your ground laws, and voting restrictions.<sup>13</sup> Public health researchers can examine additional structures and systems, such as the labor laws that produce weak worker and financial protections for immigrants. Practitioners and advocates can support policy change efforts that address both immigration- and nonimmigration-related policy change. Through these actions, the public health field can study and intervene in policies and institutions perpetuating racial/ethnic health inequities.

#### ADDRESSING INTERSECTING SYSTEMS

Cerda et al. highlight that improving immigrant health is critical for improving the health of all populations in the United States. Similarly, addressing the mechanisms of structural racism that affect immigrants of color is critical to dismantling structural racism for their US-born children and people of color broadly. Although we agree with Cerda et al. that it is important to address the needs of Latinx and Asian immigrants, a structural racism framework brings needed attention to other immigrant groups because it focuses on intersecting systems, institutions, and practices and how they reinforce one another to harm health.<sup>14</sup> Historical and present mechanisms of structural racism that may seem unique to immigrants (e.g., immigrant policies) work in conjunction with the mechanisms related to other social determinants of health, such as housing, reproductive justice, mass incarceration, and economic inequality. Addressing structural racism mechanisms related to immigrants can contribute to strategies to dismantle these other systems of structural racism.<sup>15</sup> We provide a few brief, nonexhaustive examples of the intersectional experiences of a range of immigrants of color:

\* Undocumented Latinx immigrants experiencing homelessness are uniquely vulnerable to mental health challenges. In a report from Los Angeles County, California, a region with high rates of homelessness, unhoused Latinx individuals were the least likely to receive public benefits compared with other racial/ethnic groups because of factors such as their legal status.<sup>16</sup> Approaching their mental health service needs from a structural racism framework requires that we address racially exclusionary housing policies, labor exploitation and precarious employment, and citizenship policies that intersect to produce housing instability and limit options to obtain mental health services.

\* Although women across the United States contend with abortion restrictions, undocumented women of color living along the US-Mexico border face an additional hurdle to obtaining an abortion: the direct threat of immigration enforcement. The region is dotted with multiple Border Patrol stations, where racial profiling is routine. Whether in California, which continues to allow abortions, or in Texas, which now prohibits it, undocumented women face detection and apprehension if they travel by road to obtain an abortion.<sup>17</sup> Their risks of psychological distress stem

from the intersections of sexist, antiabortion policies, citizenship policy, enforcement policies, and racialprofiling practices.

\* Black immigrants are at heightened risk of traumatic encounters with law enforcement and being caught in the US deportation dragnet. Stop-and-identify and stop-and-frisk policies, which allow law enforcement to stop and interrogate individuals, have a disproportionate effect on Black, Latinx, and Black-Latinx citizens and noncitizens because of racial discrimination in policing.<sup>13</sup> Studies have shown a link between neighborhood stop-and-frisk encounters and psychological distress.<sup>18</sup> Black immigrants are more likely to be detained and deported because of a criminal conviction, not immigration violations, than are non-Black immigrants.<sup>19</sup> Intersecting policing, criminal-legal, and immigration enforcement policies as well as racially discriminatory police practices have produced distinct vulnerabilities among Black immigrants.

\* Asylum seekers face threats to their mental health because of premigration or migration trauma and stress from the extreme precariousness of being granted protected status by the US government. Yet, although all individuals in danger are deserving of human rights, US immigration policy has favored some groups over others. Ukrainian and Syrian refugees have been welcomed as a response to devastating wars overseas. By contrast, asylum seekers from Venezuela and other countries arriving at the southern border have been treated as political pawns in actions akin to the treatment of Black individuals during the Reverse Freedom Rides in the 1960s ([bit.ly/ 3G1PpQV](https://bit.ly/3G1PpQV)). Haitian asylum seekers were violently turned away by mounted Border Patrol at the Rio Grande in Texas ([bit.ly/3tgz4Ae](https://bit.ly/3tgz4Ae)), and others have been denied entry under Title 42, a law from the 1940s that was reactivated for the COVID-19 pandemic.

\* Long-term harms of systemic racial exclusion are evident among Asian immigrants. For example, Southeast Asian youth refugees who arrived in the United States in the 1970s and 1980s were settled in communities that had long faced overpolicing and disinvestment in employment, education, and health resources. They and their families received little mental health support to process the traumas of US-caused wars.<sup>20</sup> As a result, some of these youths engaged in criminal activity and were incarcerated. Today, despite being lawful permanent residents and completing their prison sentences, under IIRIRA, the US government has proactively sought to remove thousands of these refugees from the United States.<sup>20</sup>

These examples highlight that expanding the public health and social services safety net for immigrants is necessary but not sufficient. For example, as Cerda et al. note, worker protections may be ineffective if undocumented immigrants are threatened by employer retaliation. If policy changes are made in only one domain (e.g., mental health care), it will not be enough to dismantle structural racism. Policies that decriminalize immigrants, for example, by providing them with driver's licenses or limiting local law enforcement's collaboration with immigration authorities, may lower unmet medical needs for some populations, such as the children of immigrants.<sup>21</sup> Other strategies can include working to repeal laws such as IIRIRA, advocating to end policies of anti-Black racism (e.g., stop-and-identify, voting restrictions), establishing affordable housing and renter protections, and supporting the long-time reproductive justice efforts of women of color.

#### ANTIRACIST MULTISECTORAL PARTNERSHIPS

Multisectoral partnerships that change multiple systems are necessary to address the embedded, intersecting systems of structural racism.<sup>15</sup> This requires public health to partner with other sectors, such as housing, reproductive justice, and community investment. As Cerda et al. note, immigrant communities must be key partners in such efforts. Public health researchers and practitioners can partner with and support community organizations that may not be explicitly health care focused but that are engaged in dismantling structural racism. Immigrant-led and -serving organizations have been piecing together community support and funding for a long time to meet the needs of those not served by the US safety net. Supporting and collaborating with immigrant-led organizations that incorporate a structural racism framework into their work, such as Black Alliance for Just Immigration (<https://baji.org>) and the California Immigrant Youth Justice Alliance (<https://ciyja.org>), can advance community-centered advocacy, interventions, and policy change that are informed by a deep understanding of the source of racial inequities and the strategies needed to achieve equity.

In working with partners, it is critical that we also examine and address the patterns of racism that are closest to us, being mindful of our own power and prejudices and how they influence our research questions, interventions, and relationships. Health care and social welfare leaders, policies, and programs in the United States have contributed to structural racism. Some public health programs created segregated and unequal services and reinforced racially coded concepts of the deservingness of different groups.<sup>22</sup> Interventions that have placed the responsibility for change on immigrants do not address the "fundamental" causes of racism and ultimately reinforce racial health inequities. <sup>23</sup> Scholars and practitioners from immigrant communities and communities of color should (and need support to) be leaders in addressing structural racism in our field.

The work of dismantling structural racism also needs to happen across social (e.g., familial networks, peer networks) and cultural (e.g., houses of worship, cultural organizations) settings where people organize socially and politically. As Latina public health scholars, one White and one Black, our experiences reflect that racism, racial inequalities, and colorism are present in Latin America, not just in the United States, even if the dynamics differ between countries. We are mindful of how racism is perpetuated by the structures and attitudes in these settings. Furthermore, as non-Asian women, we know that we do not have the expertise to speak of the diverse experiences of Asian immigrants and need to build multiracial partnerships to advance racial equity.

As research on structural racism and its effects on health continues to advance, the structural racism framework is a vital tool for informing immigrant health research, policies and interventions, and partnerships. When immigrant health is examined through a structural racism framework, it becomes evident that policies, practices, and attitudes related to immigration are manifestations of structural racism. Addressing the mechanisms of structural racism in immigrant health can contribute to strategies to dismantle the many other systems of structural racism.

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#### PUBLICATION INFORMATION

Full Citation: Young MED, Crookes DM. Dismantling structural racism by advancing immigrant health. *Am J Public Health*. 2023;113(S1):S16-S20.

Acceptance Date: November 11, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307172>

#### CONTRIBUTORS

The authors contributed equally to this editorial.

#### ACKNOWLEDGMENTS

We acknowledge the historical and current work of scholars of antiracism, structural racism, and immigration and thank them for their personal and professional labor in conducting the research that is the foundation of our comments.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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## DETAILS

<b>Subject:</b>	Racial discrimination; Citizenship; Homeless people; Public health; Race; Systemic racism; Racial profiling; Deportation; Abortion; Health disparities; Minority & ethnic groups; Xenophobia; Medical research; Noncitizens; Mental health; Border patrol; Immigration policy; Workers; Immigrants; Health services; Racism; Discrimination; Workplaces; Mental disorders; Health education; Immigration; Dismantling; Health research; Working conditions
<b>Business indexing term:</b>	Subject: Workers
<b>Location:</b>	Mexico; United States--US; California
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S16-S20
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Commentary
<b>ProQuest document ID:</b>	2770264168
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/dismantling-structural-racism-advancing-immigrant/docview/2770264168/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/dismantling-structural-racism-advancing-immigrant/docview/2770264168/se-2?accountid=211160</a>
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# Police Violence: Reducing the Harms of Policing Through Public Health–Informed Alternative Response Programs

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## ABSTRACT (ENGLISH)

Police violence is a public health issue in need of public health solutions. Reducing police contact through public health-informed alternative response programs separate from law enforcement agencies is one strategy to reduce police perpetration of physical, emotional, and sexual violence. Such programs may improve health outcomes, especially for communities that are disproportionately harmed by the police, such as Black, Latino/a, Native American, and transgender communities; nonbinary residents; people who are drug users, sex workers, or houseless; and people who experience mental health challenges. The use of alternative response teams is increasing across the United States. This article provides a public health rationale and framework for developing and implementing alternative response programs informed by public health principles of care, equity, and prevention. We conclude with recommendations for public health researchers and practitioners to guide inquiries into policing as a public health problem and expand the use of public health-informed alternative response programs. (*Am J Public Health*. 2023;113(S1):S37-S42. <https://doi.org/10.2105/AJPH.2022.307107>)

## FULL TEXT

### Headnote

Police violence is a public health issue in need of public health solutions. Reducing police contact through public health-informed alternative response programs separate from law enforcement agencies is one strategy to reduce police perpetration of physical, emotional, and sexual violence. Such programs may improve health outcomes, especially for communities that are disproportionately harmed by the police, such as Black, Latino/a, Native American, and transgender communities; nonbinary residents; people who are drug users, sex workers, or houseless; and people who experience mental health challenges.

The use of alternative response teams is increasing across the United States. This article provides a public health rationale and framework for developing and implementing alternative response programs informed by public health principles of care, equity, and prevention.

We conclude with recommendations for public health researchers and practitioners to guide inquiries into policing as a public health problem and expand the use of public health-informed alternative response programs. (*Am J Public Health*. 2023;113(S1):S37-S42. <https://doi.org/10.2105/AJPH.2022.307107>)

After decades of activism led by marginalized communities, the American Public Health Association (APHA) recently declared police violence a public health issue in need of public health solutions.<sup>1</sup> One intervention to reduce the



harms of policing is the use of trained, unarmed, nonpolice alternative response teams to respond to emergency calls for behavioral health crises and nonviolent incidents (e.g., noise or loitering complaints, traffic incidents, or requests for general assistance).

In this article, we (1) detail how working toward health equity in the United States requires alternatives to contemporary policing, (2) describe key differences between existing response models and public health-informed alternative response teams, (3) identify strategies for aligning alternative response programs with public health values, and (4) recommend actions for public health workers.

## HARMS OF POLICING AND THE NEED FOR ALTERNATIVES

Policing in the United States is historically rooted in suppressing racially marginalized groups to exploit labor, control wealth accumulation, and dismantle social movements that challenged White supremacy and structural racism.<sup>2</sup> Stemming from a system used to assert White dominance by consolidating resources to benefit White people in power,<sup>2</sup> current policing practices in the United States continue to perpetuate racial disparities by disproportionately targeting Black, Latino/a, Native American, and other marginalized groups.<sup>3-5</sup> These policing practices—and the resulting incarceration and ensnarement into the criminal legal system— are a root cause of health inequities.<sup>2,6,7</sup>

### Evidence of Systemic Policing Harms

Each year, police kill more than 1000 people and injure more than 50 000 young people 15 to 34 years of age in the United States.<sup>3,8</sup> These deaths and injuries are patterned by race. Black people are 5 times more likely than White people to sustain an injury by police that requires emergency room care,<sup>1</sup> and police violence is the sixth leading cause of death for young Black men.<sup>4</sup> Although police violence against Black men and boys has recently received research and media attention,<sup>9</sup> other racial/ethnic groups (e.g., Latino/a, Native American) and marginalized groups (e.g., people who are drug users, sex workers, transgender, or houseless or experience mental health challenges) are disproportionately affected. Data on the full extent of harms caused by police—including physical, sexual, and psychological violence—are not accurately documented or comprehensively collected.<sup>8,10</sup>

The harms of police violence ripple across families, communities, and society. Police violence can increase parental stress, caregiver responsibilities, job loss, and family economic hardship.<sup>6</sup> Policing practices have been shown to affect mental health and increase rates of adverse health conditions for people living in heavily policed communities.<sup>5,11</sup> Research shows that the killing of Black people at the hands of police also destabilizes Black Americans' mental health vicariously as individuals do not need to live near or know victims to be traumatized by their death.<sup>12</sup>

Current policing models also harm communities through aggressive escalation of incidents (e.g., traffic stops) and behavioral health crises. Since the 1960s, the US government has shifted funding for addressing social problems to local police departments.<sup>11</sup> This investment in police occurred even though police are not mental health or social service professionals, and 68% of law enforcement agencies have no specialized response protocol to address mental health crises.<sup>13</sup> When police respond to behavioral health crisis calls, they are likely to use the main tools of their training, citations and arrests.<sup>14</sup>

Despite limited evidence that investing in police reduces crime rates or harm to communities, state and local governments have increased funding for police over the past decades.<sup>15,16</sup> Coupled with the mounting evidence of harm and ongoing activism led by directly affected communities, these data have prompted many people in the United States to seek and build alternatives to armed police that support community health.<sup>14,17,18</sup> Given the APHA policy statement on police violence,<sup>1</sup> public health researchers and practitioners have essential roles in examining existing approaches and advocating for public health-informed alternative response programs to remove the harms of policing and promote public safety and well-being.<sup>2,6,9</sup>

### Alternative Response Versus Police-Involved Programs

Increasingly, municipalities are exploring ways to reduce the harms of policing by creating community safety response programs that do not include the police. These types of response programs have been labeled "community response models."<sup>14,17</sup> We call them "alternative" response programs to specify that they are an "alternative to police involvement." Analysis of emergency call data shows that 33% to 68% of 911 calls are

"noncriminal" and could be diverted to alternative response programs or handled administratively.<sup>17</sup> Recently established alternative response programs often begin by redirecting calls away from police for mental health or substance use crises.<sup>17</sup>

Emerging evidence suggests that these programs are efficient and effective. For instance, the country's longest-running alternative response program, Crisis Assistance Helping Out On The Streets (CAHOOTS), receives 2% of the Eugene, Oregon, police department's budget while handling 10% of calls in which police would have traditionally responded.<sup>19,20</sup> During the 6-month pilot of the Support Team Assisted Response (STAR) program in Denver, Colorado, there was a 34% reduction in the incidents the STAR team was designated to respond to, as well as a reduction in the number of crimes within the geographic boundaries of the intervention. Also, STAR was implemented at a quarter of the cost of police response.<sup>14</sup> Overall, alternative response teams are more likely to respond to calls for service with care (e.g., linkage to health services, de-escalation) versus criminalization.<sup>14,18</sup> The absence of public health-informed approaches and advocacy has meant that the most frequent types of reforms used, crisis intervention teams, expand the role of police in mental health crises rather than funding a separate response team with adequately trained social service providers. There are more than 12 000 local police departments in the United States, within which more than 3000 crisis intervention teams have been trained since the 1980s.<sup>21</sup> Another police-involved reform often implemented is the co-response model, wherein police are dispatched with mental health practitioners to behavioral health crises. Quantitative evaluations of co-response programs have shown mixed results regarding arrest rates between co-response and police-only teams,<sup>22,23</sup> and rigorous evaluations of crisis intervention team models have revealed that they do not significantly affect arrest or use-of-force rates among officers who have received the training.<sup>24</sup> Thus, the most commonly used reforms still respond with an armed officer and do not diminish the criminalization of people in mental health crisis.

Alternative response programs will likely increase across the United States as a result of recent funding by the Biden administration in Section 9813 of the American Rescue Plan for "community-based mobile crisis intervention services." Although these programs have the potential to reduce the harms of policing by reducing the scope of police response, this growing programmatic solution has wide variation, and there is an urgent need to use public health data and principles to inform these investments.

#### PUBLIC HEALTH-INFORMED ALTERNATIVE RESPONSE PROGRAMS

Existing alternative response programs vary in personnel, scope, and operation. Public health-informed alternative response teams can respond to a range of situations, including mental health or substance use crises, nonviolent incidents (e.g., noise or loitering complaints, traffic incidents, requests for general assistance), and low-level offenses (e.g., trespass or indecent exposure).<sup>14,17,18</sup> These response teams typically include people trained as social workers or medics and community members trained in crisis intervention or de-escalation. In this section, we highlight 3 key strategies based on public health values and the evidence reviewed in the preceding section to guide a public health-informed alternative response program.

The first strategy is to involve directly impacted communities in program design, implementation, oversight, and evaluation. A core principle of public health program design is that affected communities should be at the center of any design process. In this case, impacted communities would include those disproportionately harmed by police. This process should involve broad community engagement, hiring and empowering community members as key decision makers and implementers in the program.

Community engagement was critical to developing the Street Crisis Response Team (SCRT) program in San Francisco, California.<sup>25</sup> Community-based organizations and directly affected individuals were involved in planning and launching this pilot initiative. This engagement resulted in teams having a geographic focus to emphasize relationship building within different communities and instituting follow-up support after an initial crisis response. Beyond the design, members from these communities should be integrated into an alternative response program as responders or other staff. The SCRT program includes a community paramedic, a behavioral health clinician, and a peer or person with lived experience.<sup>25</sup> The CAHOOTS program also specifically hires people with lived experience or work experience in de-escalation who respond alongside a medic.<sup>20</sup> Similarly, the STAR team consists of a

mental health worker and a paramedic.<sup>14</sup>

Finally, all programs need ongoing oversight and evaluation to ensure that program goals and design are enacted appropriately and minimize harm. Members from directly affected communities need to be able to indicate which evaluation questions are most important and keep the program and its staff accountable for any harm. In Denver, after the initial success of a pilot program, the crisis response team expanded and was placed within the department of public health. However, the lack of inclusion of community members and organizations in decision making—particularly on a promised community advisory committee—has fostered distrust with community-based organizations. Alienated from this work, community members are now considering parallel response programs that are more responsive to community needs.<sup>26</sup>

The second strategy is to develop a program that operates independently of law enforcement agencies and the broader criminal legal system. Ample evidence demonstrates that police surveillance, harassment, and violence harm a community's mental and physical health.<sup>3,6,8</sup> Similarly, police contact is an entry point to the criminal-legal system, which traps historically marginalized groups into systems of parole, detention, jails, and prisons, which are also detrimental to health.<sup>1,27</sup> A public health-informed alternative response program must operate independently from these punitive and harmful systems, work to diminish their impact, and be linked to supportive public health and social services. To be considered an alternative response program, the program cannot exist within a police department, include police as first responders, or co-respond with police.

Structuring independence from police and the criminal legal system occurs at multiple points within alternative response program development. The control and operation of existing alternative response programs differ as a result of the varying concerns, needs, and power of local advocates and the responsiveness of government officials. For example, San Francisco's SCRT is administered by the Department of Public Health in partnership with the fire department,<sup>25</sup> an example of a program housed within the municipal government. Alternatively, community groups in Oakland, California, pushed to house the Mobile Assistance Community Responders (MACRO) program within a community-based agency.<sup>18</sup> After the Oakland City Council decided to locate MACRO within the fire department, community advocates successfully pushed for a resolution establishing community control of the program.<sup>18</sup> The CAHOOTS program in Eugene is housed within a nonprofit medical clinic and contracted by the local government for crisis response services.<sup>20</sup>

In addition, some communities have proposed establishing alternative response teams as entirely new city entities, for example the Department of Community Safety and Violence Prevention in Brooklyn Center, Minnesota, and the Community Safety Department in Durham, North Carolina. By contrast, efforts such as Mental Health First in Oakland and Sacramento, California, have been developed by grassroots organizers and are funded and operated by local communities entirely separate from the municipal government.<sup>18</sup>

Beyond where programs are housed, whether and how alternative response teams receive 911 calls is another critical juncture for reducing or eliminating interactions with police. Ideally, an alternative response program has its own emergency number (e.g., 311). Yet, even with a separate number, alternative response programs may seek to be first responders to specific types of calls for service received by 911 call centers. Clear training protocols for 911 dispatchers are necessary so that police are not the default responders to behavioral health crises or any other calls for service deemed appropriate for the alternative response team to address. Police response to calls in which alternatives were expected or requested may erode trust between alternative response teams and directly impacted communities, threatening program success. It is also important to establish whether law enforcement operates local 911 call centers given that this varies widely across the United States. In those instances, it is crucial to prevent law enforcement from accessing call records or influencing diversion protocols.

The third strategy is to secure adequate program and social service funding by diverting funds from police. If an alternative response program does not have sufficient resources to respond in times of crisis, community members could view it as a failure. Funding should be allocated not only for program operations but also to equitably compensate directly impacted community members involved in the program's design, implementation, evaluation, and oversight.

In addition, if the broader ecosystem of social services is underfunded,<sup>2,7,28</sup> the impact of connecting people to supportive social services will be limited. Funds should be allocated to multiple social systems given that the ultimate success of alternative response teams depends on connecting people to critical support services. Although many municipalities face budgetary constraints, evidence shows that alternative programs can divert responsibilities from the local police (e.g., CAHOOTS, STAR).<sup>14,19</sup> Reallocating public funds toward programs aligned with public health principles and the social determinants of health is critical. The funding for these alternative programs should shift resources away from police budgets as the scope of police work decreases.

This is contentious territory. Although calls to defund the police have grown, actual budgets have not decreased.<sup>29</sup> Even where the scope of police work has diminished, police budgets have not. For example, although the CAHOOTS program has diverted a significant portion of calls from the police, the police budget has not decreased commensurately with the police workload.<sup>19,20</sup> When the STAR program expanded in Denver, the police chief noted its impact but did not decrease the police budget.<sup>18</sup> Movements for alternative response programs and robust social services need municipal budgets to shift funds from punitive and harmful systems into public health-oriented preventive systems.

### RECOMMENDATIONS FOR ACTION

Alternative unarmed response programs represent a potential public health intervention to reduce the harms of policing but only if they are planned, implemented, and adopted with public health values and principles—as described in the preceding section—at the forefront. We share 3 recommendations for public health workers (e.g., researchers and practitioners) to support the expansion of public health-informed programs.

First, public health workers must consider police violence when identifying the causes of health issues and health inequities in local communities. For too long, public health entities have ignored policing as a root cause of health inequities. Public health workers can identify how armed policing and its sequelae contribute to health problems in local communities and require an urgent public health response, such as a public health-informed alternative response program.

Second, public health workers can advocate for public health-informed alternative response teams in their local area, guided by the 3 strategies in the preceding section. After further education (e.g., a review of APHA policy statements and research<sup>1,27</sup> and the first rigorous evaluation of an alternative response program<sup>14</sup> and a thorough assessment of different alternative programs by directly impacted community advocates and researchers<sup>18</sup>), public health leaders should communicate with local elected officials that policing is a public health issue that warrants intervention. Public safety is frequently considered an issue in which police have expertise. However, the social determinants of health literature suggests that many public safety issues are exacerbated by armed police and a lack of supportive social services.<sup>1,7</sup> Public health offers a critical framing that can reorient power and resources toward care, equity, and prevention and away from punitive and violent systems.

Finally, public health workers should conduct rigorous evaluations of alternative response programs in collaboration with community partners to identify their potential causal role in improving health and addressing health inequities.<sup>14</sup> It is critical to partner with directly impacted communities and individuals to ask the following questions: What are the effects of reducing police interactions and using alternative first responders? What are the characteristics of alternative response programs that improve health and reduce health inequities? What key supports are necessary to implement such programs?

### CONCLUSION

Over the past decade, public health research has demonstrated empirically that policing is a public health issue. We now need to expand our efforts using public health values, skills, and data to advocate for public health-informed programs that are alternatives to policing. Substantial public health research demonstrates that police perpetrate harm, contribute to criminalization, and inhibit linkages to supportive social services. It is time for public health to reorient public safety programs and resources toward initiatives that do not involve the police and are rooted in care, equity, and prevention.

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#### PUBLICATION INFORMATION

Full Citation: Spolum MM, Lopez WD, Watkins DC, Fleming PJ. Police violence: reducing the harms of policing through public health-informed alternative response programs. *Am J Public Health*. 2023; 113(S1):S37-S42.

Acceptance Date: August 26, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307107>

#### CONTRIBUTORS

M. M. Spolum and P. J. Fleming wrote the first draft of the article and reviewed and revised the article. W. D. Lopez and D. C. Watkins contributed to the editing and revising of the article. All of the authors conceptualized the main points of the article.

#### ACKNOWLEDGMENTS

The University of Michigan's National Center for Institutional Diversity supports the authors' research on alternative unarmed response programs. Maren Spolum was supported in part by a National Institute of Child Health and Human Development training grant to the Population Studies Center at the University of Michigan (T32HD007339). We dedicate this article to Patrick Lyoya, a 26-year-old refugee from the Democratic Republic of the Congo who was fatally shot by an officer in Grand Rapids, Michigan, during the writing of the article.

Note. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

#### CONFLICTS OF INTEREST

The authors have no disclosures or conflicts of interest to report.

#### HUMAN PARTICIPANT PROTECTION

Institutional review board approval was not required because this was not human participant research.

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## DETAILS

<b>Subject:</b>	Mental health; Police departments; Minority & ethnic groups; Program implementation; Violence; Prostitution; Drug abuse; Black people; Crisis intervention; Drug use; Police brutality; Emergency communications systems; Public health; Transgender persons; Law enforcement; Police; Emergency medical care; Criminalization; Health services; Funding; Nonviolence; Community; Social exclusion; Prevention; Sex industry; Aggression; White people; African Americans; Teams; Residents; Non-binary gender; Sexual assault; Sex crimes
<b>Business indexing term:</b>	Industry: 92212 : Police Protection 56142 : Telephone Call Centers
<b>Location:</b>	United States--US
<b>Classification:</b>	92212: Police Protection; 56142: Telephone Call Centers
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S37-S42
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal

Language of publication: English

Document type: Journal Article

DOI: <https://doi.org/10.2105/AJPH.2022.307107>

ProQuest document ID: 2770264165

Document URL: <https://www.proquest.com/scholarly-journals/police-violence-reducing-harms-policing-through/docview/2770264165/se-2?accountid=211160>

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Last updated: 2023-08-22

Database: Public Health Database

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# Persistent Criminalization and Structural Racism in US Drug Policy: The Case of Overdose Good Samaritan Laws

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## ABSTRACT (ENGLISH)

The US overdose crisis continues to worsen and is disproportionately harming Black and Hispanic/Latino people. Although the "War on Drugs" continues to shape drug policy-at the disproportionate expense of Black and Hispanic/Latino people-states have taken some steps to reduce War on Drugs-related harms and adopt a public health-centered approach. However, the rhetoric regarding these changes has, in many cases, outstripped reality. Using overdose Good Samaritan Laws (GSLs) as a case study, we argue that public health-oriented policy changes made in some states are undercut by the broader enduring environment of a structurally racist drug criminalization agenda that continues to permeate and constrict most attempts at change. Drawing from our collective experiences in public health research and practice, we describe 3 key barriers to GSL effectiveness: the narrow parameters within which they apply, the fact that they are subject to police discretion, and the passage of competing laws that further criminalize people who use illicit drugs. All reveal a persisting climate of drug criminalization that may reduce policy effectiveness and explain why current reforms may be destined for failure and further disadvantage Black and Hispanic/Latino people who use drugs. (AmJ Public Health. 2023;113(S1):S43-S48. <https://doi.org/10.2105/AJPH.2022.307037>)

## FULL TEXT



## Headnote

The US overdose crisis continues to worsen and is disproportionately harming Black and Hispanic/Latino people. Although the "War on Drugs" continues to shape drug policy-at the disproportionate expense of Black and Hispanic/Latino people-states have taken some steps to reduce War on Drugs-related harms and adopt a public health-centered approach. However, the rhetoric regarding these changes has, in many cases, outstripped reality. Using overdose Good Samaritan Laws (GSLs) as a case study, we argue that public health-oriented policy changes made in some states are undercut by the broader enduring environment of a structurally racist drug criminalization agenda that continues to permeate and constrict most attempts at change.

Drawing from our collective experiences in public health research and practice, we describe 3 key barriers to GSL effectiveness: the narrow parameters within which they apply, the fact that they are subject to police discretion, and the passage of competing laws that further criminalize people who use illicit drugs. All reveal a persisting climate of drug criminalization that may reduce policy effectiveness and explain why current reforms may be destined for failure and further disadvantage Black and Hispanic/Latino people who use drugs. (AmJ Public Health. 2023;113(S1):S43-S48. <https://doi.org/10.2105/AJPH.2022.307037>)

The overdose crisis has resulted in over 1 000 000 deaths in the United States since 1999.<sup>1</sup> There were nearly 108 000 overdose fatalities in 2021, more than in any year prior.<sup>1</sup> Overdose death rates are currently increasing faster among Black people than any other group, and Hispanic/ Latino people are experiencing particularly sharp increases in mortality from some prevalent drug combinations such as opioids and stimulants.<sup>2</sup>

For decades, the primary policy approach to drug use in the United States has been to arrest, prosecute, and incarcerate as many people as possible for as long as possible.<sup>3</sup> This approach has been ineffective in reducing drug use<sup>4,5</sup> and is associated with increased drug-related harms, including nonfatal and fatal overdoses, injection-related endocarditis, and HIV and hepatitis C incidence.<sup>6-8</sup> Strategies like mandatory minimum sentencing and disparate sentencing for crack versus powder cocaine have unjustly and disproportionately penalized Black and Hispanic/Latino people, making this set of policies a hallmark example of structural racism in the United States. In response to the first wave of the current overdose crisis, which was characterized by record fatalities among White people and driven primarily by prescription opioids,<sup>9</sup> advocates urged policymakers to adopt a more public health-centered approach to reduce drug-related harms. Their successes include expanding access to the overdose reversal agent naloxone,<sup>10</sup> increasing availability of evidence-based treatment of substance use disorder, and enacting overdose Good Samaritan Laws (GSLs).<sup>11</sup> Overdose GSLs aim to encourage overdose witnesses to seek help by providing limited legal protections from certain criminal offenses, typically including possession of controlled substances and drug paraphernalia. As of June 2021, 47 states and Washington, DC had enacted a GSL.<sup>12</sup> However, the nature and scope of GSL protections vary widely across states, and research on their impacts has produced mixed results.<sup>13-16</sup> Although 2 studies found reductions in fatal opioid overdose following GSL enactment, neither association was statistically significant at the  $P < .05$  level<sup>13,14</sup>; a third study found that only GSLs that provide protections from arrest are significantly associated with reductions in fatal opioid overdose.<sup>15</sup> Using GSLs as a case study, we argue that these public health-oriented policy changes adopted to counter the ongoing overdose crisis are undercut by persistent structural racism and criminalization of people who use drugs, which work against that goal. We highlight 3 overarching barriers to GSL effectiveness: (1) provision of very limited protections, (2) implementation being subject to police discretion, and (3) presence of competing laws that further criminalize people who use illicit drugs. Each is a manifestation of persistent structural racism in drug policy and illustrates why GSLs and related legal changes may fail to reduce drug-related harms, particularly among Black and Hispanic/Latino Americans.

### LEGAL PROTECTIONS AS THE EXCEPTION, NOT THE RULE

GSLs were developed to address fear of drug-related criminal consequences, a fundamental barrier to help-seeking among individuals witnessing an overdose.<sup>17</sup> They provide a mechanism for help-seekers to avoid those consequences and are often considered an example of prioritizing harm reduction over criminalizing people who use drugs. However, instead of decriminalizing drug possession and use outright- the most straightforward way to

ensure that fear of criminalization does not deter help-seeking—these laws merely provide exceptions through which select individuals can find relief from select criminal-legal consequences. The following examples demonstrate how the limited nature of these exceptions ultimately maintains the status quo of structurally racist drug criminalization.

#### Lack of Protections Under Community Supervision

As of June 2021,<sup>22</sup> of the 48 jurisdictions with active GSLs did not provide protections for violation of probation or parole.<sup>12</sup> This means that individuals under community supervision may face incarceration if they call for help at an overdose, because being in the presence of illicit drugs or being arrested (even if not formally charged) for any reason can constitute a violation. Given the high rate of prior criminal-legal system involvement among people who use drugs,<sup>18</sup> this disproportionately affects many whom GSLs are ostensibly intended to benefit. This is a particularly glaring example of enduring structural racism within GSLs, as Black and Hispanic/Latino people, independent of their drug use, are more likely to have prior criminal-legal interactions than White people.<sup>3</sup> Failing to provide protection from probation or parole violations is therefore likely to amplify racial inequities in criminal-legal involvement, overdose, and broader adverse health outcomes related to substance use and incarceration.

#### Lack of Protections From Arrest

Only 27 states and Washington, DC provide protection from arrest for the offenses covered by the GSL.<sup>12</sup> In the remaining 20 states, help-seekers (and, typically, the overdose victims) can still be arrested and detained for covered offenses, even though the GSL protects them from subsequent charge or prosecution.<sup>12</sup> A national survey of patrol officers revealed that more than one third of those who had responded to an overdose in the prior 6 months reported making an arrest on scene.<sup>19</sup> Preserving the ability to arrest and detain help-seeking individuals is unlikely to sufficiently dismantle fear of police as a barrier to medical helpseeking and has numerous downstream risks, even if charges are not pursued.<sup>20,21</sup> Detainment, even for a short time, can have potentially lifealtering consequences for employment (e.g., missed shifts) and dependent care responsibilities, and can subject people dependent on opioids to forced withdrawal. Moreover, it increases the potential for stigma, harassment, and violence associated with police interactions and detainment,<sup>20,21</sup> which disproportionately affects Black and Hispanic/ Latino Americans, illustrating another structurally racist characteristic of many GSLs.<sup>3</sup> Given the adverse consequences of arrest itself, it is unsurprising that a recent study found evidence of reductions in fatal overdose only in states where GSLs specifically included arrest protections.<sup>15</sup>

More broadly, there is considerable confusion among the public about which protections GSLs provide.<sup>22,23</sup> Colloquially, the term "arrest" is often used interchangeably to mean arrest, charge, and prosecution. This may contribute to distrust that law enforcement officials are abiding by the laws, which studies have suggested is a considerable barrier to their effectiveness.<sup>24</sup> Individuals who believe that the law protects from arrest and are subsequently arrested when seeking help for an overdose may interpret this as law enforcement failing to comply with the law, even if they are ultimately released without charge.

This confusion may be further exacerbated by insufficient or inaccurate information regarding these laws. Many state Web sites do not provide information about the state's GSL protections, and those that do may mischaracterize them. For example, a Fact Sheet produced by the New York Department of Health erroneously states that, under certain circumstances, "The New York State 911 Good Samaritan Law allows people to call 911 without fear of arrest" [emphasis added] for possession of drug paraphernalia or "under 8 ounces" of a controlled substance.<sup>25</sup> However, the law only provides protection from charge and prosecution for those crimes; a related law provides protection from arrest for possession of controlled substances, but of much smaller amounts. This difference is not merely semantic: it reflects the distinction between being forcibly detained by law enforcement or not.

In some states, such as Iowa, South Dakota, and Tennessee, GSLs only offer protection a single time,<sup>26</sup> subjecting the bystander and the police to a bizarre decision tree that entails knowledge of the overdose history of those at the scene. The lack of clarity, consistency, and comprehensiveness of GSLs poses a clear obstacle to ensuring that police and bystanders understand these laws' protections. It further complicates help-seeking decisions during a critical window of time and does so in a way that may disproportionately reduce GSL effectiveness among Black and Hispanic/ Latino Americans.

## RELIANCE ON POLICE DISCRETION AND TRUST IN POLICING

Another barrier to GSL effectiveness is the fact that equitable implementation depends on police discretion. Police discretion is a critical determinant of whether policy-level reforms translate into the changes in street-level practice necessary for improvement in downstream health outcomes.<sup>27</sup> Individuals who are structurally disadvantaged under the status quo are most vulnerable to this discretion.<sup>28</sup> Even where more sweeping reforms are adopted, as with cannabis liberalization, evidence demonstrates ongoing structural racism illustrated by persistent or amplified racial disparities in arrest.<sup>29</sup> In the case of even the most comprehensive current GSLs, police retain latitude in whether and how to physically interact with individuals at an overdose scene, including decisions about interrogation, searches, confiscation of drugs or paraphernalia, and whether to charge individuals with adjacent low-level offenses (often referred to as crimes of poverty, such as loitering).<sup>27</sup> GSL effectiveness may therefore rely on how entrenched a culture of racist policing is,<sup>3</sup> and on the community's perceptions of whether that culture has shifted. Despite reforms, recent data show that drug-related arrests have not decreased,<sup>30</sup> and concerns about police conduct and arrest have been shown to persist in settings for years after GSL enactment,<sup>31</sup> particularly among people of color.<sup>22</sup>

## COMPETING POLICIES REINFORCE DRUG CRIMINALIZATION

An additional barrier to GSL effectiveness is the persistence of laws firmly rooted in drug criminalization, as well as the introduction of new ones. Even if comprehensive GSLs that provide immunity from a much broader range of crimes than current laws are successfully enacted, myriad legal consequences may await individuals seeking help.<sup>24</sup> Drug-induced homicide laws, which authorize the prosecution of drug-related deaths as criminal killings, offer a clear illustration of this contradictory environment. These laws assign criminal liability for a drug-related death to the individual who supplies the drug. In many cases, this person is a family member or friend who sold a small amount of drug to someone they knew, or shared or used the drug with the deceased. As of January 2019, 23 states and Washington, DC had a drug-induced homicide law (all but 2 also have a GSL).<sup>32</sup> Drug-induced homicide laws may make individuals present at the scene of an overdose more reluctant to call 911.<sup>33</sup> In a recent study, 87% of people who used drugs in Maryland were familiar with the state's drug-induced homicide law, compared with just 53% aware of the GSL.<sup>22</sup> Furthermore, hearing of someone else being charged under the state's drug-induced homicide law was strongly associated with greater perceived vulnerability of overdose-related arrest; these concerns were disproportionately reported by non-White respondents.<sup>22</sup>

The increased popularity of drug-induced homicide laws, as well as the recent proliferation of laws that create harsher penalties for the sale or possession of fentanyl and other synthetic opioids, signal a doubling-down on failed Drug War rhetoric and actions.<sup>4</sup> It further sends a stark message to potential help-seekers about the government's priorities regarding prevention of fatal overdose. In states with both a GSL and a drug-induced homicide law, individuals in possession of drugs who seek help at an overdose scene may be protected from the legal consequences of drug possession- but if the overdose becomes fatal, they may find themselves facing felony charges ranging from "delivery or distribution resulting in death" to "murder in the first degree."<sup>32</sup> Although GSLs are intended to motivate help-seeking, concomitant drug-induced homicide laws-along with laws that prohibit trespassing, loitering, possession with intent to distribute, and numerous other offenses of which people who use illicit drugs are frequently accused-do the opposite. Here again, structural racism is at play: early data suggest drug-induced homicide charges are being deployed at disproportionately high rates among Black and Hispanic/Latino individuals.<sup>3,34,35</sup>

## CONCLUSIONS

Amid the current overdose crisis, rhetoric has proclaimed that "we can't arrest our way out of the problem."<sup>36</sup> However, this rhetoric has largely failed to translate into reality. Instead, the persistence of a broader, structurally racist environment of criminalization that is maintained by policymakers and law enforcement continues to threaten health and racial equity outcomes. The case of GSLs clearly illustrates this dichotomy. The combination of laws designed to provide protections only in limited circumstances, actions and decisions that erode trust in the policies and the officials enforcing them, and contradictory laws that further reinforce drug criminalization, signal continued

structural racism that undercuts public health policies and their potential impacts on racial justice moving forward. Analogous barriers undermine other harm reduction policies; for example, efforts to expand access to naloxone (which is often in injectable form) and safe injection equipment among people who use illicit drugs are compromised by criminalization of syringe possession in many states.<sup>37</sup> This status quo of structurally racist criminalization and enforcement will continue to disproportionately limit the effectiveness of public health-oriented drug policies for Black and Hispanic/Latino people who use illicit drugs, and entrench racial inequities in corresponding health and social outcomes.

A number of steps would allow for more robust impacts of GSLs amid escalating overdose mortality. First, improvement can and should be made to GSLs to ensure that protections are the rule rather than the exception. This includes comprehensive protections from arrest for a broad range of crimes and violations of probation or parole, without limitation on the number of times the immunity is provided.<sup>15</sup> Second, interventions are needed to establish a harm reduction- and public health-oriented environment more broadly. Several North American settings have abandoned routine police attendance to drug overdose calls in favor of a well-resourced behavioral health response system.<sup>38</sup> This may help bypass issues of distrust in law enforcement, although empirical evidence from these settings is needed. In addition, the recent adoption of overdose prevention centers in New York City and Rhode Island may serve as an example of structural interventions to promote the safety of people at risk for overdose in health-promoting, rather than criminalizing, environments.<sup>39</sup> However, efforts need to be taken to ensure equitable access to these sites by Black and Hispanic/Latino people, and research is necessary to determine whether additional steps, such as prohibiting police from targeting participants, are needed. Finally, a more direct and comprehensive approach to reducing drug-related harm that focuses on the health, rights, and dignity of people who use drugs is needed. Rather than narrow provisions of immunity, decriminalizing or legalizing illicit substances could more directly remove drug use from the purview of the criminal legal system, offering an opportunity to usher it into the public health arena. Internationally, countries are increasingly decriminalizing drug possession, actions endorsed by public health and racial justice advocates.<sup>40-42</sup> Although there is limited experience of this strategy domestically, in 2021, Oregon's Ballot Measure 110 went into effect, decriminalizing personal possession of drugs in the state while increasing access to health assessments and substance use disorder treatment and recovery services. Evaluations of this change, informed by and with the direct involvement of people who use drugs, will be critical to understanding its potential for effectively reducing drug harms in a racially equitable way and its feasibility for adoption in other states.<sup>43</sup>

Progressive policies rooted in a true harm reduction framework have produced considerable enthusiasm and are the product of decades of organizing efforts to shift societal views and approaches to drug use. However, even these well-meaning policies will continue to perpetuate structural racism and fail to mitigate overdose deaths if the broader policy environment does not abandon the criminalization of drug use in earnest. Until then, Black and Hispanic/Latino communities will continue to be disproportionately targeted by the War on Drugs. >4JPH

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#### PUBLICATION INFORMATION

Full Citation: Pamplin II JR, Rouhani S, Davis CS, King C, Townsend TN. Persistent criminalization and structural racism in US drug policy: the case of overdose Good Samaritan Laws. *Am J Public Health*. 2023;113(S1):S43-S48.

Acceptance Date: June 28, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307037>

#### CONTRIBUTORS

J. R. Pamplin II and T. N Townsend jointly conceptualized the essay. J. R. Pamplin led the writing, and S. Rouhani, C. S. Davis, C. King, and T. N. Townsend additionally contributed to the writing. All authors contributed equally to editing and reviewing the essay.

#### ACKNOWLEDGMENTS

This work was supported by a Center for Opioid Epidemiology and Policy pilot grant (principal investigator: T. N Townsend).

We dedicate this work to our beloved friend and colleague, Dr. Tarlise (Tarlise) Townsend, who sadly passed away after the completion of this manuscript. Tarlise was a brilliant scientist and a fierce advocate for equity who walked-the-walk just as much as she talked-the-talk. She was an adventurous soul, an explorer, and, most of all, a warm and caring friend. She is deeply missed.

We acknowledge Alex Bennett, Aliza Cohen, Luther Elliott, Frank Taveras, and Efram Thompson for their support, feedback, and insight during the development of this essay.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

#### HUMAN PARTICIPANT PROTECTION

Institutional review board approval was not necessary because there was no involvement of human participants.

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## DETAILS

**Subject:** Narcotics; Hispanic Americans; Fatalities; Drug use; Effectiveness; Public health; Drugs; Prosecutions; Police; Imprisonment; Drug policy; Criminalization; Systemic racism; Law enforcement; Arrests; War; Discrimination; Controlled substances; Overdose; White people; Drug overdose; Health research; Police discretion; Good samaritans

**Location:** United States--US; New York

**Publication title:** American Journal of Public Health; Washington

**Volume:** 113

<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S43-S48
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307037">https://doi.org/10.2105/AJPH.2022.307037</a>
<b>ProQuest document ID:</b>	2770264160
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/persistent-criminalization-structural-racism-us/docview/2770264160/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/persistent-criminalization-structural-racism-us/docview/2770264160/se-2?accountid=211160</a>
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<b>Last updated:</b>	2023-08-22
<b>Database:</b>	Public Health Database

Document 5 of 39

# Strategies for Naming and Addressing Structural Racism in Immigrant Mental Health

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## ABSTRACT (ENGLISH)

Immigrants account for 13.7% of the US population, and the great majority of these individuals originate from Latin America or Asia. Immigrant communities experience striking inequities in mental health care, particularly lower rates of mental health service use despite significant stressors. Structural barriers are a significant deterrent to obtaining needed care and are often rooted in racist policies and assumptions. Here we review and summarize key pathways by which underlying structural racism contributes to disparities in immigrant mental health, including anti-immigration policies, labor and financial exploitation, and culturally insensitive mental health services. Significant accumulated research evidence regarding these barriers has failed to translate into structural reform and financial investment required to address them, resulting in pronounced costs to both immigrant populations and society at large. We propose specific strategies for addressing relevant structural inequities, including reforming economic and financial policies, community education initiatives, and task-sharing and strengths-based interventions developed in partnership with immigrant communities to promote access to mental health care for populations in dire need of culturally appropriate services.

## FULL TEXT

### Headnote

Immigrants account for 13.7% of the US population, and the great majority of these individuals originate from Latin America or Asia. Immigrant communities experience striking inequities in mental health care, particularly lower rates of mental health service use despite significant stressors. Structural barriers are a significant deterrent to obtaining needed care and are often rooted in racist policies and assumptions.

Here we review and summarize key pathways by which underlying structural racism contributes to disparities in immigrant mental health, including anti-immigration policies, labor and financial exploitation, and culturally insensitive mental health services. Significant accumulated research evidence regarding these barriers has failed to translate into structural reform and financial investment required to address them, resulting in pronounced costs to both immigrant populations and society at large.

We propose specific strategies for addressing relevant structural inequities, including reforming economic and financial policies, community education initiatives, and task-sharing and strengths-based interventions developed in partnership with immigrant communities to promote access to mental health care for populations in dire need of culturally appropriate services. (Am J Public Health. 2023;113(S1): S72-S79.

<https://doi.org/10.2105/AJPH.2022.307165>)

There are 45 million immigrants in the United States, defined here as any foreign-born individuals living in this country. Representing 13.7% of the population, this group accounts for the largest number of immigrants in any country worldwide.<sup>1</sup> When immigrants and their immediate family members are considered together, their share of the total population increases to nearly 30%.<sup>2</sup> In light of these statistics, it is clear that improving immigrant health is critical for improving the country's overall health.

The vast majority of US immigrants originate from either Latin America and the Caribbean (51%) or Asia (31%).<sup>3</sup> On arrival to the United States, most immigrants are subject to racialization processes that result in the ascription of a racialized minority identity (e.g., Latina/x/o<sup>4</sup> or Asian) by society and the subsequent gradual internalization of that identity.<sup>2</sup> Although the assignment of individuals from diverse ethnic and cultural backgrounds to racial monoliths on the basis of an external phenotype is scientifically unjustified,<sup>2</sup> it substantially shapes the immigrant experience through socially mediated race-based discrimination and associated adverse mental health outcomes.<sup>5,6</sup>

Latina/Latinx/Latino (Latina/x/o) and Asian immigrants are subject to not only interpersonal racism but also structural racism, here defined as "the totality of ways in which societies foster [race-based] discrimination via mutually reinforcing systems (e.g., in housing, education, employment, earnings, benefits, credit, media, health care, criminal justice, etc.)."<sup>7</sup>(p650) These embedded forms of structural discrimination become interwoven with underlying legal, economic, and cultural norms, reinforcing exclusionary beliefs, attitudes, and actions against racialized minorities.<sup>6,7</sup>

Much of the research on immigrant mental health has focused on characteristics of these populations that might limit their usage of mental health services, especially stigma and culturally influenced illness beliefs.<sup>8</sup> Although these factors are important targets for intervention, it is also critical to name and address the impact of systemic and interpersonal race-based discrimination on poor mental health outcomes. A framework recognizing the fundamental role of both structural and interpersonal racism could help explain several observations regarding immigrant mental health outcomes and service use, including (1) the immigrant health paradox, in which immigrants often enjoy better health than their US-born counterparts, perhaps as a result of less exposure to racism and racist structures; and (2) a higher risk of depression and anxiety among certain immigrants than among their nonimmigrant counterparts.<sup>9</sup> Recognizing the utility of considering factors beyond stigma and cultural beliefs, a growing body of research has attempted to elucidate the mechanisms by which interpersonal racism, xenophobia, and social disenfranchisement are internalized and negatively affect the mental health of marginalized communities,<sup>10</sup> including immigrants.<sup>6,11</sup> To build on these efforts, it is essential to characterize and address the role of institutionalized and structural racism in contributing to negative mental health outcomes and hindering access to appropriate mental health services. Given the significant representation of Latina/x/o and Asian immigrants within the US immigrant population and their unique and shared experiences as racialized immigrant groups, an examination of the literature on these populations can yield valuable insight into the effects of structural racism on immigrant mental health. Evidence suggests that, relative to US-born White individuals, Asian and Latina/x/o immigrants experience higher rates of race-based discrimination across multiple institutional domains, including health care, housing, employment, and law enforcement.<sup>2,12,13</sup>

In their recent incisive article, Misra et al. proposed a range of mechanisms through which structural racism affects immigrants' overall health.<sup>2</sup> Here we build on these scholars' work by reviewing and summarizing 3 major pathways by which structural racism contributes specifically to inequities in immigrant mental health outcomes and access to care: (1) anti-immigration policies, (2) labor exploitation and financial disinvestment, and (3) culturally insensitive mental health services. We then propose strategies to develop and implement structural reforms to address these shortcomings, ameliorate stressors directly contributing to poor mental health outcomes, and improve mental health access and engagement among immigrant populations.

Although we focus on the 2 largest immigrant groups—Latina/x/o and Asian—many of the pathways and strategies explored here apply, with important nuances and variations, to other immigrant subpopulations such as immigrants from the Middle East and Africa.<sup>2</sup> In addition, important nuances and variations exist within and between Latina/x/o and Asian immigrant groups including national origin, reasons for immigration, religious influences, and availability of support networks (among other intersectional factors, many of which are not explicitly addressed here). Despite these limitations, and as long as disaggregated data remain scarce, considering Latina/x/o and Asian immigrants as we do in this analysis remains a useful framework to begin naming and addressing structural racism in immigrant mental health.

#### ANTI-IMMIGRATION POLICIES

Citizenship and immigration status are legal identifiers that ultimately determine to whom immigration policies apply. Citizen immigrants are foreign-born naturalized citizens, and noncitizen immigrants are all other foreign-born individuals, including individuals residing permanently in the United States (e.g., legal permanent residents, refugees), those temporarily residing in the country (e.g., for employment or education), and those in the country without legal authorization (e.g., undocumented immigrants).

Federal policies broadly regulate citizenship and immigration status and dictate the allocation of resources to subsidize state-level coverage of immigrant populations.<sup>2</sup> The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 introduced restrictions on the eligibility of noncitizens for federal public benefit programs, including Medicaid. Although reforms since then have tended to expand coverage for immigrant populations, recent history is not without anti-immigration policies at the federal level. A prominent recent example is the now-revoked 2019 Public Charge Rule implemented by the Trump administration, which qualified lawful receipt of Medicaid, public housing, or Supplemental Nutrition Assistance Program benefits as a potential reason for inadmissibility for

permanent legal residency.

Within the constraints set by federal guidelines, policies at the state level ultimately determine access to social services and benefits, including health insurance, government identification, and higher education. Exclusionary immigration policies at the state level are perhaps best represented by omnibus immigration laws, or bills that (unlike single immigration laws) intend to regulate immigration through 3 or more provisions, such as requiring law enforcement to verify immigration status during a lawful stop ("show me your papers" laws), penalizing the employment of undocumented immigrants, and limiting immigrants' access to social services.<sup>14</sup>

As a result of between-state variability, more data are available at the state than the federal level specifically associating anti-immigrant legislative climates with worse mental health outcomes. A systematic review conducted by Martinez et al.<sup>15</sup> revealed that undocumented immigrants living in states with anti-immigration health policies—defined as policies granting no or minimum rights to access health services—exhibit consistently higher rates of depression, anxiety, and posttraumatic stress disorder. Furthermore, omnibus immigration laws have specifically been linked to poorer mental health outcomes among Latina/o/x immigrants, irrespective of documentation status.<sup>14,16</sup>

By contrast, changes in policies aimed at protecting certain immigrant subpopulations, such as the Deferred Action for Childhood Arrivals (DACA) program, have been associated with significantly fewer gaps in health care engagement and lower odds of depression among Latina/x/o and Asian beneficiaries relative to their noneligible undocumented counterparts.<sup>5</sup> DACA helped to improve mental health outcomes among recipients while increasing the gross domestic product by an estimated 0.02%.<sup>17</sup> Although the DACA program benefits a specific subset of the immigrant population—limiting the generalizability of these findings to the broader Latina/x/o and Asian immigrant community—the program's positive impact on the mental health of its beneficiaries and the US economy helps illustrate the potential effects of more inclusive, immigrant-friendly policies at a broader population level.

Systemic racism encoded in federal and state-level immigration policies seems to affect mental health through at least 2 general pathways. First, policies limiting the eligibility of noncitizens for public health insurance programs have a negative impact on mental health by restricting access to care. Noncitizens are less likely than their US-born and naturalized citizen counterparts to possess health insurance.<sup>18</sup> Lack of insurance is, in turn, associated with decreased mental health service use among immigrants.<sup>19,20</sup> Currently, segments of the documented noncitizen population may qualify for Medicaid and the Children's Health Insurance Program, but most are significantly restricted by eligibility criteria, including a 5-year waiting period.

Furthermore, undocumented immigrants and DACA recipients are not eligible for federally funded Medicaid benefits and are barred from purchasing insurance through the Affordable Care Act marketplace. Thus, these individuals must often rely on emergency Medicaid services, which include only those psychiatric services necessary to protect life or safety.<sup>19</sup> Reliance on emergency funds to address the health needs of undocumented immigrants, including mental health needs, has been postulated to lead to the forgoing of necessary care and higher long-term health care spending.<sup>18</sup>

Second, anti-immigration policies can enable and legitimize stressors that contribute to adverse mental health outcomes. For example, among Latina/ x/o immigrants, along with limiting access to care through reductions in health insurance coverage and job opportunities, omnibus immigration laws contribute to increased fears of deportation, perceived discrimination, and feelings of lack of safety.<sup>14</sup> Although further research is needed, "show me your papers" provisions of omnibus immigration laws, by increasing stressors such as racial profiling during police stops, appear to exert a more significant effect on mental health among Latina/o/x immigrants than provisions that more directly limit access to care.<sup>14</sup>

#### ECONOMIC DISINVESTMENT AND EXPLOITATION

In 2020, immigrants made up 17% of the total US workforce and disproportionately occupied sectors designated as "essential" during the COVID-19 pandemic.<sup>21</sup> Latina/o/x individuals account for nearly half of the foreign-born labor force, whereas Asians make up about one quarter.<sup>21</sup> Despite their labor contributions, immigrants continue to face structural racism in the form of labor exploitation.<sup>2</sup> Here we argue that this form of economic disinvestment in the

immigrant population has important effects on immigrants' mental health outcomes and access to care. In part because of constrained job opportunities resulting from their immigration status, immigrant workers are disproportionately employed in the most dangerous industries and are often exposed to chemical and physical hazards.<sup>22</sup> Inadequate labor protection and ineffective pathways for demanding recourse force immigrants to continue working under unsafe conditions, likely placing them at higher risk for sustaining work-related injuries than their US-born counterparts.<sup>2,22</sup> In addition, these same systemic vulnerabilities help facilitate asymmetric interpersonal dynamics in the workplace, leading to experiences of violence, discrimination, abuse, and harassment.<sup>22</sup>

These hazardous working conditions and work-related stressors are associated with poor mental health outcomes among Latina/x/o and Asian immigrants, including elevated rates of depression, psychological distress, and substance misuse.<sup>22</sup> Diminished access to employment-based private health insurance<sup>19</sup> and increased difficulty in accessing health care facilities because of long working hours and remote job locations<sup>22</sup> illustrate the negative consequences of economic disinvestment beyond mental health outcomes and into immigrants' access to mental health care.

Although laws have been enacted specifically to protect immigrant workers from labor exploitation, legislative forms of structural discrimination have often counteracted these attempts at the cost of mental well-being. Detailing the complex balance and imbalance between laws that protect certain immigrant labor rights and laws that circumvent these protections is beyond the scope of this article. However, the negative ramifications of legislative structural discrimination for immigrant mental health become apparent when considering the prohibitively high risks of retaliation that undocumented immigrants face if they attempt to denounce their employers' violations of worker rights. Although laws exist to prohibit such retaliation, in practice employers often report dissidents to US Immigration and Customs Enforcement,<sup>23</sup> highlighting shortcomings in the enforcement of existing protective laws. Immigrants who possess work visas are not exempt from exploitation, as their employment status is intrinsically tied to their ability to legally remain in the country.<sup>2</sup>

In addition, undocumented immigrant workers regularly fear deportation as a consequence of workplace immigration raids.<sup>22,24</sup> This immigration enforcement tactic has been explicitly linked to adverse mental health outcomes among Latina/o/x adults, regardless of immigration status.<sup>24</sup> Structural racism reflected in a lack of serious protections from financial exploitation and the absence of legal pathways for demanding recourse contribute to the prevalence of such exploitative practices and may perpetuate their adverse effects on immigrant mental health.

Although noncitizen immigrants- particularly undocumented immigrants- are most vulnerable to structural discrimination via anti-immigration policies and economic disinvestment, these populations are by no means the only ones affected. As reflected by the evidence so far presented, many antiimmigration policies and forms of economic disinvestment also directly affect documented immigrants.<sup>2,14,16,19,20,22,24</sup> Furthermore, the mental health of this broader population is affected by the same forms of structural racism that affect undocumented immigrants in at least 2 ways. First, the concept of familial vulnerability, wherein experiences of structural discrimination affect not only the targeted individuals but also their entire family unit,<sup>25</sup> offers a mechanism by which anti-immigration policies and economic disinvestment can affect the mental health outcomes of both documented immigrants and US-born individuals closely associated with undocumented immigrants, including children.

Second, structural forms of discrimination targeting undocumented immigrants, particularly state-level anti-immigration policies, are associated with poor mental health outcomes and limited access to care among documented immigrants<sup>26</sup> and even nonimmigrants.<sup>16</sup> This spillover effect has been partially attributed to an increased fear of jeopardizing access to full citizenship status among documented immigrants<sup>26</sup> and the exacerbation of interpersonal discrimination mechanisms (including more frequent experiences of overt discrimination) affecting any individual belonging to a racial or religious minority group who might be suspected of being an immigrant.<sup>16</sup>

As a result of these mechanisms, the public health burden of anti-immigration policies and economic disinvestment is further amplified. This paradigm, coupled with the detrimental long-term financial burden of disinvesting in

immigrant health,<sup>19</sup> emphasizes the importance of addressing the structural oppression that specifically targets immigrants- both undocumented and documented- and its negative consequences for immigrant mental health.

#### CULTURALLY INSENSITIVE MENTAL HEALTH SERVICES

In the case of both Latina/x/o and Asian immigrants, regardless of documentation status, limited English language proficiency-defined by the US Department of Health and Human Services as English not being one's first language and having a limited ability to read, write, speak, or understand English- has been consistently identified as a major barrier to access to and continued use of health care services in the United States, including mental health services.<sup>20</sup> Language concordance has been found to improve retention in outpatient psychiatric settings<sup>27</sup> and to increase the likelihood that patients will discuss their mental health needs in primary care, although this particular effect might depend on the patient's age and spoken language.<sup>27</sup> Language concordance seems particularly important for Asian and Latina/x/o immigrants seeking psychological help.<sup>20</sup>

In the domain of mental health, professional interpreter services improve disclosures in patient-physician communications, self-understanding, and referral to specialty care while reducing clinically significant errors.<sup>28</sup> Federal guidelines require most health care programs and providers, including those accepting any form of federal remuneration apart from Medicare Part B, to offer meaningful language assistance services free of cost to their patients.<sup>29</sup> However, the high cost of interpreter services often limits compliance with this requirement. Despite federal guidelines, states are not required to reimburse providers for the cost of language services-although 14 states and the District of Columbia have decided to do so through Medicaid and the Children's Health Insurance Program CHIP<sup>29</sup>-and are not required to claim available federal matching funds. Another strategy available to states is transferring the financial burden to contracted managed care organizations and providers, although this has been described as a mechanism that ultimately hinders the affordability and availability of such services.<sup>29</sup>

Another critical barrier to the effective use of mental health services is a lack of knowledge among immigrant communities regarding available resources.<sup>20</sup> This barrier seems particularly important for Asian immigrants, although it also appears to be true for Latina/x/o immigrants.<sup>20</sup> Limited awareness of mental health resources likely reflects both a lack of tailored outreach efforts designed to increase mental health literacy among these populations and the inadequacy of at least some trialed interventions. In turn, the relative lack of culturally adapted interventions may reflect assumptions that immigrant populations will conform to currently available approaches, most of which have been based on federally funded research lacking immigrant representation at all levels, from priority setting to involvement as participants.<sup>2</sup>

By contrast, successful mental health care outreach and delivery efforts beyond the provision of language translation seem to leverage specific cultural characteristics of these communities. It is well known that Asian and Latina/x/o immigrants rely heavily on familial and informal community networks for mental health support,<sup>20</sup> and referral from these networks has been proposed as an important pathway for accessing mental health care among immigrants.<sup>20</sup> In line with this observation, family- and community-oriented psychoeducational interventions and outreach efforts are associated with improved mental health outcomes among Latina/x/o immigrants.<sup>30</sup>

#### ADDRESSING STRUCTURAL RACISM IN IMMIGRANT MENTAL HEALTH

Latina/x/o and Asian immigrants are 40% less likely to use mental health services than their US-born counterparts.<sup>19</sup> Rather than focusing on strategies to curb the effects of subpopulation-specific cultural values or negative attitudes toward mental health care, which are addressed elsewhere in the literature, we offer 2 main pathways for addressing the impact of structural racism on immigrant mental health: reforming economic and financial policies with the needs of immigrants in mind and partnering directly with immigrant communities in the development and implementation of mental health interventions.

#### Immigration, Insurance, and Economic Reform

It should be evident that policy reform would fundamentally address several of the aforementioned structural inequities affecting mental health outcomes and access to care. This approach would entail changes facilitating the integration of immigrants into social services regardless of citizenship status. Ideally, these policy reforms should not only decrease deportation fears among undocumented individuals who are already integral contributors to society

but also empower the broader immigrant population to use mental health care services, promoting their overall health and productivity.

Expanding Medicaid coverage for mental health services to immigrant populations would greatly assist Latina/ x/o and Asian immigrants in overcoming financial barriers to accessing necessary care. Broadening coverage to include nonemergent but necessary outpatient mental health treatment of patients with serious psychiatric conditions, regardless of citizenship status, would not only lead to higher service use rates but could also reduce costs associated with untreated mental health conditions.<sup>19</sup> Shifting from emergency coverage to incentivizing the use of preventive and subacute services would likely increase cost-effectiveness and decrease the ethical burden placed on providers.<sup>31</sup>

Moreover, there appears to be no association between expansion of public health insurance coverage and interstate migration among low-income immigrants,<sup>32</sup> contradicting oftenthreatened concerns to the contrary. Broadening access to affordable buy-in private insurance options should also be considered as a complementary tool to expand coverage for low-income documented immigrants.<sup>19</sup> In addition, nonparticipating states should consider offering public health insurance to immigrant children, as this is associated with improved health service use among this population.<sup>33</sup> In general, public assistance programs benefiting low-income children fully pay for themselves in the long run through increased tax collection.<sup>34</sup>

The immense physical and psychological burdens placed on immigrant workers as a result of hazardous working conditions illuminate the need for legislative changes that effectively defend immigrant worker rights and promote safe working environments. Such laws should unequivocally guarantee protection from any forms of retaliation, particularly those that could lead to deportation, if undocumented workers or workers on temporary visas report abusive practices.

Financial reforms should also aim to increase funding for interpreter and language services and thus promote accessibility of existing psychological care among immigrants. Solutions that reduce the costs of these services should be explored as well, including use of centralized video or telephone interpreter services that could be shared across Medicaid state programs.<sup>29</sup>

#### Partnership With Immigrant Communities

Designing and implementing public health interventions with an overreliance on aggregated scientific data derived from homogeneous research populations and without direct engagement of diverse community members will often lead to prescription of solutions based on reductive assumptions about the populations they aim to serve.<sup>35</sup> Such an approach is particularly problematic when designing mental health interventions for populations such as Latina/x/o and Asian immigrants, in which cultural attitudes and risk factors are often blamed for low mental health care utilization. Instead, in addition to advocating for disaggregation in mental health research, a simultaneous effort should be made to partner directly with immigrant communities to develop and implement culturally relevant interventions.

Tailoring culturally sensitive psychosocial interventions to a given community's demographics should be based on direct outreach and awareness of pressing necessities identified by community members themselves. In addition, adopting strengths-based paradigms- in which community members and partners identify community-specific strengths that promote emotional wellness-has been proposed as a mechanism to improve immigrants' mental health outcomes and access to care.<sup>5,20,30</sup> Examples of strengths-based interventions include psychoeducational efforts emphasizing individual- and community-level capacity to deal with stressors, training on leveraging existing networks and mental health resources, culturally informed teaching of healthy coping strategies, and the creation and promotion of employment and educational opportunities.<sup>30</sup>

Furthermore, interventional strategies should harness the positive influence of trusted organizations, including faithbased institutions, neighborhood councils, and community centers. Partnering with community leaders in these spaces can lead to greater acceptance and integration of psychoeducational efforts within existing programming and even physical infrastructure.

Successful interventions developed in partnership with communities should leverage not only community

organizations but also trusted social networks and human resources. Such task-sharing strategies, which involve training lay members of the target community to facilitate psychosocial support interventions, can help address shortages in the mental health provider workforce. This approach has proven successful in global mental health settings and, more recently, in the United States, and it has already been proposed as a means to address mental health disparities in Asian American communities.<sup>36</sup>

Two existing task-sharing interventions are the Mental Health Gap Action Program and Problem Management Plus. The former seeks to expand the mental health care capabilities of primary care physicians, strengthening their role in improving mental health outcomes and care access for immigrants through increased screening and early intervention,<sup>37</sup> whereas the latter trains lay helpers to deliver brief transdiagnostic interventions. Remote adaptations of these strategies have already been deployed to address COVID-19-related mental health care barriers.<sup>38</sup>

Training community health workers- lay members of communities who work in association with the local health care system-to provide psychosocial care has also shown promise in addressing racial gaps in mental health care delivery and should be considered a feasible strategy in the immigrant mental health space.<sup>39</sup> In addition, the availability of mental health peer specialists in outpatient settings has been associated with increased service use and decreased disparities among US-born Latina/x/o youths,<sup>40</sup> suggesting a potentially effective application for immigrant youth communities. As a potential added benefit, strengths-based and task-sharing approaches might help to decrease the stigma surrounding mental health and improve mental health literacy through the facilitation of trusting relationships between community members.

Despite many findings demonstrating the effectiveness of community-based interventions, several barriers limit the feasibility of these projects, particularly a critical lack of funding for both research and implementation. Thus, advocacy efforts must expose and confront a long-standing and crippling absence of investment in such community partnerships and support appropriate policies and financial allocations dedicated toward enabling the success of task-sharing and community-based projects.

## CONCLUSION

We have highlighted several key pathways through which structural racism can negatively affect immigrant mental health outcomes and access to care. Although the pathways we have outlined, including anti-immigration policies, financial and economic exploitation and disinvestment, and culturally insensitive mental health services, are by no means comprehensive, they illustrate the complex, mutually reinforcing, and often covert mechanisms that perpetuate health care disparities. Structural racism is not only a multifactorial phenomenon but also a deeply rooted force plaguing our systems and institutions. Thus, eradicating it and addressing its effects on immigrant mental health require a multipronged approach based on meaningful collaboration among stakeholders across society. The success of such an immense undertaking demands, first and foremost, political and economic support for immigrant mental health, which, as described, will exert broader societal benefits. Without disregarding the importance of cultural factors such as stigma and illness beliefs, policymakers must recognize how structural racism locks out immigrants from needed treatment and resources. Through economic and financial policy reforms and culturally adapted mental health interventions developed and enacted through community partnerships, we can and must take action to address the effects of structural racism on immigrant mental health outcomes and access to care.

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<http://www.ajph.org> by clicking the "Reprints" link.

#### PUBLICATION INFORMATION

Full Citation: Cerda IH, Macaranas AR, Liu CH, Chen JA. Strategies for naming and addressing structural racism in immigrant mental health. *Am J Public Health*. 2023;113(S1):S72-S79.

Acceptance Date: October 31, 2022

DOI: <https://doi.org/10.2105/AJPH.2022.307165>

#### CONTRIBUTORS

All of the authors contributed to the research for and writing of this article.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

#### HUMAN PARTICIPANT PROTECTION

No protocol approval was needed for this research because no human participants were involved.

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## DETAILS

<b>Subject:</b>	Mental health services; Mental health; Exploitation; Racism; Reforming; Employment; Health care; Discrimination; Immigration policy; Health research; Health services; Immigrants; Policies; Immigration; Inequality; Populations; Noncitizens; Stress; Mental depression; Labor migration; Health insurance; Systemic racism; Public health
<b>Business indexing term:</b>	Subject: Employment Health insurance
<b>Location:</b>	Latin America; Asia; United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S72-S79
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington

<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307165">https://doi.org/10.2105/AJPH.2022.307165</a>
<b>ProQuest document ID:</b>	2770264123
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/strategies-naming-addressing-structural-racism/docview/2770264123/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/strategies-naming-addressing-structural-racism/docview/2770264123/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-08-31
<b>Database:</b>	Public Health Database

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Anonymous

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### FULL TEXT

\_TVM:UNDEFINED\_

### DETAILS

<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S3
<b>Publication year:</b>	2023

Publication date:	Jan 2023
Publisher:	American Public Health Association
Place of publication:	Washington
Country of publication:	United States, Washington
Publication subject:	Public Health And Safety, Medical Sciences
ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Table Of Contents
ProQuest document ID:	2770264080
Document URL:	<a href="https://www.proquest.com/scholarly-journals/table-contents/docview/2770264080/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/table-contents/docview/2770264080/se-2?accountid=211160</a>
Copyright:	Copyright American Public Health Association Jan 2023
Last updated:	2023-02-17
Database:	Public Health Database

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# Historic Redlining Practices and Contemporary Determinants of Health in the Detroit Metropolitan Area

Mehdipanah, Roshanak, PhD; McVay, Katelyn R, BS; Schulz, Amy J, PhD

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## ABSTRACT (ENGLISH)

**Objectives.** To examine how redlining, a historical racially discriminatory housing policy implemented by the Home Owners' Loan Corporation (HOLC), is associated with current neighborhood determinants of health in the Detroit Metropolitan Area. **Methods.** We analyzed associations between census tract-level HOLC color grades (red = "hazardous"; yellow = "declining"; blue = "desirable"; and green = "best") and a developed neighborhood determinants of health index (DOHI) consisting of 8 indicators of economic, social, governance, and physical environment characteristics using spatial regression analysis and controlling for change in the census tract's

percentage of White residents. Results. A total of 484 Detroit Metropolitan Area census tracts had HOLC grades. The mean redlining score across all census tracts was 3.02 (min = 1.0; max = 4.0). The mean contemporary DOHI was 19.11 (min 5 8.0; max = 36.0). Regression models show significantly higher DOHI scores in yellowlined (b 5 2.71; 95% confidence interval [CI] 5 1.52, 3.91), bluelined (b 5 5.33; 95% CI 5 3.65, 7.01), and greenlined (b 5 9.25; 95% CI 5 6.86,11.64) neighborhoods compared with redlined neighborhoods. Conclusions. Historical redlined neighborhoods experience contemporary determinants of health conditions that are less conducive to health compared with those in nonredlined neighborhoods. These differences also reflect the accumulation of resources essential for health in greenlined neighborhoods.

## FULL TEXT

### Headnote

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**Methods.** We analyzed associations between census tract-level HOLC color grades (red = "hazardous"; yellow 5 "declining"; blue = "desirable"; and green = "best") and a developed neighborhood determinants of health index (DOHI) consisting of 8 indicators of economic, social, governance, and physical environment characteristics using spatial regression analysis and controlling for change in the census tract's percentage of White residents.

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**Conclusions.** Historical redlined neighborhoods experience contemporary determinants of health conditions that are less conducive to health compared with those in nonredlined neighborhoods. These differences also reflect the accumulation of resources essential for health in greenlined neighborhoods.

**Public Health Implications.** Neighborhood development initiatives should consider the impacts of historical redlining on contemporary neighborhood conditions. (AmJ Public Health. 2023;113(S1): S49-S57.

<https://doi.org/10.2105/AJPH.2022.307162>)

Public health research has examined the impacts of residential segregation on health and health inequities largely through pathways that indicate greater disinvestment and lack of resources in neighborhoods with greater proportions of non-White racialized groups, particularly nonHispanic Blacks and Hispanics/Latinx.<sup>1,2</sup> For the most part, such research has overlooked the structural forces that created and reinforced segregation in these neighborhoods. Redlining practices of the Home Owners' Loan Corporation (HOLC) exploited segregation, providing more opportunities for wealth building among Whites while simultaneously stripping homeownership opportunities from non-White racialized groups, particularly Black Americans.<sup>3-5</sup> Understanding the extent to which those historical practices are associated with differential health opportunities-reflected in economic, social, governance, and physical environmental determinants of health-is critical for public health efforts to reduce racial health inequities.

As part of a series of programs established in the 1930s to help middle-class Americans purchase and maintain homes, the HOLC program had the primary purpose of stabilizing the nation's mortgage lending system.<sup>4</sup> HOLC created maps to classify neighborhoods by their perceived level of lending risk. Neighborhoods were assigned 1 of 4 grades and corresponding colors: A (green) for "best," B (blue) for "still desirable," C (yellow) for "definitely declining," and D (red) for "hazardous." Areas with a larger proportion of non-White racialized groups, primarily non-Hispanic Blacks, were classified as "hazardous" for investment. Redlining institutionalized neighborhood racial segregation and restricted access to homeownership for non-White racialized homebuyers, who turned to land contracts with no safety nets where buyers could lose any equity built on their home if a payment was missed.<sup>6</sup>

Redlined neighborhoods have experienced long-term disinvestment.<sup>4,6</sup> Redlining maps present a unique opportunity to examine the long-term impact of racist structural policies with geographic specificity contributing to the racial health equity gap seen in the United States. For example, research has connected historical redlining with socioeconomic factors like credit scores and disinvestment,<sup>3</sup> foreclosures,<sup>7</sup> violence,<sup>8</sup> physical factors like excess heat,<sup>9</sup> and health including preterm birth<sup>10</sup> and mental health.<sup>11</sup>

The Detroit Metropolitan Area (DMA), with a population of approximately 3.8 million, offers an important case study for understanding these processes. Made up of 3 counties, Oakland, Macomb, and Wayne (where Detroit city is located),<sup>12</sup> the DMA was among the nation's largest and most prosperous metropolises at the start of the 20th century.<sup>13</sup> As described by Sugrue, redlining practices of the 1930s set the stage for the establishment of suburbs in the 1960s to 1970s that lured White homeowners to move from the city to heavily subsidized suburban areas with lower property taxes. Deindustrialization and globalization contributed to the loss of many manufacturing jobs, while remaining employment opportunities moved to the suburbs.<sup>13</sup> Together, these processes moved economic sources away from the city and into largely White and wealthy neighborhoods.<sup>13,14</sup> By 2010, Detroit had lost close to two thirds of its population, and with it much of its resources.<sup>14</sup> These historical processes have contributed to the racial divide seen today: in 2020, Macomb and Oakland counties had approximately 11.7% and 13.6% nonHispanic Blacks, respectively.<sup>15</sup> Wayne County was 38.8% non-Hispanic Black,<sup>13</sup> with 77.2% of non-Hispanic Black residents living in Detroit city.<sup>12</sup>

Historical redlining has been linked to specific health outcomes. We take this research a step further, to examine its associations with economic, social, governance, and physical environmental determinants of health. Our conceptual model borrows from existing frameworks developed by Krieger et al.<sup>10</sup> and Swope et al.<sup>16</sup> focusing on the neighborhood or intermediate-level factors associated with health inequities. According to Swope et al., redlining leads to disinvestment, with increasing racial segregation and concentrated disadvantage influencing place-based risk factors like air pollution and healthy food access. Similarly, in the framework of Krieger et al., redlining leads to neighborhood trajectories of disinvestment, residential segregation, and homeownership, which simultaneously affect placebased resources for healthy living and the census tracts' demographic and socioeconomic composition. Therefore, examining historical patterns can help us understand the pathways through which institutional racism maintains racial hierarchy by, for example, concentrating economic, social governance, and physical environmental benefits in areas predominantly occupied by nonHispanic Whites while eroding access to these critical determinants of health for racially minoritized groups.<sup>2,17,18</sup>

In this study, we examined the associations between historical redlining and the distribution of multiple contemporary social, economic, governance, and physical environmental indicators of health equity (henceforth, social determinants of health) in the DMA. Examining such associations can build evidence to work upstream to inform policies that improve economic, social, governance, and physical environments for better health and health equity. We tested the hypothesis that the legacy of redlining continues, with areas historically deemed as "hazardous" for investment leading to disinvestment overtime are associated with worse contemporary social determinants of health indicators. We argue that those patterns contribute to contemporary racial health inequities in the DMA.

## METHODS

We conducted an ecological study to examine the associations between historical neighborhood HOLC grades and a neighborhood determinants of health index (DOHI). To create the DOHI, we adapted commonly used methods for examining economic, educational, and civic opportunity (e.g., US Census Opportunity Index, 2010),<sup>19</sup> to examine opportunities for health conceptualized across 4 domains that are well-established predictors of health: economic growth, social and human development, governance, and physical environments. We used census tract level as a proxy for neighborhood to capture the variability across geographic areas within the DMA. This level was selected as the finest spatial scale at which all data used in this analysis were available and to maximize comparisons with previous research.<sup>20,21</sup>

Home Owners' Loan Corporation Grade

Detroit HOLC redlining maps were obtained from the University of Michigan, Institute for Social Research.<sup>22</sup> Using

digitized HOLC mortgage security risk maps from the University of Richmond's Digital Scholarship Lab,<sup>23</sup> researchers at the Institute for Social Research overlaid the HOLC maps with 2010 census tracts. Using ArcGIS version 10.8.2 (Esri, Redlands, CA), they determined the proportion of HOLC residential security grades within the boundaries of each census tract.<sup>22</sup> A numerical value (A-1 [greenlined], B-2 [blue-lined], C-3 [yellow-lined], and D-4 [red-lined]) was assigned. A historical redlining score was then calculated from the summed proportion of HOLC grades multiplied by a weighting factor based on the area within each tract. A higher HOLC score corresponds with greater redlining in the census tract. In this study, we used both a continuous historical redlining score assessing the degree of redlining and a categorical variable consisting of the 4 grades.

#### Determinants of Health Equity Index

We used the Detroit Urban Health Equity Assessment Tool (Detroit Urban HEART) to guide the selection of indicators to include in the DOHI. The Detroit Urban HEART tool consists of economic, social, governance, and physical environmental indicators that have been established as predictors of mental and physical health.<sup>24</sup> Urban HEART was developed by the World Health Organization specifically to engage stakeholders in a participatory process of developing indices that are relevant and reflective of their community.<sup>25</sup> The goal was to support urban stakeholders to address health inequities by addressing the social determinants of health.<sup>25</sup> More than 100 cities in 54 countries have used the tool.<sup>25</sup>

In 2015-2016, Urban HEART was adapted for Detroit by the Healthy Environments Partnership, a community-based participatory research partnership consisting of community-based organizations, academic researchers, and health service providers. A detailed description of this process can be found elsewhere.<sup>24</sup> Briefly, 14 indicators of health, well-established in the literature, across 5 domains (economic growth, social and human development, governance, physical environment and infrastructure, and population health) were identified and used to categorize areas across the city and to develop strategic actions.<sup>24</sup>

For the analysis presented in this article, we focused on a subset of 8 of the 14 indicators in 4 domains. We omitted the fifth domain, population health, consisting of 4 variables, given our focus on determinants of health rather than on health outcomes. In addition, for the analysis presented here, to address correlation, we grouped 2 indicators of education (the percentage of the population with a high-school education and the percentage with a bachelor's degree), and excluded the median housing value variable because of correlation with percentage of homeownership and median household income. Table A (available as a supplement to the online version of this article at <https://ajph.org>) provides a description of the indicators included by domain.

To create our index, we calculated quintile scores for each of the variables described previously. Quintiles are often used to categorize income and other socioeconomic measures when examining inequities across areas.<sup>26</sup> Quintiles with higher values received a higher score (e.g., census tracts within the quintiles with the greatest economic growth received a score of "5"). For the PM<sub>2.5</sub> (airborne particulate matter with a diameter of less than 2.5 micrometers) variable, quintiles with lower values received higher scores reflecting less pollution. We summed the quintile scores for each variable to create an additive index, with higher index scores representing more favorable conditions for health across the 4 domains, ranging from 8 (low on all indicators) to 40 (high on all indicators).

#### Covariates

To account for the "White flight" that occurred between the time redlining was implemented and the present day, we constructed a variable that captures the change in the percentage of White residents from 1970 to 2019 using the 1970 Census and the 2019 American Community Survey 5-year estimates.

#### Statistical Analysis

We calculated the mean value of all census tracts by HOLC score for each indicator and for the index. We used the ESTAT MORAN function on Stata version 17 (StataCorp LP, College Station, TX), a postestimation test used after using a regression model with spatial data to perform a Moran test for spatial correlation among the residuals, for the DOHI, our dependent variable. Our findings showed significant ( $P < .001$ ) spatial autocorrelations indicating that the observations are not independent and identically distributed across the DMA. We then used the SPREGRESS command to fit our spatial regression models using an inverse distance-weighted matrix. We present findings from

models that regressed our index on the HOLC grades categorical variable, adjusted for the change in White population overtime.

## RESULTS

The analysis presented here includes 484 of the possible 495 DMA census tracts that had a corresponding HOLC grade. We excluded 9 census tracts because of missing data for variables in the index or the covariate.

Table 1 shows neighborhoods that had been designated historically with an A grade (green = "best") fared better across most contemporary indicators. The greatest advantages appear in economic indicators, with A-graded census tracts having a mean median household income almost double that of neighborhoods graded as B and C, and almost 3 times that of the D-graded neighborhoods. Similarly, 91.18% of residents in greenlined census tracts had a high-school education or more, compared with 88.61%, 84.69%, and 77.56% in blue-, yellow-, and redlined census tracts, respectively. Differences across neighborhoods in ambient levels of PM2.5 were smaller although they trended in a similar direction. Neighborhoods historically designated with a D grade ("hazardous") fared worse on most contemporary indicators including a substantially lower homeownership rate (46.15%) and percentage of children living above the poverty line as defined by the US Census (54.62%) compared with other graded neighborhoods. The one exception to this finding was the slightly higher percentage of residents with a work commute less than 30 minutes in D-graded neighborhoods compared with the other-graded neighborhoods. When these indicators were used in the DOHI score, trends suggest that residents of formerly greenlined census tracts experience conditions that are more supportive of the opportunity for good health across multiple domains, compared with current residents of census tracts that were historically graded with lower HOLC scores.

Panel a of Figure 1 illustrates that the tracts with a D grade (red), deemed as "hazardous," were mostly located in the downtown areas of Detroit, while tracts that were deemed as "best" or A-graded (green), were clustered in the west and north of Detroit city. Panel b of Figure 1 illustrates the spatial distribution of the DOHI scores in the same HOLC-graded tracts. Census tracts that appear in the darkest blue are those with the highest quintile of DOHI scores. Those in the fourth, third, and second quintiles are shown in successively lighter shades of blue, and those census tracts with the lowest (quintile 1) DOHI scores are shown in light gray.

A visual inspection of Figures 1a and 1b suggests considerable overlap, with census tracts with HOLC grades of A (green) tending to have higher contemporary DOHI scores, as indicated in dark blue, while many with historical scores of D (red) have lower (light blue or gray) DOHI scores.

In Table 2 we present results from the spatial regression models in which we tested the hypothesis that HOLC scores are significantly associated with contemporary DOHI scores as captured in our index, while controlling for percent change in White residents. Results are shown for 4 models, using red-, yellow-, blue-, and greenlined neighborhoods as the referent, to specifically examine differences across all neighborhood types.

Results shown in model 1 indicate that access to positive determinants of health captured in our DOHI are significantly greater in formerly yellowlined (b 5 2.71; 95% confidence interval [CI] 5 1.52, 3.91), bluelined (b = 5.33; 95% CI 5 3.65, 7.01), and greenlined (b 5 9.25; 95% CI 5 6.86, 11.64) census tracts, compared with formerly redlined tracts. Formerly greenlined neighborhoods have, on average, a 9.25-point advantage (on a scale of 8-40) over formerly redlined census tracts, after accounting for changes over time in racial composition.

Models 2 through 4 report results using yellow-, blue-, and greenlined neighborhoods, respectively, as the referent group, and allow comparisons of relative advantage and disadvantage in determinants of health across census tracts with varying HOLC scores. As with model 1, these models illustrate the nonlinear nature of relative advantage and disadvantage in access to multidimensional determinants of health for census tracts with varying HOLC scores. This is further illustrated in Table 3, where mean differences across the HOLC-graded areas are collectively driven by the DOHI indicators, where, on average, greenlined areas fare better across all the indicators in comparison with the others. We conducted a sensitivity analysis that included census tracts with no HOLC grade as a category (shown in Table B, available as a supplement to the online version of this article at <https://ajph.org>). These non-HOLC-designated tracts had significantly lower levels of inequities than those designated as red, yellow, and blue. On the contrary, these tracts had higher levels of inequities than those designated as green, although not significant.



## DISCUSSION

Our findings are consistent with the hypothesis that the impacts of structural racism in the housing system, enacted in the form of HOLC grades, are associated with contemporary DOHI scores in the DMA almost a century later. Because HOLC grades were implemented in urban communities with populations of 40 000 or more,<sup>27</sup> these associations are most visible in urban areas of the DMA (e.g., Detroit). We found significant associations between HOLC grades and contemporary indicators of economic, social, governance, and physical environmental characteristics. Specifically, formerly redlined census tracts scored significantly lower on the DOHI that captures multiple determinants of health, compared with formerly yellow-, blue-, and greenlined census tracts. Furthermore, greenlined neighborhoods appear to have accrued larger relative benefits in terms of social determinants of health compared with, for example, census tracts that were scored predominantly yellow or blue.

Similar to opportunity indices commonly used in economic analyses,<sup>28</sup> the DOHI offers a measure for examining the geographic distribution of health opportunities. The patterns identified through this study suggest variations in the distribution of widely used determinants of health, some 80 years after the HOLC grading system was implemented. They are consistent with systemic economic disinvestment of redlined neighborhoods and opportunity hoarding in areas historically categorized as green. While our study is among the first to compare redlining maps to contemporary determinants of health, findings reported here are consistent with previous studies that have established the consequences of these practices on health,<sup>10,11</sup> violence,<sup>8</sup> housing,<sup>3</sup> and environmental conditions.<sup>9</sup>

The use of a multidomain DOHI contributes to the growing body of literature examining the ways that structural racism, or racism embedded in public policy, is associated with access to resources that are essential for health. Our index draws on well-established determinants of health that have demonstrated links to health in Detroit<sup>20,21,24,29</sup> and reflecting those sufficiently established to be included in the US Department of Health and Human Services' 2030 Healthy People Objectives.<sup>30</sup> The DOHI used here offers a holistic assessment of various area-level characteristics and is the first to our knowledge to specifically examine their associations with HOLC grades in Detroit. Our findings are consistent with existing studies that demonstrate that HOLC grades are associated with the contemporary distribution of risk and opportunity and that those distributions are associated with racial inequities in health.<sup>10,17,31</sup>

Our findings suggest that each HOLC grade is associated with differences in access to critical determinants of health across multiple domains, with relative privilege in access to resources increasingly apparent with higher HOLC grades. While recent efforts by the city government are aiming to provide more employment opportunities, housing stability, and investment in neighborhoods, Detroit residents in many census tracts continue to experience high levels of housing instability, restricted educational opportunities, and excess exposure to environmental pollutants.<sup>20,21,29</sup>

Furthermore, our findings provide an example of the persistent effects of structural racism, or racist ideologies that are embedded in social policies. Neighborhoods with larger proportions of Black residents were more likely to be redlined; those neighborhoods remain disproportionately Black in contemporary Detroit. The contributions of those historical policies to differential patterns of investment, governance, and environmental exposures and to contemporary racial inequities in health offer one example of racism as a structural driver of health inequities.<sup>17</sup>

### Limitations

There are several limitations in our data and analysis. First, the analyses presented here suggest associations between historical redlining scores and an index that sums multiple determinants of health. We report statistically significant differences between HOLC-graded neighborhoods and contemporary determinants of health, but are not able, based on this analysis, to infer causal mechanisms. There is, however, substantial evidence from other sources to suggest that HOLC grades did determine the extent and types of investment available to residents, resulting in systematic investment and disinvestment across neighborhood types.<sup>4,5</sup>

There is also substantial evidence, some of it longitudinal, to suggest that many, if not most, determinants of health used in our index are associated with differential health outcomes over time including, for example, studies

establishing associations between childhood poverty and adult health,<sup>32</sup> household wealth and health,<sup>33</sup> and exposure to particulate matter and health.<sup>20</sup> Together, these bodies of research are consistent with an interpretation that living in areas that have experienced systematic disinvestment is associated with reduced access to resources needed to protect health throughout life, while residing in areas with accumulated resources across multiple domains is protective of health.

While it is unlikely that the HOLC scores singularly caused disinvestment in redlined neighborhoods or investment in greenlined neighborhoods, they did contribute to patterns of investment that shape access to important determinants of health. In our analysis, we controlled for percent change in White residents from 1970 to 2019. The 1970 US Census data were the earliest census we could obtain that had tracts mapped onto the 2010 census tracts, allowing for comparison over the years. Despite this limitation and given that a large proportion of population change occurred in the 1960s and is captured by the 1970 Census, we expect that the impacts of White population change across census tracts in the city before the 1970 Census would be fairly minimal.

Another limitation is that we did not account for the unequal investment in certain areas of the DMA that were formerly redlined but where recent investments have led to redevelopment attracting higher-income residents.<sup>34</sup> These areas tend to be in the Detroit downtown core, including the Midtown area, which has seen considerable population growth and economic development in recent decades.<sup>34</sup> There are conflicting views on gentrification in Detroit,<sup>34,35</sup> and this study did not account for this process. However, our findings are likely conservative if such changes have occurred, impacting the DOHI score, especially in formerly redlined areas by furthering inequities between "nonhazardous" tracts compared with "hazardous" ones. Future studies should incorporate longitudinal socioeconomic changes into the analysis of redlining effects, particularly in areas that have seen significant recent economic development.

In this analysis, our focus was on determinants of health rather than health outcomes. While this may be considered a limitation by some, we argue that the important contribution made here is not in linking HOLC scores to health outcomes, as has been done by cited papers. Rather, our objective in this study was to examine associations between HOLC scores and the determinants of health that help to support the health of communities—that is, the conditions that make health possible. In doing so, we aimed to consider implications for the determinants of health as potential points for public health interventions toward the end of racial health equity. This analysis offers consideration for specific interventions that may help to interrupt the pathways linking historical patterns of disinvestment and opportunity hoarding and to consider those that may be most amenable to change as well as most impactful in improving health opportunities among residents whose contexts are currently less conducive to health.

#### Public Health Implications

Understanding the historical roots of contemporary health inequities is critical to inform current conversations about reparations needed—for example, in the form of explicitly focused reinvestment in housing, infrastructure (e.g., water systems), and greening—to reduce the adverse impacts of longstanding disinvestment, as well as the enactment of greater protections for residents whose economic well-being and health are placed at risk because of patterns of systematic disinvestment in predominantly Black Detroit neighborhoods. Our article highlights such inequities in addition to the discrimination in local policies that govern funding and resource allocation where a few neighborhoods, largely consisting of White residents, are benefiting more, resulting in better opportunities. Finally, our study demonstrates the need for reinvestment strategies that protect, sustain, and promote health with a particular focus on historically redlined communities. Such policies and practices must be implemented in a manner that understands the risks, as formerly redlined communities become more desirable, and include protections against displacement of current residents. >4JPH

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## PUBLICATION INFORMATION

Full Citation: Mehdipanah R, McVay KR, Schulz AJ. Historic redlining practices and contemporary determinants of health in the Detroit metropolitan area. *Am J Public Health*. 2023;113(S1):S49-S57. Acceptance Date: October 20, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307162>

## CONTRIBUTORS

All authors contributed to the conceptualization, data collection, analysis, and final draft.

## ACKNOWLEDGMENTS

We would like to thank Ritesh Mistry, PhD, and Josh Errickson, PhD, for their guidance on the spatial analysis.

## CONFLICTS OF INTEREST

All authors disclose no conflicts of interest.

## HUMAN PARTICIPANT PROTECTION

This study used secondary data that are publicly available and, therefore, exempt.

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## DETAILS

<b>Subject:</b>	Population; Spatial analysis; Socioeconomic factors; Censuses; Housing policy; Historic districts; Regression analysis; Regression models; Census; Neighborhoods; Health disparities; Metropolitan areas; Outdoor air quality; Health; Statistical analysis; Economic growth; Redlining; Social research; Segregation; Residents; Health care; Suburban areas; Public health; Economic analysis; Hispanic people; Heart; Home ownership
<b>Business indexing term:</b>	Subject: Metropolitan areas Economic growth Redlining
<b>Location:</b>	Detroit Michigan; United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S49-S57
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English

Document type: Journal Article

DOI: <https://doi.org/10.2105/AJPH.2022.307162>

ProQuest document ID: 2770264073

Document URL: <https://www.proquest.com/scholarly-journals/historic-redlining-practices-contemporary/docview/2770264073/se-2?accountid=211160>

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Last updated: 2023-03-01

Database: Public Health Database

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# Structural Racism and Health Inequities: Moving From Evidence to Action

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## ABSTRACT (ENGLISH)

Ignoring structural racism as a core determinant of social inequities, political inequities, and economic inequities ignores its roles as a fundamental driver of the ongoing and stark health inequities racialized and marginalized communities face. The laws, policies, and practices that are manifestations of structural racism in the United States include policing policies and police violence, the War on Drugs, housing discrimination, mass incarceration, occupational inequities, and xenophobic immigration policies, to name a few of the most insidious forms of structural racism. In this issue of AJPH, we present a collection of (1) empirical articles providing evidence on how specific laws, policies, and practices related to the aforementioned topics have upheld and reified structural racism and, specifically, how they have shaped the health inequities pervasive in the United States; and (2) articles providing clear evidence of why researchers must center structural racism as a core determinant of health and health inequities.

## FULL TEXT

Ignoring structural racism as a core determinant of social inequities, political inequities, and economic inequities ignores its roles as a fundamental driver of the ongoing and stark health inequities racialized and marginalized communities face. The laws, policies, and practices that are manifestations of structural racism in the United States include policing policies and police violence, the War on Drugs, housing discrimination, mass incarceration,

occupational inequities, and xenophobic immigration policies, to name a few of the most insidious forms of structural racism. In this issue of AJPH, we present a collection of (1) empirical articles providing evidence on how specific laws, policies, and practices related to the aforementioned topics have upheld and reified structural racism and, specifically, how they have shaped the health inequities pervasive in the United States; and (2) articles providing clear evidence of why researchers must center structural racism as a core determinant of health and health inequities.

#### POLICING AND POLICE VIOLENCE

Born out of "slave patrols" meant to uphold the institutions of slavery and human bondage, sharpened during the Reconstruction era by local militias formed to deny rights to freed persons who were enslaved, and codified by local and state Jim Crow laws, the modern-day policing system is rooted in the application of force and violence to maintain control. We can move across time to find further evidence- such as the violent policing of Native Americans and successive waves of immigrants-of how the policing system in the United States was established to maintain White supremacy and White power. Modern policing in major urban cities-including but not limited to New York, New York; Los Angeles, California; and Chicago, Illinois-have employed various stop-and-frisk policies as a means of proactive policing in high-crime areas. Across the board, the overwhelming number of police encounters under these programs were in neighborhoods with majority Black or Hispanic/Latino populations. The direct harms of these proactive policing policies were to those targeted for surveillance and arrest. Equally important are the indirect harms to community members, who may not have been directly targeted for surveillance but live with the stress and stigma of violence and control inflicted by proactive policing practices.

In this issue, Jahn et al. (p. S21) present findings that shed light on how structural racism as manifested by the harms perpetuated via proactive policing in communities of color affects preterm birth rates. Their findings demonstrate that exposure to high levels of neighborhood proactive policing creates environmental conditions associated with greater risk of preterm birth for Black persons. The public health implications of these finding cannot be ignored in the context of an enduring maternal and infant health crisis, both in the United States as a whole and in Louisiana, which consistently has one of the worst state-level rankings on maternal mortality (<https://bit.ly/3DUhQ0j>) fueled by Black-White disparities in maternal deaths.<sup>1</sup>

Alang et al. (p. S29) offer an equal parts insightful and powerful framework for analyzing four interrelated mechanisms driven by the intersection of racism and sexism that create a "unique axis of oppression" exposing women of color to police brutality. Viewed through the lens of gendered racism, researchers can employ this framework to examine how police brutality toward Black and Brown women creates vulnerabilities that, in turn, produce poor health outcomes. In particular, and relevant to the work of Jahn et al., the fourth mechanism proposed by Alang et al.-"burden of vicarious marginalization"-offers a way for future researchers to understand the complex and layered ways the direct and indirect experiences vis-a-vis knowledge of community police violence, police brutality, and police neglect make them more vulnerable to worse maternal and infant health outcomes.

Finally, recognizing the need to modernize and rehabilitate policing practices to undo the disproportionate harms inflicted on people and communities of color from police violence, Spolum et al. (p. S37) summarize several recommendations for successful community-based, alternative response programs in addition to policing. Such alternative response teams most frequently dispatch mental health specialists or emergency medical services to respond to mental health crises or other nonviolent and noncriminal emergencies, which is shown to reduce the use of lethal and, often, unlawful force. Most critically, deployment of these teams affirms our commitment to treating all persons in need and in crisis, irrespective of where they are or who they are, with dignity and respect as a fundamental human right.

#### RACISM AND THE WAR ON DRUGS

As the overdose crisis in the United States persists and overdose-related fatalities continue to mount, there are sharp increases in overdose mortality among Black people, Indigenous people, and other people of color (BIPOC). A July 2022 Morbidity and Mortality Weekly Report study reported that overall overdose deaths increased by 30% between 2019 and 2020 and that there was a 44% and 39% increase among non-Hispanic Black and American

Indian or Alaska Native persons, respectively.<sup>2</sup>

Given the continuing rise in overdose fatalities, interventions to curb the overdose crisis have shifted from criminal and carceral approaches to treatment and rehabilitation. However, the implementation of both the punitive and harm reduction policy paradigms is overshadowed by racial/ethnic inequities. Mandatory minimum sentencing, such as the Rockefeller Drug Laws enacted in 1973 in New York City, required long prison terms for people convicted of a range of drug-related offenses. These laws, both in New York and across the country, were largely responsible for the dramatic rise of the prison-industrial complex and the racial disparities in the prison population. In the shift toward a harm reduction policy approach, Good Samaritan laws minimize the threat of legal action to anyone witnessing an overdose so they will be encouraged to seek immediate help. However, as Pamplin et al. (p. S43) note, these laws offer limited protection to individuals under community supervision, who are more often likely to be BIPOC and often rely on police discretion. Thus, these limited protections are less likely to be used by or to assist Black, Hispanic/Latino, and Indigenous persons.

#### REDLINING AND HOUSING SEGREGATION

The United States has a long and ugly history of housing policies and practices backed by the federal government, financial institutions, and local community and neighborhood groups—all with the singular goal of creating racially segregated neighborhoods. From laws codifying housing exclusion based on race/ethnicity to community groups establishing neighborhood norms identifying "desirable" and "not desirable" neighbors, segregation has shaped the US residential landscape as well as the unequal distribution of social, political, and economic resources.

Racial/ethnic segregation in housing is yet another indicator of structural racism and a driver of underresourcing and disadvantaging communities of color across the United States. Medipanah et al. (p. S49) provide additional and important evidence on the legacy of redlining—a policy of cutting off low-income and racialized minority residents from housing loans during the first half of the 20th century—in the Detroit, Michigan, metropolitan area. Their findings demonstrate how historical disinvestment and concentrated disadvantage resulting from redlining in the Detroit metro area are associated with producing worse contemporary social determinants of health, in, for example, median income, employment, high school education, percentage children living above the poverty line, percentage health insurance coverage, commute travel times of less than 30 minutes, and diesel particulate matter exposure.

#### MASS INCARCERATION

Mass incarceration is not only a consequence of racially driven policing and policing policy but also the product of many failing systems that constitute the social determinants of health: inadequate education, a racist war on drugs policy, differential policing and police activity, inadequate affordable housing, insufficient social services, and grossly limited economic opportunities. Blankenship et al. (p. S58) weave together the epidemics of insufficient affordable housing and mass incarceration to direct our attention to how these two intersecting manifestations of structural racism reinforce and amplify one another to produce health inequities. To understand this intersection, one must understand that the impact of mass incarceration begins well before and extends well after a prison term is served. Mass incarceration is preceded by proactive policing that places BIPOC under greater surveillance and increased exposure to and interaction with police, and, therefore, at greater risk for arrest and incarceration. And mass incarceration is followed by community supervision and parole as well as a criminal record that undermine the ability to access public housing, social services, and other supports that prevent recidivism.

#### OCCUPATIONAL AND ECONOMIC INEQUITIES

Yearby et al. (p. S65) specifically call for structural racism to be incorporated as a fundamental cause of health inequities and an underlying driver of the unequal distribution of the social determinants of health among minoritized and racialized groups. Importantly, their proposed model not only centers structural racism as manifested by inequitable employment and economic opportunities but also is applied to agricultural workers, an understudied and often ignored group whose health needs and health inequities are significant. This revised framework recognizes that the restrictions on employment opportunities for Black Americans and non-US citizens, both historically and currently, that have limited them to low-wage occupations (e.g., in the agricultural sector) are rooted in racist policies that continue to propel the economic marginalization of these groups. Although there is robust literature on the



associations between employment status and income inequality as drivers of health inequities, few studies have acknowledged the structural racism and discrimination in the enactment of labor policies and practices that underly employment status and income inequality. Failure to do so ignores how these created inequities in employment status and income act as drivers of physical and mental health inequities.

#### IMMIGRATION POLICY AND XENOPHOBIA

The immigration and refugee crisis in the United States is yet another example of how racism, nativism, and fear dominate the immigration policy debate to create and sustain structurally racist policies that undermine a humanitarian response. Born out of xenophobia toward successive waves of immigrants, the immigration process- from visa requirements, immigration practices, and citizenship requirements- is geared toward maintaining control, dominance, and the political, economic, and social status quo of power for the White majority. Once in the United States, immigrants continue to face structurally racist policies that determine their ability to work, where they can live, the types of benefits they can receive, and the services they can use. As Cerda et al. (p. S72) note, failure to recognize the structurally racist policies that shape the immigrant and refugee experience pushes us backward to employing an individualistic model that views mental health inequities as shaped by individual-level determinants of health.

Finally, Young and Crookes (p. S16) call attention to addressing the intersectionality of racist experiences for immigrants of color, specifically for Black, Latino, and Asian immigrants, and how partnerships across multiple sectors can address the intersecting systems of structural racism.

#### MEASURING RACISM

There is well-established evidence of the effect of racism on health and how the psychosocial stress associated with it "gets under the skin" of racialized and minoritized groups in the United States to create health inequities.

Moreover, the summarized articles underscore how current laws, policies, and practices affect the health of US racialized and minoritized groups. However, measures of racism are not always incorporated in our public health surveillance and monitoring systems to document how racism is embodied to affect health. White et al. (p. S80) show the deficiencies of our current monitoring systems in collecting, monitoring, tracking, and analyzing measures of individual racism and structural racism as well as how this lack of standard for racism surveillance hinders our ability to identify and dismantle the systemic racism affecting our ultimate goal of health equity for all.

#### FINAL THOUGHTS

Collectively, the articles in this supplement highlight many of the mechanisms through which structural racism manifests and acts to produce health inequities. But these are by no means all of the mechanisms. These articles show that to reduce-let alone end-the health inequities that we see today, we must acknowledge that structural racism is a fundamental driver of health inequities and call for law, policy, and practice changes to prevent, reduce, and eventually eradicate it. Most importantly, these articles provide concrete examples of how these changes could reduce health inequities and improve population health in the United States, especially for racialized and minoritized groups.

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#### PUBLICATION INFORMATION

Full Citation: Kapadia F, Borrell LN. Structural racism and health inequities: moving from evidence to action. *Am J Public Health*. 2023;113(S1):S6-S9.

Acceptance Date: November 12, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307174>

#### CONTRIBUTORS

Both authors conceptualized, drafted, and edited this editorial.

#### CONFLICTS OF INTEREST

Neither author has any conflicts of Interest to report.

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## DETAILS

<b>Subject:</b>	White supremacy; Mortality; Employment; Violence; Health disparities; Prisons; Economic opportunities; Hispanic Americans; Fatalities; Segregation; Minority & ethnic groups; Criminal sentences; Mental health; Neighborhoods; Affordable housing; Imprisonment; Harm reduction; Evidence; Premature birth; Community; Social exclusion; Redlining; African Americans; Police brutality; Health surveillance; Marginality; Health; Housing; Discrimination; Inequality; Immigration policy; Police; Drug policy; Drug discrimination; Aggression; Policies; Systemic racism; Public health
<b>Business indexing term:</b>	Subject: Employment Economic opportunities Affordable housing Redlining
<b>Location:</b>	United States--US; Detroit Michigan; New York
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S6-S9
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal

Language of publication:	English
Document type:	Journal Article
ProQuest document ID:	2770263933
Document URL:	<a href="https://www.proquest.com/scholarly-journals/structural-racism-health-inequities-moving/docview/2770263933/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/structural-racism-health-inequities-moving/docview/2770263933/se-2?accountid=211160</a>
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Last updated:	2023-08-31
Database:	Public Health Database

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# Mechanisms Connecting Police Brutality, Intersectionality, and Women's Health Over the Life Course

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[ProQuest document link](#)

## ABSTRACT (ENGLISH)

Police brutality harms women. Structural racism and structural sexism expose women of color to police brutality through 4 interrelated mechanisms: (1) desecration of Black womanhood, (2) criminalization of communities of color, (3) hypersexualization of Black and Brown women, and (4) vicarious marginalization. We analyze intersectionality as a framework for understanding racial and gender determinants of police brutality, arguing that public health research and policy must consider how complex intersections of these determinants and their contextual specificities shape the impact of police brutality on the health of racially minoritized women. We recommend that public health scholars (1) measure and analyze multiple sources of vulnerability to police brutality, (2) consider policies and interventions within the contexts of intersecting statuses, (3) center life course experiences of marginalized women, and (4) assess and make Whiteness visible. People who hold racial and gender power—who benefit from racist and sexist systems—must relinquish power and reject these benefits. Power and the benefits of power are what keep oppressive systems such as racism, sexism, and police brutality in place. (*AmJ Public Health*. 2023;113(S1):S29-S36. <https://doi.org/10.2105/AJPH.2022.307064>)

## FULL TEXT

### Headnote

Police brutality harms women. Structural racism and structural sexism expose women of color to police brutality through 4 interrelated mechanisms: (1) desecration of Black womanhood, (2) criminalization of communities of color, (3) hypersexualization of Black and Brown women, and (4) vicarious marginalization.

We analyze intersectionality as a framework for understanding racial and gender determinants of police brutality,

arguing that public health research and policy must consider how complex intersections of these determinants and their contextual specificities shape the impact of police brutality on the health of racially minoritized women. We recommend that public health scholars (1) measure and analyze multiple sources of vulnerability to police brutality, (2) consider policies and interventions within the contexts of intersecting statuses, (3) center life course experiences of marginalized women, and (4) assess and make Whiteness visible. People who hold racial and gender power—who benefit from racist and sexist systems—must relinquish power and reject these benefits. Power and the benefits of power are what keep oppressive systems such as racism, sexism, and police brutality in place. (AmJ Public Health. 2023;113(S1):S29-S36. <https://doi.org/10.2105/AJPH.2022.307064>)

Police brutality is a social determinant of health, causing mortality, morbidity, and disability.<sup>1,2</sup> Police brutality also extends to police neglect and words, policies, and actions that dehumanize, intimidate, and cause physical, psychological, and sexual harm.<sup>1,3</sup> Police brutality can be experienced directly through personal contact with the police, vicariously through witnessing or hearing about police actions in the media or within one's kin and social networks, and ecologically through living, working, or attending schools in heavily policed neighborhoods.<sup>2,4</sup> Exposure to and health consequences of police brutality are not equally distributed. Racially minoritized communities are disproportionately exposed to police brutality, significantly increasing mortality rates and elevating odds of physical and psychological problems.<sup>2</sup> Even though most of the research focuses on male victims of police brutality,<sup>5</sup> Black and other women and gender-nonconforming people of color are significantly harmed, and their experiences rendered invisible.<sup>6</sup> Intersectionality behooves us to analyze beyond the racism of police brutality. We examine how intersecting systems of racism and sexism expose racially minoritized women to police brutality. We also discuss the relevance of applying an intersectionality framework in research that examines the health impacts of police brutality and in the development of policies to eliminate this form of structural violence that harms women of color.

We use "women of color" to refer to Black women and other racially minoritized women who are not racialized as White. We understand that anti-Blackness is at the center of structural racism and police brutality<sup>7</sup> and that, even within the heterogeneous category of "women of color," Black women experience anti-Black racism perpetrated and sustained by other women of color.<sup>8</sup> However, our analysis focuses on the experiences of women of color to acknowledge the complex reality that we are all victims of the White supremacy that makes structural racism possible, and we can be complicit in each other's oppression. We simultaneously center the experiences of Black women and incorporate how other women of color, especially Indigenous women and Latinas, are racialized and gendered in ways that disproportionately expose them to police brutality.

#### POLICE BRUTALITY, RACISM, AND SEXISM

Police brutality is not new. Colonizers who settled in what is now known as New England appointed constables to police and murder Indigenous Peoples, ensuring control over seized lands.<sup>9</sup> During the antebellum era, White men of various social classes were deputized by the law to surveil, whip, arrest, shoot, and lynch enslaved and freed Black persons.<sup>10</sup> Moreover, law enforcement officers encouraged the beatings and killings of (perceived) Mexicans who were considered trespassers. Law enforcement officers often secured victims, enabling White mobs to murder them.<sup>11</sup> That Black and Brown communities continue to be disproportionately exposed to police brutality<sup>2</sup> tells us that policing is a tool of White supremacy and racial domination. Indeed, contemporary evidence that being White protects from police brutality<sup>12</sup> also demonstrates that the system of policing has remained unchanged.

Police brutality is the most enduring form of structural racism.<sup>13</sup> We define structural racism as the universe of historical and contemporary factors that operate across multiple systems and institutions to foster racial oppression by providing power, privileges, and resources to people who are White at the expense of others who are not White.<sup>14</sup> As a form of structural racism, police brutality is sustained by many systems. It influences processes, expectations, and outcomes across other systems in ways that continue to disadvantage racially minoritized communities.

Police brutality is also sustained by structural sexism, and it shapes people's experiences and life chances by gender.<sup>5</sup> We define sexism as a cumulative array of factors that operate across institutions to ensure male

supremacy at the expense of women and gender-nonconforming persons.<sup>15</sup> Structural sexism is characterized by pervasive and "systematic gender inequality in power and resources-at the macro, meso, and micro levels of the gender system."<sup>15(p487)</sup> Gender inequities disproportionately expose women to police neglect and to sexual harassment by police.<sup>5,16</sup> These inequities foster entitlement to and sexualization of women's bodies by both the police and the public. Women's claims of and worries about police brutality, as well as their demands to the police, are easily dismissed because of systematic deprioritization of their needs.<sup>17</sup>

#### GENDERED RACISM AND POLICE BRUTALITY

Gendered racism refers to a distinct form of structural racism that is perpetuated and experienced along gender lines.<sup>18</sup> This concept was introduced specifically to highlight how the racial oppression of Black women is structured by racist perceptions of gender that are mediated by institutional and interpersonal actions.<sup>18</sup> For women not racialized as White, gendered racism encompasses and extends beyond the separate and additive effects of structural racism and structural sexism. It recognizes that (1) racism harms women of color like it does men of color, (2) sexism harms women of color like it does White women, and (3) a third phenomenon-a hybrid of racism and sexism-emerges as a unique axis of oppression that harms women of color in multiplicative ways. Gendered racism draws from Black feminist and womanist frameworks that emphasize intersectionality-how ideologies, structures, and systems of oppression intersect with each other to reproduce new axes of oppression.<sup>19-21</sup>

Intersectionality is a theoretical framework to analyze the interconnected nature of systemic oppression.<sup>21</sup> It examines power dynamics within and between groups and makes visible the interlocking, distinct, multiplicative, and evolving ways that policies and practices impact individuals and groups based on their relationship to power.<sup>21,22</sup> Intersectionality calls attention to how the needs and experiences of Black women are ignored by White feminist movements and by antiracist movements that predominantly center the experiences of Black men, underscoring that racism and sexism are inextricably linked in their influence on the life chances of Black women. This analysis is scarce within the literature about the public health impacts of police brutality.

Even though other systems of inequality shape the health of Black women, such as social class, cis-heteronormativity, citizenship, and disability, to name a few, we examine 2 main systems and their impact on police brutality: racism (race) and sexism (gender). We focus on the intersection of racism and sexism because public health discourse on police brutality often centers victims as men, especially Black men. This further makes invisible the multiple ways by which Black and other women of color are harmed by police violence. Given limited national data on how police brutality impacts Black women specifically, our analyses of mechanisms through which intersecting systems of racism and sexism expose them to police brutality over the life course can help inform research and policy, including data collection, analyses, and implementation of interventions. These 4 interrelated mechanisms include (1) desecration of Black womanhood, (2) criminalization of communities of color, (3) hypersexualization of Black and Brown women, and (4) vicarious marginalization (Figure 1).

#### Desecration of Black Womanhood

Womanhood is typically perceived as White. Black women are often dehumanized and perceived as outside of the category of "woman."<sup>23</sup> Desecration of Black womanhood describes how Black women are held in opposition to the White supremacist ideal of White women as the exemplar of womanhood. White women are perceived as pure, righteous, and worthy of protection and dignity, and their sanctification occurs at the expense of Black women. For example, during the first wave of incarceration of women in the late 1800s, Black women were disproportionately arrested and imprisoned.<sup>24</sup> Like Black men, they were considered aggressive.<sup>24</sup> Unlike White women, they were rarely perceived to have been sufficiently punished, or to have suffered enough. They were not perceived as having the "feminine" qualities ascribed to womanhood, qualities that merited patriarchal protection-submissiveness, fragility, and soft-spokenness. Black women were imprisoned alongside men. In contrast, reformatories were opened to house White women who were perceived to need moral reform and protection from the bad influence of Black women and from dangerous Black men.<sup>24</sup>

Indeed, this dehumanization goes as far back as the time of slavery. Black women were chattel: nonpeople.<sup>23</sup> They were treated as tools for wealth accumulation through grueling labor they were forced to perform and through

childbearing: the children they bore and loved were also considered chattel. They were forced to literally (routinely through rape) reproduce the labor force.<sup>23</sup> Because of gendered racism, even after the formal abolition of slavery in the 19th century, Black women continue to be dehumanized, viewed as disposable, inherently threatening, and not worthy of defense.<sup>21,23</sup>

Today, Black women and Latinas report higher rates of police brutality in the forms of physical police violence, psychological intimidation, and police neglect, compared with non-Latina White women.<sup>25</sup> Black and Indigenous women have disproportionately greater risk of being killed at the hands of police, a rate more than twice that of White women.<sup>26</sup> In gendered racialized dynamics, White men and police officers serve as "protectors" of normative White womanhood. However, Black and other women of color are desecrated-perceived as perpetual threats-and their humanity rendered invisible by state agents.<sup>5</sup> Racist stereotypes and tropes of Black women such as being "lazy," "loud," and "promiscuous" also desecrate Black womanhood, elevating exposure to police brutality.<sup>6</sup> Desecration of Black womanhood is shaped in part by the criminalization of Black and Brown communities, communities to which Black women belong (Figure 1).

#### Criminalization of Black and Brown Communities

Routinely racialized forms of policing in general and the war on drugs in particular facilitate the criminalization and routine profiling of Latina, Black, and Indigenous women as drug couriers and purveyors, leading to disproportionate stops, searches, detention, and incarceration of women of color.<sup>6</sup> Indeed, before the police-perpetrated death of Sandra Bland that began as a result of a traffic stop, Bland had been arrested twice and charged for possession of small amounts of marijuana. After her first arrest, she served 30 days in Harris County jail, a facility that is among the Department of Justice's most criticized facilities for unconstitutional confinement.<sup>6</sup> Black women are routinely victims of violent policing. As scholars have documented, many unarmed Black girls and women have been killed and physically assaulted by police, including 7-year-old Aiyana Stanley-Jones, who was killed while she was sleeping, and 22-year-old Rekia Boyd, who was shot in the head and killed in Chicago in 2015.<sup>27</sup>

Women of color and members of their social and kin networks are targeted in the racist War on Drugs. For example, Breonna Taylor's ex-boyfriend was the subject of an ongoing drug investigation. Taylor's affiliation to him was used as an excuse to issue a no-knock warrant for her address, criminalizing and murdering her in her own apartment.<sup>28</sup> Tarika Wilson and her 14-month-old son were killed under similar circumstances, shot by police during a drug raid targeting a Black man. Wilson was at home, holding her son.<sup>27</sup>

Black women's survivorship and attempts at self-protection are also criminalized.<sup>29</sup> For example, girls and women like Marissa Alexander, Cyntoia Brown, Alisha Walker, and CeCe McDonald were criminalized for defending themselves from interpersonal violence from which the police provided no safety. Many Black women and gender-nonconforming survivors continue to be incarcerated for the "crime" of protecting themselves from perpetrators of violence. As Kaba puts it, unlike normative White women, Black survivors of violence are treated as though they deserve abuse, and as though they are "incapable of claiming a self worth defending."<sup>29</sup>(p32)

#### Hypersexualization

Gendered racism helps explain the sexualized nature of police violence toward women of color. As building blocks of the United States, racial capitalism and colonialism rely on ownership and exploitation of bodies that are racialized as Black and Brown.<sup>30</sup> Racial capitalism and colonialism are co-constitutive- they reinforce each other and coproduce other forms of oppression. They are also patriarchal, with both relying on the "sexual exploitation of women of color through rape and systems of concubinage."<sup>31</sup>(p2) One of the contemporary manifestations of sexual exploitation of Black and other non-White women is hypersexualization- assumptions that women of color are sexually deviant, aggressive, available, and promiscuous.<sup>32</sup> Hypersexualization is driven, in part, by criminalization of Black and Brown communities. Thus, it facilitates surveillance of the bodies of women of color as well as sexual violence against them. It is no surprise that women of color are more likely than any other group to be sexually harassed, assaulted, and raped by the police during searches and routine traffic and street stops.<sup>16</sup> Data from the experiences of women in Baltimore, Maryland; New York City; Philadelphia, Pennsylvania; and Washington, DC, suggest that Latinas experience police sexual violence at much higher rates than non-Latina White women.<sup>25</sup>

Indigenous women and transgender women of color are also disproportionately victims of police sexual harassment, assault, and rape.<sup>6</sup>

Police disproportionately threaten women of color with drug-related arrests and charges that can lead to incarceration or interfere with work and family life if they do not perform sexual acts.<sup>6</sup> Police sexual violence extends beyond harassment, assault, and rape. It includes invasions of privacy such as voyeurism and viewing and distributing sexually explicit photographs or videos of crime victims.<sup>16</sup> Unnecessary pat downs and strip and body cavity searches are also forms of police sexual violence commonly perpetrated against girls and women of color.<sup>6</sup>

#### The Burden of Vicarious Marginalization

Vicarious marginalization refers to "the marginalizing effect of police maltreatment that is targeted toward others."<sup>33</sup>(p2104) Interlocking dimensions of gender, social class, and broader racial inequities constrain women of color who reside in impoverished neighborhoods. These margins of oppression symbolize a lack of power, and they increase exposure and vulnerability to police brutality. Vicarious exposure to police brutality-knowledge about the harmful experiences of others within one's network-might increase anticipatory stress of police brutality. As women of color are typically perceived as pillars of and caregivers in their communities, gender norms compel them to assume protector and provider roles for family members and friends, including those arrested, incarcerated, or murdered by the police.<sup>34</sup> These burdens can increase stress and take away from resources that matter for health-hence, affecting health outcomes.

Moreover, perceiving their own vulnerability to police brutality as secondary, Black and Indigenous women often focus their attention on the physical appearance of Black and Indigenous boys and men in their lives-for example, their clothing, hair, weight and height-given how their looks might expose them to police brutality,<sup>35</sup> often to the neglect of considerations for their own health and safety. As survivors of loved ones unjustly killed by the carceral system, Black women may face a rapid deterioration of health and early death from the stress of fighting for justice on the deceased's behalf as well as from the trauma of the sudden loss. Erica Garner-daughter of Eric Garner, who was choked to death by police in 2014-died from a heart attack at age 27 after years of advocacy work. Journalistic work has also evidenced repeated reports of Black women survivors facing multiple physical health consequences in addition to the psychological trauma of the violent deaths of their loved ones. Structural racism in the form of racial residential segregation establishes disproportionately Black and Brown neighborhoods characterized by economic deprivation and lethal police surveillance.<sup>36</sup>

#### IMPLICATIONS

A significant and growing body of research links police brutality to various health outcomes.<sup>2</sup> The violence and injustice of police brutality and its impact on health have centered police brutality as a salient determinant of health requiring policy action.<sup>37</sup> To eliminate police brutality and address its health consequences, research and policy must address the complex ways in which systems such as race and gender intersect over the life course to increase exposure to police brutality, harming health. Considering multiple sources of vulnerability and how they increase or moderate risk independently and interconnectedly across different axes matters. This requires more systematic collection of various forms of data on police brutality, especially among Black and Brown women. For example, personal narratives, ethnographies, and interviews about the nature and outcomes of police brutality; the social, political, and economic contexts in which it is experienced and anticipated; and how it affects multiple health outcomes are important data for public health policy.

We propose 4 specific recommendations for research and policy:

1. Research should examine multiple sources of vulnerability. Anti-Blackness is unquestionably at the center of police brutality.<sup>7</sup> However, determinants of exposure to police brutality and the moderators of its impact on health should not be limited to anti-Blackness or anti-Black masculinity. For example, lesbians, transgender women, and gender-nonbinary adults are more likely than their heterosexual and cisgender counterparts to be stopped, arrested, and verbally and physically assaulted by the police.<sup>2</sup> Women with limited household incomes disproportionately experience psychological police violence and police neglect (police not responding when needed, responding too late, or responding inappropriately) compared with their peers with higher incomes.<sup>25</sup> Data analyses on the impact

of police brutality on health should not only examine these statuses independently but should also explore multiple systems that drive health consequences of police brutality and their intersections. As Lisa Bowleg writes, "intersectionality's promise lies in its potential to elucidate and address health disparities across a diverse array of intersections including, but not limited to, race, ethnicity, gender, sexual orientation, [socioeconomic status], disability, and immigration and acculturation status."<sup>38</sup>(p1270) Researchers who seek to answer these questions must then apply analytic methods that focus on interlocking types of oppression. A systematic review by Guan et al.<sup>39</sup> provides some examples. We must capture the multidimensionality of structural inequity in our research.

Leveraging measures such as the Multidimensional Measure of Structural Racism can move this effort forward.<sup>40</sup>

2. Consider the context of intersecting statuses in policy-making. Mechanisms through which factors such as race, gender identity, and disability, for example, intersect to shape exposure to police brutality and how this exposure affects health are context-specific and dynamic. Cisgender privilege might protect an impoverished Black woman from police brutality in the same context where her Blackness and disability increase her vulnerability. Interventions like divesting from carceral systems and instead investing in access to resources that matter for health like affordable housing can help reduce exposure to police brutality among Black unhoused and economically marginalized women who are disproportionately surveilled. However, intersectionality requires us to consider how Black transgender women, for example, will still face housing discrimination and other forms of transphobic exclusion and violence that ultimately leaves them exposed to and harmed by police brutality. Just like multiple intersecting systems and structures shape the health of women of color, multiple policies are required to address intersecting systems that shape health.

3. Center the experiences of marginalized populations over the life course. An intersectionality framework requires us to analyze co-constitutive systems and mechanisms that shape health and to also ground these analyses in experiences of historically marginalized populations over their life course.<sup>22,38</sup> This will make certain policies and interventions are responsive to their needs. For example, we know that Black, Latinx, and Indigenous households are exposed to police brutality at disproportionately higher rates than White households.<sup>2</sup> As adults, women from these households continue to be exposed to police brutality because they are considered not worthy of defending<sup>29</sup> or inherently violent, because they are perceived as proximal to criminalized Black and Brown men and because their communities and economic circumstances are more broadly marginalized and criminalized.<sup>5,6</sup> Examining how direct police contact and vicarious and ecological exposure to police brutality during childhood, adolescence, and key periods in their lives affect health is important. Interventions to address the health impacts of police brutality must also consider the direct and indirect experiences of police brutality over the life course of women of color, especially women whose lives are at the intersection of multiple axes of oppression.

4. Assess and expose the benefits of Whiteness. Finally, intersectionality emphasizes the relevance of power in shaping health.<sup>22,38</sup> Structural racism is about power-systemic social, economic, and political domination. Structural racism is White-controlled; it is maintained and reproduced by the invisibility of Whiteness. Assessing the ways by which Whiteness, including normative constructions of White womanhood, sustains police brutality will make Whiteness more visible. Making Whiteness visible can contribute to the elimination of health inequities caused by police brutality and structural racism more broadly. Specifically, public health researchers must pose questions that explore how Whiteness limits exposure to police brutality and how and when it is mobilized as a powerful resource to buffer the impact of police brutality on the health of White and White-adjacent (benefiting from Whiteness by virtue of light skin but belonging to a racially minoritized group) people who might also be exposed.

## CONCLUSION

Police brutality harms women. Women of color in the United States occupy at least 2 marginalized statuses. We argue that these statuses intersect in distinct ways to shape their exposure to police brutality and, ultimately, their health. Conceptualizations of gender, femininity, masculinity, and sexuality, while evolving, are constantly racialized. Assessing the impact of police brutality on the health of women of color in the context of historical and contemporary meanings and performances of sexuality and gender might expand our understanding of determinants of police brutality. Racist and sexist stereotypes, policies that target and criminalize Black and Brown communities, Black



women's attempt at survivorship and self-protection, and broader structural inequities intersect to expose women of color to police brutality. Simultaneously, police brutality is used to criminalize and punish them for experiencing these inequities.

Gender and race are not the only factors that matter for police brutality and health. Other factors such as socioeconomic status and (dis)ability intersect to increase or reduce vulnerability to police brutality and produce new mechanisms that connect police brutality to health. These factors, the nature of their intersections, and the mechanisms they create are context-specific and dynamic. A life course assessment of these intersections is an important research agenda for public health.

Such research will help identify areas for specific interventions, as well as explore the impact of policies on differentially marginalized populations. Our 4 recommendations are not a 1-to-1 match with the 4 mechanisms we identify. Each recommendation matters for undoing all the mechanisms that connect gendered racism to police brutality. For example, multiple sources of data and measures of structural oppression can help us identify systems and patterns that desecrate Black womanhood or that facilitate the hypersexualization of women of color in different contexts. And decentering Whiteness will certainly dismantle all 4 mechanisms.

Ultimately, the goal is to eliminate police brutality, structural sexism, and structural racism. Investing in new, noncarceral ways to promote community safety is long overdue. Dismantling both structural racism and structural sexism matter significantly for improving the health of women of color. However, these efforts require the willingness of people who hold racial and gender power—who benefit from racist and sexist systems—to relinquish power and reject these benefits. Power and benefits of power are what keep oppressive systems in place. We have the tools to dismantle the systems of oppression that maintain police brutality; we must now decide if we have the will. >4JPH

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#### PUBLICATION INFORMATION

Full Citation: Alang S, Haile R, Hardeman R, Judson J. Mechanisms connecting police brutality, intersectionality, and women's health over the life course. *Am J Public Health*. 2023;113(S1):S29-S36.

Acceptance Date: July 24, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307064>

#### CONTRIBUTORS

S. Alang and R. Haile conceptualized the article and wrote the first draft. R. Hardeman further developed the policy and research recommendations. J. Judson further developed the mechanisms that expose Black and other women of color to police brutality.

#### ACKNOWLEDGMENTS

This work was supported, in part, by a National Institutes of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development grant (R01 HD103684).

Note. The views expressed in this publication do not necessarily reflect the official policies and views of the National Institutes of Health nor do they imply endorsement by the US government.

#### CONFLICTS OF INTEREST

There are no conflicts of interest.

#### HUMAN PARTICIPANT PROTECTION

Human participants were not involved, therefore institutional review board approval was not required.

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## DETAILS

<b>Subject:</b>	White supremacy; Womens health; Public health; Criminalization; Systemic racism; Sexism; Marginality; Law enforcement; Racism; Power; Intersectionality; Gender; Women; Discrimination; Social exclusion; Health research; White people; Oppression; Minority & ethnic groups; Black people; Police brutality; Murders & murder attempts; Police
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<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S29-S36
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307064">https://doi.org/10.2105/AJPH.2022.307064</a>
<b>ProQuest document ID:</b>	2770263820
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/mechanisms-connecting-police-brutality/docview/2770263820/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/mechanisms-connecting-police-brutality/docview/2770263820/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-08-10
<b>Database:</b>	Public Health Database

Document 10 of 39

# Integrating Racism as a Sentinel Indicator in Public Health Surveillance and Monitoring Systems

## ABSTRACT (ENGLISH)

**Objectives.** To evaluate public health surveillance and monitoring systems' (PHSMS) efforts to collect, monitor, track, and analyze racism. **Methods.** We employed an environmental scan approach. We defined key questions and data to be collected, conducted a literature review, and synthesized the results by using a qualitative description approach. **Results.** We identified 125 PHSMS; only 3—the Behavioral Risk Factor Surveillance System, Pregnancy Risk Assessment and Monitoring System, and California Health Interview Survey—collected and reported data on individual-level racism. Structural racism was not collected in PHSMS; however, we observed evidence for linkages to census and administrative data sets or social media sources to assess structural racism. **Conclusions.** There is a paucity of PHSMS that measure individual-level racism, and few systems are linked to structural racism measures. **Public Health Implications.** Adopting a standard practice of racism surveillance can advance equity-centered public health praxis, inform policy, and foster greater accountability among public health practitioners, researchers, and decision-makers. Failure to explicitly address racism and the insufficient capacity to support a robust health equity data infrastructure severely impedes efforts to address and dismantle systemic racism. (AmJ Public Health. 2023;113(S1):S80-S84. <https://doi.org/10.2105/AJPH.2022.307160>)

## FULL TEXT

### Headnote

**Objectives.** To evaluate public health surveillance and monitoring systems' (PHSMS) efforts to collect, monitor, track, and analyze racism.

**Methods.** We employed an environmental scan approach. We defined key questions and data to be collected, conducted a literature review, and synthesized the results by using a qualitative description approach.

**Results.** We identified 125 PHSMS; only 3—the Behavioral Risk Factor Surveillance System, Pregnancy Risk Assessment and Monitoring System, and California Health Interview Survey—collected and reported data on individual-level racism. Structural racism was not collected in PHSMS; however, we observed evidence for linkages to census and administrative data sets or social media sources to assess structural racism.

**Conclusions.** There is a paucity of PHSMS that measure individual-level racism, and few systems are linked to structural racism measures.

**Public Health Implications.** Adopting a standard practice of racism surveillance can advance equity-centered public health praxis, inform policy, and foster greater accountability among public health practitioners, researchers, and decision-makers. Failure to explicitly address racism and the insufficient capacity to support a robust health equity data infrastructure severely impedes efforts to address and dismantle systemic racism. (AmJ Public Health. 2023;113(S1):S80-S84. <https://doi.org/10.2105/AJPH.2022.307160>)

Public health surveillance and monitoring systems (PHSMS) collect data to guide disease prevention, improve population health, and eliminate racial/ethnic health inequities.<sup>1</sup> Addressing inequities may be hampered, in part, by inadequate efforts to incorporate measures of racism data in PHSMS. One recent study reported the inadequacy of PHSMS in monitoring racism, stigma, and COVID-19-related surveillance.<sup>2</sup> However, a broader assessment of PHSMS's capacity to collect, monitor, track, and analyze racism (operating at multiple levels) relative to general population health outcomes has not been conducted. We aimed to fill this gap by conducting an environmental scan of PHSMS to assess data collected on and linked to racism measures, highlight barriers and opportunities for data collection and linkages, and discuss public health implications.

### METHODS

We performed an environmental scan to assess PHSMS capacity to collect racism data and linkages with structural

racism measures. Our process entailed (1) defining key questions and data to be collected, (2) conducting a literature review, and (3) synthesizing the results with a qualitative description approach.<sup>3</sup> A priori study questions asked (1) what are the strengths, weaknesses, and gaps in PHSMS's capacity to collect racism and (2) to what extent are PHSMS linked with measures of structural racism? We identified PHSMS that (1) were Centers for Disease Control and Prevention-supported or -led and active from 2015 to 2020, (2) collected and reported data periodically or on an ongoing basis, and (3) monitored human health. We searched the Web site, technical documentation, data collection instruments, and publications for measures on racism, racism-related experiences, and racial discrimination. A literature review identified studies linking structural racism with PHSMS. We searched PubMed, Google Scholar, and Web of Science databases. We used a qualitative descriptive approach to synthesize the results.

## RESULTS

We identified 125 PHSMS, and only 3- the Behavioral Risk Factor Surveillance System (BRFSS), Pregnancy Risk Assessment and Monitoring System (PRAMS), and California Health Interview Survey- collected and reported data on racism or race-related experiences (Table A, available as a supplement to the online version of this article at <https://ajph.org>).

We observed heterogeneity in measures used to operationalize racism. BRFSS collects information about health risk behaviors, conditions, and use of preventive services. Reactions to Race is an optional BRFSS module, comprising 6 questions assessing socially assigned race, race consciousness, differential treatment at work and in health care, and reports of emotional or physical symptoms to differential treatment. Since its initial pilot in 2002, approximately 50% of states administered the module for at least 1 year, with fewer states administering it in consecutive years.<sup>4</sup> PRAMS collects data about maternal attitudes and experiences before, during, and after pregnancy. Although not a part of the "core" (fixed questions asked each year), race-related experiences 1 year before birth and during pregnancy were queried. Only 22 states assessed racism in PRAMS.<sup>5</sup> The California Health Interview Survey provides population estimates for Californians across several health indicators. Respondents were asked about racial/ethnic discrimination in health care in select waves (i.e., 2003, 2005, 2015, 2017, and 2021). Structural racism measures were not collected in PHSMS; however, we observed evidence for linkages to census and administrative data sets or social media sources to assess structural racism (Table 1). Data linkages enabled characterization of structural racism across judicial, economic, educational, housing, residential segregation, political, and immigration domains. Multiple quantitative measures were operationalized across each domain. For example, the economic domain included indicators related to Black-White inequalities in unemployment, poverty, and homeownership. PHSMS most commonly linked with structural racism were BRFSS; PRAMS; National Health Interview Survey; Surveillance, Epidemiology, and End Results Program; National Death Index; and National Vital Statistics System for births, fetal deaths, and mortality data. Studies captured structural racism at multiple geographic levels including census block, census tract, zip code, county, metropolitan statistical area, and state.

## DISCUSSION

Racism measures are not routinely collected and integrated in PHSMS. We identified budgetary constraints, methodological issues, decision-making authority, data linkage, and aggregation as key considerations for this observation. While a comprehensive racism measure may assess chronicity, recurrence, severity, and duration, and delineate between direct and indirect experiences,<sup>6</sup> concerns about survey length may constrain the type of scales included. The decision-making authority that determines and gives value to the data included in PHSMS raises serious equity issues. For example, state BRFSS advisory committees composed of community and academic partners who provide input and may bear financial responsibility for items administered in optional modules. This can lead to bias and the continued omission of racism measures in PHSMS. Actionable suggestions to address these data gaps entail adding racism measures to a rotating core. The permanent adoption of racism measures as standard fixed questions would mirror the recent decision by PRAMS leadership and set a poignant standard for PHSMS.<sup>5,7</sup>

In synthesizing findings from PHSMS linked with structural racism, studies leveraged multiple data sources, social

media, innovative tools for data generation, and data-mining techniques (e.g., machine learning) to operationalize structural racism. Other novel opportunities to characterize structural racism and link with PHSMS involve designing data clearinghouses for historical and contemporary laws<sup>8</sup> and research tools that permit access to data sharing across government agencies. For example, the New Jersey Integrated Population Health Data Project develops an integrated data system linking health and social administrative data.<sup>9</sup>

#### PUBLIC HEALTH IMPLICATIONS

Integrating racism as a sentinel indicator in PHSMS can advance equity-centered public health praxis and antiracist policy development, implementation, and evaluation, and foster greater accountability among public health actors. The absence of racism data precludes the development of data-driven health objectives and hampers targeted evidence-based action to address health inequities. For example, the Healthy People initiative guides national health promotion, disease prevention, and health equity efforts. Every 10 years, data from PHSMS are used to inform measurable objectives and set benchmarks to evaluate progress. While select social determinants of health (e.g., educational attainment) are tracked and considered targets for action, capturing the lived experience of racism with the same scientific rigor and consistency is nonexistent.

Harnessing racism data has the potential to strengthen data-driven governance and data-based policymaking to create equitable communities. Racism data coupled with racial equity tools (e.g., racial equity impact assessments) can be used to critically evaluate the effect of budgetary decisions, policies, legislation, and regulations on population health and inequities. Systems of accountability for public health practitioners, health care providers, policymakers, and other key stakeholders can be designed. For example, a novel structural racism measure utilizes data from the Census Bureau's Census of Governments, which collects information on financial decision-making related to revenues, expenditures, debts, and assets across government entities.<sup>10</sup> These data can illuminate structural forces influencing financial decision-making.

Antiracist public health necessitates an infrastructure with data tools that collect, track, and evaluate dynamic patterns of racism at all levels. Advancing health equity requires strategies for sustained political support and systemic change. For example, in 1992, Congress passed the Cancer Registries Amendment Act (Pub L No. 102-515) establishing the National Program of Cancer registries, which authorized funds to develop and set standards for cancer registries and establish a reporting system.<sup>11</sup> Earmarking funds to finance the optimization of PHSMS to capture, analyze, and report racism data would represent an intentional effort toward equity-centered surveillance. There is a collective memory in communities that endures the scars of the unethical use of data that reifies racist ideologies and perpetuates intergenerational racial/ethnic health inequalities. While data alone will not serve as a panacea for dismantling racism, the omission to explicitly name, measure, collect, and track racism data severely impedes science and precludes translational efforts to achieve health equity. ÅfPU

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#### PUBLICATION INFORMATION

Full Citation: White K, Beatty Moody DL, Lawrence JA. Integrating racism as a sentinel indicator in public health surveillance and monitoring systems. *Am J Public Health*. 2023;113(S1):S80-S84.

Acceptance Date: October 17, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307160>

#### CONTRIBUTORS

K. White conceptualized the article, wrote the first draft, and revised the article. D.L. Beatty-Moody contributed to the conceptualization of the article and revision. J. A. Lawrence made critical contributions to the revision of the article.

#### ACKNOWLEDGMENTS

The authors acknowledge Blen Asres and Alfonso Rodriguez-Lainz for help with identifying the public health surveillance and monitoring systems and David R. Williams and Camara Phyllis-Jones for helpful comments on a preliminary draft of the article.

#### CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

#### HUMAN PARTICIPANT PROTECTION

Institutional review board approval was not required for this study because it does not meet the criteria of human participant research.

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#### DETAILS



<b>Subject:</b>	Censuses; Literature reviews; Surveillance; Racial discrimination; Praxis; Health disparities; Risk assessment; Pregnancy; Monitoring systems; Risk analysis; Risk taking; Data; Social media; Infrastructure; Decision making; Risk factors; Public health; Race; Cancer; Health surveillance; Systemic racism; Epidemiology; Social networks; Discrimination; Disease prevention; Accountability; Mental health; Data collection; Surveillance systems; Medical personnel
<b>Business indexing term:</b>	Subject: Social networks Risk assessment; Industry: 92312 : Administration of Public Health Programs
<b>Location:</b>	United States--US; California
<b>Company / organization:</b>	Name: University of Maryland; NAICS: 611310
<b>Classification:</b>	92312: Administration of Public Health Programs
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S80-S84
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307160">https://doi.org/10.2105/AJPH.2022.307160</a>
<b>ProQuest document ID:</b>	2770263764

**Document URL:** <https://www.proquest.com/scholarly-journals/integrating-racism-as-sentinel-indicator-public/docview/2770263764/se-2?accountid=211160>

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**Last updated:** 2023-04-06

**Database:** Public Health Database

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# Structural Racism and Public Health

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## FULL TEXT

The enactment of racist laws, creation of discriminatory policies, and implementation of biased practices across the social, political, and economic spectrum to uphold White patriarchy has produced and sustained an interwoven and deeply embedded system of structural racism in the United States. This system of structural racism, established to maintain oppression over racialized and minoritized groups, continues to produce gross inequities across the board in access to education, social services, criminal justice, safe and healthy food and water, housing, employment, safe environments, and health care. These created inequities yield stark inequalities in physical and mental health and well-being for individuals and communities that are racialized and marginalized in the United States.

While the public and scientific discourse now clearly call out structural racism, there is much work yet to be done to dismantle the systems that keep it in place. Our work must evolve in the ways in which we study inequalities in health and well-being within and across racialized and marginalized groups. Quite simply, our public health enterprise cannot and should not simply stop at identifying inequalities in health status across racialized and marginalized groups (e.g., Black-White differences in a given health status outcome). Rather, we must strive to carefully consider and expose the underlying system as well as intersecting systems of structural racism that produce these inequalities.

What appears to be a simple and logical next step does present challenges. To understand how structural racism operates, we must have and employ frameworks that recognize and appropriately center structural racism as a fundamental driver of inequities in the social determinants of health. Again, a simple and, yet, not simple task. Understanding and acknowledging inequities in the social, political, and economic structures that produce unequal health status requires taking the time and doing the work of recognizing the discriminatory laws, policies, and practices that undergird these inequities.

Next, we must be able to link these findings to concrete approaches that dismantle the racist and discriminatory laws, policies, and practices driving inequities in the social determinants of health. This means providing actionable steps at local, state, and federal levels. Equally important is the work to dismantle the cultural and societal norms, attitudes, beliefs, and practices that support and perpetuate racist and discriminatory laws, policies, and practices. The latter

involves working at the community and grassroots level and cannot be undervalued for its ability to influence change from the ground up—an especially important consideration given the current divisiveness on these issues in the United States.

The articles in this supplement offer frameworks for future research that center structurally racist laws, policies, and practices as the fundamental drivers of health inequities. There are also articles that provide empirical evidence to this effect. But this is only the beginning. We hope that this issue serves as a clarion call for public health researchers, practitioners, advocates, and policymakers who will dedicate themselves and their work to provide further evidence as well as insights on approaches to dismantling the laws, policies, and practices that uphold structural racism. The health and well-being of all the people in the United States, not just some, depend on it. .4JPI-1

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## DETAILS

<b>Subject:</b>	Health policy; Public health; Systemic racism; Epidemiology; Graduate schools; Discrimination; Social exclusion; Health care policy; Embedded systems; Graduate studies; Minority groups
<b>Location:</b>	New York; United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S4
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	EDITOR'S CHOICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences

ISSN: 00900036

Source type: Scholarly Journal

Language of publication: English

Document type: Letter To The Editor

DOI: <https://doi.org/10.2105/AJPH.2022.307175>

ProQuest document ID: 2770263721

Document URL: <https://www.proquest.com/scholarly-journals/structural-racism-public-health/docview/2770263721/se-2?accountid=211160>

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Last updated: 2023-04-06

Database: Public Health Database

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# The Impact of Racism, Class, and Criminal Justice on Women's Distress and Health: A Reinforcing Cycle of Social Disadvantage

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## ABSTRACT (ENGLISH)

The intersection of racism, classism, gender discrimination, and criminal justice involvement in the United States continues to manifest syndemic inequalities. In their work, Alang et al. (p. S29) describe police brutality and the adverse outcomes produced in women's lives over time. Drawing on seminal work on intersectionality and public health,<sup>1,2</sup> Alang et al. argue for in-depth consideration of how gender and racism influence police brutality and the impact of interactions with the police on the health and well-being of racialized women. Personal and vicarious witnessing of police brutality and other adverse criminal justice contacts has been shown to affect women and Black individuals.<sup>3,4</sup> Moreover, Black and Latina women are significantly more likely to fear police brutality than White women, and this anticipatory fear is linked with depressed moods.<sup>5</sup> Furthermore, evidence suggests that even having a family member incarcerated during a woman's childhood is associated with a higher likelihood of depressed mood in adulthood.<sup>5</sup>

The interaction between the criminal justice system and racial minority status is complex, as evidenced by results on the impact of a partner's incarceration on racially minoritized women and consequences for their own life. In the case of Black women, evidence suggests that partner incarceration is linked with substance use.<sup>6</sup> Although the

mechanisms through which partner incarceration leads to drug use need further exploration, the knitted relationship between gender and race can lead to heightened vulnerability and inequality. 6 Moreover, fear of harassment from police reduces access to syringe service programs and other harm reduction programs among racialized people who use drugs and may contribute to rising overdoses and fear of overdoses among minoritized groups, contributing to health disparities.

## FULL TEXT

The intersection of racism, classism, gender discrimination, and criminal justice involvement in the United States continues to manifest syndemic inequalities. In their work, Alang et al. (p. S29) describe police brutality and the adverse outcomes produced in women's lives over time. Drawing on seminal work on intersectionality and public health, 1,2 Alang et al. argue for in-depth consideration of how gender and racism influence police brutality and the impact of interactions with the police on the health and well-being of racialized women. Personal and vicarious witnessing of police brutality and other adverse criminal justice contacts has been shown to affect women and Black individuals. 3,4 Moreover, Black and Latina women are significantly more likely to fear police brutality than White women, and this anticipatory fear is linked with depressed moods. 5 Furthermore, evidence suggests that even having a family member incarcerated during a woman's childhood is associated with a higher likelihood of depressed mood in adulthood. 5

The interaction between the criminal justice system and racial minority status is complex, as evidenced by results on the impact of a partner's incarceration on racially minoritized women and consequences for their own life. In the case of Black women, evidence suggests that partner incarceration is linked with substance use. 6 Although the mechanisms through which partner incarceration leads to drug use need further exploration, the knitted relationship between gender and race can lead to heightened vulnerability and inequality. 6 Moreover, fear of harassment from police reduces access to syringe service programs and other harm reduction programs among racialized people who use drugs and may contribute to rising overdoses and fear of overdoses among minoritized groups, contributing to health disparities. 7-9

Although minoritization based on race and sex complicates health and social equity, the impact of adverse criminal justice contacts on women receives less attention than the impact on racialized men, eliciting calls for gender-inclusive racial justice initiatives. 1 Notwithstanding criminal justice-related cases of physical and sexual exploitation of women, few studies have quantified the prevalence and magnitude of such incidents.

Research by Cottler et al. 10 showed that among a sample of 318 women involved in the criminal justice system, 25% reported police sexual misconduct. Of these women, 96% reported having sex with an on-duty officer, 77% reported repeated exchanges, and 31% reported being raped by police. 10 In a study by Stringer et al., a smaller yet sizable percentage of women involved in the criminal justice system (14%) reported police sexual misconduct, significantly increasing depression and posttraumatic stress disorder among victims. 11 An especially vulnerable group of women are those who engage in sex work, have a history of multiple arrests, and are affected by the syndemic nature of substance use and poverty, as they may be coerced into sexual activities in exchange for favors from police officers. 10-12 The few studies quantifying adverse criminal justice outcomes and participant insights gain validation with US Department of Justice reports and the never-ending stream of media stories. 13, 14

The lack of measurement of these issues in large, representative samples limits our understanding of the impact of adverse criminal justice contacts on women's health. In a brief descriptive analysis, we used data from the 2016 to 2019 National Survey on Drug Use and Health (n=565 184) to further highlight the effects of racism, gender, class, and criminal justice on women's health and well-being. We explored the impact of ever being booked in prison (a measure of criminal justice involvement) among White and Black women and how the disparities observed in the initial measure transformed when poverty status (a proxy for social class) was incorporated into the analysis.

Panel A of Figure 1 shows that Black women who had been booked in prison reported worse health than any other group. They were followed by White women who had been booked and Black women who had never been booked. Interestingly, White women who had contact with the criminal justice system reported poor or fair self-reported health

at levels closer to those of Black women who did not have contact with the criminal justice system than White women who reported no contact. The patterns observed in Figure 1 underscore how racial minority status and criminal justice involvement adversely affect health. White women who had never been booked in prison reported lower levels of poor or fair self-reported health than the other groups included in the analysis.

We also explored the association between self-reported health and racial minority status, class, and criminal justice involvement categories (Figure A, available as a supplement to the online version of this article at <https://ajph.org>). Disparities in self-reported health status were more evident and magnified when income level was considered. We acknowledge the various measurement issues arising from self-reported health, but it is still one of the most widely collected and used health outcomes and is associated with physiological dysregulation, other adverse health outcomes, and mortality.<sup>15,16</sup>

Panel B of Figure 1 shows corresponding trends for serious psychological distress. The descriptive analysis showed that White women who had been booked in prison reported worse serious psychological distress than the other groups. They were followed by Black women who had been booked in prison and White women who had not been booked. Black women who had never been booked in prison reported serious psychological distress at lower levels than the other groups assessed included in the study. When income level was considered, this pattern shifted. The odds of meeting the threshold for serious psychological distress were lower among White women who had never been booked and who lived above the poverty threshold than among most of the other groups. The only exception was Black women who had not been booked and lived above the poverty threshold (Figure A).

These results add quantification to some of Alang et al.'s arguments and corroborate previous research on the negative impact of adverse criminal justice contacts on psychological health.<sup>5</sup> Mattingly et al.<sup>3</sup> found that, among a large sample of racially/ethnically diverse young adults in California, distress regarding police brutality rose from 2017 to 2020, with Hispanic and Black individuals having the highest distress. Distress over police brutality was linked with substance use in racialized groups. Overall, the constant exposure to police brutality on media channels and physical witnessing of these incidents by racialized communities, along with personal police contact, produce vicarious and collective trauma.<sup>4,17</sup> There is a disproportionate police presence in racialized communities, making anticipatory fear of adverse criminal justice contacts pronounced.<sup>4,5</sup>

In recent years, the constant stream of media stories and videos of police brutality victims and adverse criminal justice outcomes has illuminated pervasive racism in the United States, leading to calls for reformation within the criminal justice system. Research by Reingle et al.<sup>18</sup> showed that every increase in police academy graduating class size was linked with a 9% increase in the odds of discharge for police sexual misconduct, and having a graduating class above 35 was associated with more than four times the odds of discharges than smaller classes. These results imply that solutions to adverse criminal justice contacts may include limiting police academy class sizes and instituting steady hiring practices, rather than intensive hiring periods, to ensure proper training of all members. Alang et al. note that "power and the benefits of power are what keep oppressive systems in place." Acknowledging and addressing the effects of these intersectional social factors will be key to improving women's health.

#### CORRESPONDENCE

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#### PUBLICATION INFORMATION

Full Citation: Jones AA, Santos-Lozada AR. The impact of racism, class, and criminal justice on women's distress and health: a reinforcing cycle of social disadvantage. *Am J Public Health*. 2023; 113(S1):S13-S15.

Acceptance Date: October 4, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307149>

#### CONTRIBUTORS

A. A. Jones conceptualized the study, advised on the operationalization of measures, and wrote the article. A. R.

Santos-Lozada performed the data analysis, produced the data visualizations, and assisted in the writing process.

## ACKNOWLEDGMENTS

This study was supported by the National Institute on Drug Abuse (award K01DA051715; principal investigator: A. A. Jones). The Population Research Institute (PRI) provided infrastructure for the data analysis. The PRI is supported by a grant from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (P2CHD041025), the Social Science Research Institute, and Pennsylvania State University.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

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## DETAILS

<b>Subject:</b>	Gender; Rape; Data analysis; Prisons; Post traumatic stress disorder; Young adults; Poverty; Sex discrimination; Racism; Minority & ethnic groups; Black people; Drug use; Public health; Race; Imprisonment; Womens health; Intersectionality; Self report; Sex industry; White people; Police brutality; Judicial system; Harassment; Needle exchange programs; Female offenders; Fear; Fear & phobias; Social justice; Racial differences; Women; Black white relations; Well being; Inequality; Childhood; Latin American cultural groups; Drugs; Criminal justice; Police; Prisoners; Classism; Discrimination; Substance use; Drug abuse; Children; Substance abuse; Psychological distress; Minority groups; Harm reduction; Overdose; Black women
<b>Business indexing term:</b>	Subject: Sex discrimination
<b>Location:</b>	United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S13-S15
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences



ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
ProQuest document ID:	2770263464
Document URL:	<a href="https://www.proquest.com/scholarly-journals/impact-racism-class-criminal-justice-on-womens/docview/2770263464/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/impact-racism-class-criminal-justice-on-womens/docview/2770263464/se-2?accountid=211160</a>
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Last updated:	2023-09-27
Database:	Public Health Database

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# Structural Racism, the Social Determination of Health, and Health Inequities: The Intersecting Impacts of Housing and Mass Incarceration

Blankenship, Kim M, PhD; Rosenberg, Alana, MPH; Schlesinger, Penelope, BA; Groves, Allison K, PhD, MHS; Keene, Danya E, PhD

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## ABSTRACT (ENGLISH)

Public health researchers have directed increasing attention to structural racism and its implications for health equity. The conceptualization of racism as historically rooted in systems, structures, and institutions of US society has important implications for addressing social determinants of health (SDOH). It requires theorizing SDOH as embedded in and expressions of racially oppressive historical structures that are manifested in and maintained by policies, programs, and practices in multiple domains that dynamically intersect to reinforce and reproduce in new ways: race inequities in health. We develop this argument using housing, a SDOH recognized as reflecting longstanding racist practices and policies that, among other things, have restricted the affordable housing options of Black people to segregated neighborhoods with limited resources. We argue that understanding and addressing the health inequities resulting from structural racism associated with housing requires simultaneously understanding and addressing how housing intersects with mass incarceration, another SDOH and manifestation of structural racism. We suggest that unless these intersections are intentionally analyzed and confronted, efforts to address the impacts of housing on racial health disparities may produce new forms of health inequities. (AmJ Public Health. 2023;113(S1):S58-S64. <https://doi.org/10.2105/AJPH.2022.307116>)

## FULL TEXT

### Headnote

Public health researchers have directed increasing attention to structural racism and its implications for health equity. The conceptualization of racism as historically rooted in systems, structures, and institutions of US society has important implications for addressing social determinants of health (SDOH). It requires theorizing SDOH as embedded in and expressions of racially oppressive historical structures that are manifested in and maintained by policies, programs, and practices in multiple domains that dynamically intersect to reinforce and reproduce in new ways: race inequities in health.

We develop this argument using housing, a SDOH recognized as reflecting longstanding racist practices and policies that, among other things, have restricted the affordable housing options of Black people to segregated neighborhoods with limited resources. We argue that understanding and addressing the health inequities resulting from structural racism associated with housing requires simultaneously understanding and addressing how housing intersects with mass incarceration, another SDOH and manifestation of structural racism.

We suggest that unless these intersections are intentionally analyzed and confronted, efforts to address the impacts of housing on racial health disparities may produce new forms of health inequities. (AmJ Public Health. 2023;113(S1):S58-S64. <https://doi.org/10.2105/AJPH.2022.307116>)

Public health researchers are directing increasing attention to structural racism and its implications for advancing health equity. Structural racism is not a new concept. Twentyfive years ago, for example, Williams<sup>1</sup> presciently argued that race differences in health provide a measure of the consequences of our history of racist oppression. It is this history, and its ongoing manifestations, that the concept of structural racism seeks to capture.

Although varied, definitions direct attention beyond individual demonstrations of racism to focus on systemic racial exclusion from power and its consequences.<sup>2</sup> Racism is recognized as historically rooted in systems, structures, and institutions in multiple domains of US society and embedded in the policies, practices, programs, and operating logic producing and maintaining these domains, and the system of racial oppression more generally, at any given historical moment.<sup>3</sup>

This framing has important implications for conceptualizing and addressing the social determinants of health (SDOH). Bailey et al. argue that structural racism shapes "the distribution of the social determinants of health."<sup>3</sup>(p1461) But accounting for structural racism also requires moving beyond the distribution of these determinants. It suggests as well the importance of recognizing and theorizing about the determination of SDOH.<sup>4</sup> Not only are SDOH distributed differentially because of structural racism, they have different meanings and implications for Black people than for White people because they are determined by and represent a contemporary manifestation of this racism.

Also important to this conceptualization is understanding how these processes operate and intersect across different domains, potentially reinforcing or challenging one another.<sup>5</sup> This framing has critical implications for promoting health equity, which we illustrate here by discussing examples of how housing intersects with mass incarceration—each recognized as SDOH determined by structural racism—in producing health inequities.

### DETERMINATION OF HOUSING

Much recent attention has focused on analyzing housing as a SDOH in the United States, with a particular interest in the health consequences associated with the shortage of affordable housing and the cost burdens and instability it produces. In no state in the country will a minimum wage job affordably cover the rent of a 1-bedroom apartment.<sup>6</sup> Public housing and rental assistance are typically funded at levels that meet the needs of just 20% of those with eligible income.<sup>7</sup> This unmet need for affordable rental housing contributes to increasing the rates of homelessness and crowded and unstable housing arrangements, with well-documented health consequences.<sup>8</sup> Low-income renters who do find housing often experience significant cost burdens,<sup>9,10</sup> which are associated with many adverse health-related outcomes.<sup>11-13</sup> Housing instability—via evictions and other forced moves—is also associated with poor health outcomes.<sup>14-17</sup>

These experiences are not racially neutral; access to stable, affordable housing is distributed by race.<sup>10</sup> Twenty

percent of Black households are extremely low-income renters, as compared with 6% of White households.<sup>18</sup> Furthermore, Black renters comprise a disproportionate share of those evicted.<sup>19</sup> The associated health outcomes are also distributed by race,<sup>10</sup> but situating affordable and stable housing in a structural racism framework directs attention beyond the distribution of these SDOH by race to the context that has produced this distribution: its determination. In this regard, the structural racism underlying residential segregation is critical.

Research documents that racial exclusion was essential to the project of suburban development in the late 19th and early 20th centuries,<sup>20-22</sup> including through racially restrictive deed covenants and the professionalization of realtors, whose standards influenced government policies and programs.<sup>22,23</sup> Although various government policies have contributed to residential segregation, New Deal housing policy is considered particularly significant.<sup>24</sup> To increase access to affordable housing for unemployed workers through the construction of public housing, the Public Works Administration was known to tear down existing housing to replace it with segregated projects, in some instances turning what were once racially integrated neighborhoods into segregated ones.<sup>25</sup>

Even after local authorities took over public housing construction, US Housing Authority guidelines required public housing to reflect the neighborhood racial composition and cautioned against integrating communities by constructing projects for White families in predominantly Black neighborhoods.<sup>25,26</sup> Racially restrictive covenants excluded Black people from the Federal Housing Administration (FHA)-backed opportunities. Additionally, FHA underwriting guidelines standardized the valuation of homes in terms of "neighborhood risk," signified in large part by neighborhood racial composition, a practice known as redlining.<sup>24</sup> Passage of the Fair Housing Act in 1968 made redlining illegal, opening the housing market to Black people but did so on "predatory and exploitative terms."<sup>27</sup>(p18) Previously excluded from homeownership because they were too "risky" to lend to, "risky" buyers became a source of profit in an era of FHA-insured home mortgages meant to encourage home ownership in predominantly Black neighborhoods.<sup>27</sup>

Situating housing in this structural racism framework highlights the importance of considering how both affordable housing and stable housing (which are SDOH) are distributed differently by race. It is also important to consider the context in which these SDOH occur because the context is shaped by structural racism and gives these SDOH different meanings for Black residents than for White residents. In the 1990s, for example, risky subprime loans were differentially marketed (distributed) to poor Black clients, who represented a unique niche for such loans because of residential segregation. However, residential segregation also structured the impact (meaning) of these loans, with Black and Hispanic neighborhoods bearing the brunt of the foreclosure crisis.<sup>28</sup> Similarly, even for low-income Black renters who do live in an affordable and decently maintained building, that building is more likely to be located in a high-poverty, racially segregated neighborhood<sup>29</sup> that is surrounded by abandoned housing,<sup>30</sup> more exposed to pollutants,<sup>31</sup> and further from grocery stores stocked with healthy foods<sup>32</sup> than the decent and affordable buildings lived in by their White counterparts. Also, homeownership does not represent the same path to wealth accumulation for Black owners as it has for White owners,<sup>33,34</sup> nor does it bring them the same health advantages.<sup>35</sup>

#### DETERMINATION OF MASS INCARCERATION

Locating the affordable housing crisis in the racist history and interests that produced residential segregation has important implications for understanding and addressing health inequities. Also critical is another contemporary form of structural racism that has structured and given meaning to housing access and affordability and the context in which it occurs: mass incarceration. Comprising less than 5% of the world's population, the United States accounts for 20% of those incarcerated.<sup>36</sup> In any given year, more than 600 000 people enter US prisons and more than 10 million enter jails; about a quarter of them will be rearrested in the same year.<sup>37</sup> Many have not been convicted of a crime; they sit behind bars because they cannot afford the bail that would release them.<sup>37</sup> When released, many will join the more than 4.3 million people currently under probation or parole.<sup>38</sup> The consequences of arrest, incarceration, or community supervision will follow most throughout their lifetime because each leaves a (virtually permanent) public record that can be used to exclude them from resources critical for healthy living.<sup>39</sup> Further affected by mass incarceration are the nearly 113 million people, or 50% of adults, who have had a family member incarcerated for at least 1 year or the 6.5 million with an immediate family member currently incarcerated.<sup>40</sup>

These experiences with the criminal legal system are not racially neutral. Black people are incarcerated at almost 5 times the rate of White people<sup>37</sup>; and non-Hispanic Black people comprise 38% of those on parole and 30% of those on probation.<sup>38</sup> They are 50% more likely to have had a family member incarcerated and 3 times more likely to have had a family member incarcerated for more than a year.<sup>40</sup> Entry into the criminal legal system typically begins with a police encounter, not necessarily with a crime. When driving, Black drivers are more likely than are White drivers to be stopped, and when stopped, searched by police.<sup>41</sup> Black people are also more likely to be subject to "stop and frisk" policing practices.<sup>42</sup>

The disproportionate distribution of Black people under the scrutiny of the criminal legal system cannot be explained by race differences in the perpetration of crimes. Instead, consistent with a structural racism framing, it is the product of the history of racial oppression that mass incarceration signifies.<sup>43</sup> This history is embedded in policies and practices designed to preserve White privilege, including in the US Constitution, which, to reconcile slavery with founding principles of liberty and equality, defined a slave as "three-fifths of a man."<sup>44-46</sup> When the Thirteenth Amendment ended slavery, it did so with 1 exception: "as a punishment for crime." Southerners then worked to ensure that all expressions of Black freedom were prohibited, first through Black Codes, then via Jim Crow laws.<sup>44,46</sup> Policing practices took shape in this context, with police responsible for enforcing these laws.<sup>46</sup> Scholars differently locate the emergence of the current form-mass incarceration-that this racist history takes (e.g., as part of the President Johnson administration's "war on poverty"<sup>47</sup> or the President Nixon administration's "war on drugs"<sup>44</sup>). What is abundantly clear, however, are its powerful impacts on life: whereas Black people of all socioeconomic backgrounds are subject to the suspicious gaze of those who assume their criminality, and many experience mass incarceration through their connection to incarcerated family members, these impacts are most profound in low-income, racially segregated urban neighborhoods.<sup>48</sup>

Mass incarceration is increasingly recognized as a SDOH in its own right,<sup>49-51</sup> operating at multiple levels<sup>52,53</sup> and among the formerly incarcerated,<sup>49,50</sup> their children and romantic partners,<sup>54,55</sup> and their communities.<sup>56</sup> Here, we highlight examples of how it intersects with housing, with subsequent implications for health equity.

#### HOUSING-MASS INCARCERATION INTERSECTION

One manifestation of mass incarceration is federal and state laws that have created a new category of citizens who-by virtue of their criminal record, especially when for a drug-related crime-do not have the rights or access to resources accorded other citizens. Access to affordable housing is among such rights they lose. Federal regulations require housing authorities to ban public housing or vouchers for at least 3 years for applicants who have been, or who have a household member who has been, evicted from federally assisted housing for a drug-related crime in the past 3 years. Federal regulations also require housing authorities to set standards prohibiting admission to or permitting eviction from households if a member is using drugs.<sup>57</sup> Although the regulations leave room for housing administrations' discretion in implementation, most local polices are more restrictive than federal law requires.<sup>58,59</sup> Landlords, too, use criminal background checks in determining who to rent to.

Undoubtedly, these policies contribute to rates of homelessness among formerly incarcerated people that are nearly 10 times those among the general public.<sup>60</sup> When combined with policies that criminalize homelessness, they can create a "revolving door" between incarceration and the community<sup>60,61</sup> that can exacerbate any existing, and may provoke new, health problems as people move through this door.<sup>62</sup> These policies also create communities in which the systematic exclusion of some members from access to affordable housing shapes the meaning of having such access for others. In this context, it can be difficult to develop and maintain long-term stable relationships and the health benefits they can bring.<sup>63</sup> Relatedly, residents who seek to fill housing gaps exacerbated by criminal legal policies by providing a place for friends, family, or acquaintances to stay put their own health and housing in jeopardy.<sup>64</sup> They risk eviction or losing a voucher if a guest has a warrant against them or brings drugs or attention from the police or landlords-or just because strict housing policies prohibit guests from staying for more than 14 days.<sup>58</sup>

Mass incarceration also intersects with housing to further shape life in racially segregated, low-income neighborhoods through harsh policing tactics and heavy surveillance that have become increasingly part of the daily

lives of residents.<sup>65</sup> When implemented in neighborhoods where a legacy of structural racism has segregated low-income Black people with limited access to housing and where there is heavy police surveillance, policies that define drug crimes as deserving stricter penalties than other crimes virtually ensure that residents will be noticed gathering on street corners. Suspicious police officers will assume they are and sometimes may find them selling drugs<sup>66</sup> even as their White counterparts, who self-report equivalent rates of drug selling,<sup>67</sup> conduct their business unobserved behind the locked doors of their homes. Highly surveilled contexts can also lead to housing instability for those returning from prison or jail who, to ensure that their residences comply with strict parole and probation stipulations, avoid otherwise stable situations for more precarious ones.<sup>68,69</sup>

This same heavy police presence in combination with assumptions of Black criminality can turn everyday items, such as cell phones and toys, into "dangerous objects," justifying the killing of their owners. Even witnessing these forms of policing affect the health of community residents.<sup>70,71</sup> A home in some contexts may provide a place to escape from external stressors (i.e., provide ontological security), which Padgett<sup>72</sup> theorizes is a central mechanism through which housing can benefit health. However, the homes of those living in racially segregated, heavily policed spaces are subject to surveillance and even raiding by police, child welfare services, and probation or parole officers—diminishing any sense of security and further jeopardizing stability, health, and well-being.<sup>68,73,74</sup> As housing gains increasing attention as a SDOH and expanding access to affordable housing a strategy for promoting health equity,<sup>75</sup> it is critical to account not only for the implications of a structural racism framework for understanding the determination of this SDOH but also for how housing intersects with mass incarceration—another SDOH and manifestation of structural racism. Otherwise, our efforts run the risk of exacerbating, if not creating new forms of, health inequities.

As an example, consider "evidence-based" calls that promote tenant-based housing voucher programs to improve health but do not address the exclusion from these programs of those with criminal records.<sup>75</sup> These programs may extend access to safe, stable, and affordable housing and the health benefits that accompany it, but for whom and with what implications for those who remain excluded? At minimum, criminal records should not determine access to housing, or any other rights and benefits of citizens. Still, if criminal records no longer dictate housing access, will potential health benefits be fully realized if the neighborhoods in which housing is located continue to be racially segregated and oversurveilled? As decision makers contemplate policies to expand access to affordable housing, it is critical to recognize and consciously ask how that access is given meaning by a context where structural racism has produced residential segregation as well as mass incarceration and how best to challenge the structural racism at their cores. Also critical are solutions that enhance the ability of residents themselves to do the challenging.

## CONCLUSIONS

We conclude with 2 thoughts. First, in keeping with the special issue theme, "structural racism and public health," we have focused on structural racism, but we acknowledge that it simultaneously intersects with systems of gender and class oppression. Promoting health equity also requires intentionally recognizing and addressing these forms of oppression. Second, in a dynamic and complex conceptualization that recognizes the historically rooted and currently manifesting structures of oppression undergirding different policy domains that have produced health inequities, it is difficult to anticipate all the impacts of efforts to address them—often referred to as "unintended consequences." The stronger our theory and methods are in understanding and analyzing the oppressive systems and structures at the heart of SDOH, and the more intentional our efforts to recognize and challenge these systems of oppression (and the new forms they will take if unchallenged), the better we will be at advancing health equity.

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## PUBLICATION INFORMATION

Full Citation: Blankenship KM, Rosenberg A, Schlesinger P, Groves AK, Keene DE. Structural racism, the social determination of health, and health inequities: the intersecting impacts of housing and mass incarceration. *AmJ Public Health*. 2023;113(S1):S58-S64.

Acceptance Date: August 30, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307116>

## CONTRIBUTORS

K. M. Blankenship developed the overall conceptualization and framing of the article, contributed expertise on mass incarceration, and drafted the article. A. Rosenberg, P. Schlesinger, A. K. Groves and D. E. Keene contributed to shaping and revising the framing. D. E. Keene contributed expertise on housing. All coauthors provided input and editorial feedback on the article.

## ACKNOWLEDGMENTS

The themes for this essay emerged from work supported by the National Institute of Mental Health, the National Institutes of Health (NIH; grant R01MH110192; primary investigator: K. M. Blankenship) and the Russell Sage Foundation (grant 1911-18814; primary investigators: D.E. Keene and K.M. Blankenship).

We wish to thank reviewers for their insightful comments on earlier drafts.

Note. Any opinions expressed are those of the authors and do not necessarily represent the views of NIH or the Russell Sage Foundation.

## CONFLICTS OF INTEREST

The authors are not aware of any potential or actual conflicts of interest.

## HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because this work was not directly based on any human participant data.

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## DETAILS

<b>Subject:</b>	Public health; Housing; Racism; Neighborhoods; Health disparities; Discrimination; Housing authorities; Affordable housing; Concept formation; Racial differences; Policies; Inequality; Black people; Historical structures; Oppression; Imprisonment; Low income groups; General public; Systemic racism; Mass incarceration
<b>Business indexing term:</b>	Subject: Affordable housing
<b>Location:</b>	United States--US
<b>Company / organization:</b>	Name: Federal Housing Administration; NAICS: 925110
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S58-S64
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences

ISSN: 00900036

Source type: Scholarly Journal

Language of publication: English

Document type: Journal Article

DOI: <https://doi.org/10.2105/AJPH.2022.307116>

ProQuest document ID: 2770263359

Document URL: <https://www.proquest.com/scholarly-journals/structural-racism-social-determination-health/docview/2770263359/se-2?accountid=211160>

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Last updated: 2023-09-28

Database: Public Health Database

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# Neighborhood Proactive Policing and Racial Inequities in Preterm Birth in New Orleans, 2018–2019

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## ABSTRACT (ENGLISH)

**Objectives.** To measure neighborhood exposure to proactive policing as a manifestation of structural racism and its association with preterm birth. **Methods.** We linked all birth records in New Orleans, Louisiana (n = 9102), with annual census tract rates of proactive police stops using data from the New Orleans Police Department (2018–2019). We fit multilevel Poisson models predicting preterm birth across quintiles of stop rates, controlling for several individual- and tract-level covariates. **Results.** Nearly 20% of Black versus 8% of White birthing people lived in neighborhoods with the highest rates of proactive police stops. Fully adjusted models among Black birthing people suggest the prevalence of preterm birth in the neighborhoods with the highest proactive policing rates was 1.41 times that of neighborhoods with the lowest rates (95% confidence interval = 1.04, 1.93), but associations among White birthing people were not statistically significant. **Conclusions.** Taken together with previous research, high rates of proactive policing likely contribute to Black-White inequities in reproductive health. **Public Health Implications.** Proactive policing is widely implemented to deter violence, but alternative strategies without police should be considered to prevent potential adverse health consequences. (Am J Public Health. 2023;113(S1):S21–S28. <https://doi.org/10.2105/AJPH.2022.307079>)

## FULL TEXT

### Headnote

**Objectives.** To measure neighborhood exposure to proactive policing as a manifestation of structural racism and its association with preterm birth.

**Methods.** We linked all birth records in New Orleans, Louisiana (n = 9102), with annual census tract rates of proactive police stops using data from the New Orleans Police Department (2018-2019). We fit multilevel Poisson models predicting preterm birth across quintiles of stop rates, controlling for several individual- and tract-level covariates.

**Results.** Nearly 20% of Black versus 8% of White birthing people lived in neighborhoods with the highest rates of proactive police stops. Fully adjusted models among Black birthing people suggest the prevalence of preterm birth in the neighborhoods with the highest proactive policing rates was 1.41 times that of neighborhoods with the lowest rates (95% confidence interval = 1.04,1.93), but associations among White birthing people were not statistically significant.

**Conclusions.** Taken together with previous research, high rates of proactive policing likely contribute to Black-White inequities in reproductive health.

**Public Health Implications.** Proactive policing is widely implemented to deter violence, but alternative strategies without police should be considered to prevent potential adverse health consequences. (Am J Public Health. 2023;113(S1):S21-S28. <https://doi.org/10.2105/AJPH.2022.307079>)

Proactive policing is widely implemented in urban contexts and involves stopping and searching individuals and surveilling communities.<sup>1</sup> Although there are several definitions for this type of police activity, it is broadly characterized by pursuing a suspect not as a result of a citizen request but rather because of officer discretion.<sup>1,2</sup> Proactive stops can occur frequently and are often intentionally concentrated in specific, disproportionately Black, neighborhoods, contributing to racial inequities in arrests.<sup>2,3</sup> Proactive policing, therefore, perpetuates structural racism in the criminal legal system and is rooted in legacies of racist neighborhood disinvestment and dispossession.<sup>2,4</sup>

Residents and scholars have critiqued proactive policing and the ways it harms Black communities and serves as a chronic stressor to residents.<sup>3,5-8</sup> A growing body of research suggests that the public health implications of proactive policing extend beyond individuals directly involved in police stops.<sup>7,9</sup> Living in a neighborhood with high levels of proactive policing could contribute to racialized hypervigilance and chronic stress, particularly for Black caregivers concerned for their own and their family's well-being and safety from police violence.<sup>10-12</sup> The impact of living in a neighborhood with high levels of police contact on adolescent and adult mental health has been explored in several studies.<sup>7,12-14</sup> However, to our knowledge, fewer studies have examined health effects of proactive policing during pregnancy,<sup>11</sup> a life-course period in which individuals are particularly at risk for deleterious effects of stressful residential contexts.<sup>15</sup>

Previous research has also identified related neighborhood-level manifestations of structural racism including historical redlining and persistent neighborhood disinvestment and racial inequities in perinatal health and adverse birth outcomes.<sup>16-18</sup> These and other factors including gentrification have dictated where Black people live and controlled the flow of material goods and resources into or out of certain communities, contributing to racially disparate policing practices.<sup>2,17,19</sup>

Preterm birth is a leading cause of infant mortality,<sup>20</sup> and, nationally, the racial inequity in preterm birth persists with rates 1.5 times higher among Black infants compared with White infants.<sup>21</sup> This racialized patterning is mirrored in New Orleans, Louisiana—a majority Black city—where the preterm birth rate is consistently 2-fold higher among Black residents compared with White residents.<sup>22</sup> Over a number of years, the US Department of Justice documented a persistent pattern of frequent and racially biased police stops in New Orleans, with evidence of harassment and disrespectful treatment of Black and lesbian, gay, bisexual, and transgender individuals during police stops.<sup>23</sup> This report prompted a federal consent decree to address unconstitutional police conduct in New Orleans that is ongoing

and began in 2013.<sup>23</sup> Federal investigations have identified unconstitutional patterns of police stops in several other US cities including Newark, NJ<sup>24</sup>; Los Angeles, CA; Ferguson, MO; and Baltimore, MD.<sup>25</sup>

Our study thus had 2 aims: first, to examine whether New Orleanians who lived in neighborhoods with more frequent proactive police stops during their pregnancy were at increased risk of preterm birth and, second, to assess the degree to which neighborhood police stops might contribute to the Black-White racial inequity in preterm birth. We hypothesized that living in a neighborhood where people are frequently stopped or searched by police operates as chronic stressor to pregnant people, and Black pregnant people in particular, that increases the risk of preterm birth.

## METHODS

We conducted this secondary, multilevel, cross-sectional study with publicly available data from the New Orleans Police Department and state vital statistics data. We geocoded birth records for every birth occurring in New Orleans from 2018 to 2019 ( $n = 9102$ ) to identify Federal Information Processing System codes for census tract of residence. We identified cases of preterm birth as those occurring at less than 37 weeks gestation and excluded 12 births missing gestational age. The vital statistics data do not include information on gender identity, and we therefore use gender-inclusive language when discussing attributes of the birthing parent in our study population. We also hypothesized that any contextual effects of proactive policing would similarly impact the pregnancies of cisgender women and transgender and gender-nonconforming people.

### Exposure Measures

We constructed our neighborhood proactive policing variable by using publicly available field interview data from the New Orleans Police Department (2018-2019). We considered proactive stops to be those classified by police as because of a "suspicious person" or "suspicious vehicle." We calculated annual rates of average daily census tract total and proactive police stops per 100 000 residents by using census tract population denominator data from the 5-Year American Community Survey (ACS 2015-2019) and categorized these rates into quintiles. We similarly calculated rates of Black and White total and proactive stops to examine racially concordant associations with preterm birth for Black and White birthing people, respectively. Sample size limited our ability to assess additional racial/ethnic groups. We merged rates of total and proactive police stops to birth records by census tract Federal Information Processing System code.

### Additional Covariates

Birth records also contained data on several important individual-level variables that are known to be associated with preterm birth and neighborhood mobility, including age (continuous years), highest level of educational attainment at the time of birth (<9th grade, 9th-12th grade no diploma, high-school diploma or general educational development (GED), some college, associate degree, bachelor's degree, master's degree, doctorate or professional degree), and whether the birth was financed by Medicaid. Our effect modification analyses used birthing person race and ethnicity as self-reported on the birth certificate (non-Hispanic White, Black, American Indian/Alaska Native, Asian, Native Hawaiian or other Pacific Islander, multiracial, other race, Hispanic).

To address neighborhood differences in other contextual drivers of adverse birth outcomes and proactive policing, we used census tract data from the ACS. Census tract measures included quintiles of the following: percentage of working-age unemployed adults, percentage with less than high-school education, percentage of households with child poverty, and population density per square mile. We additionally adjusted for an annual rate of 911 calls related to violence (i.e., aggravated assault and battery, rape, homicide, armed robbery) using public data from the New Orleans Police Department.

### Statistical Analyses

To assess our study's first aim, to determine whether New Orleanians who lived in neighborhoods with higher rates of proactive police stops were at increased risk of preterm birth, we first examined the rates of proactive police stops across term and preterm births, along with our other individual and census tract-level variables (Table 1). We then mapped the census-tract rates of proactive police stops for 2018 and 2019 (Figure 1), as well as census-tract prevalence of preterm birth.

We fit multilevel Poisson models with tract-level random intercepts and robust standard errors to estimate risk or

prevalence ratios for preterm birth across quintiles of neighborhood proactive stops.<sup>26</sup> We stratified our models across birthing person race and ethnicity to assess whether proactive policing as a manifestation of anti-Black structural racism was more strongly associated with preterm birth among Black birthing people. We additionally examined associations between total police stops and preterm birth to determine whether our findings for proactive stops were reflective of a broad relationship between neighborhood policing and preterm birth (Table 2). All models adjust for age, education, Medicaid status, and year, and tract-level unemployment, education, poverty, population density, and rate of 911 calls for violence. Birth records were geocoded in ArcGIS Pro 2.9.0 (Esri, Redlands, CA), and all statistical analyses, mapping, and visualizations were done in R version 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

To examine our study's second aim, to assess the degree to which neighborhood police stops exacerbate racial inequities in preterm birth, we used the method described by Ward et al.<sup>27</sup> that considers the prevalence of the exposure and outcome across groups as well as the relationship between exposure and outcome across groups. To do so, we fit an interaction model to test for effect modification by race and ethnicity and plotted the racial differences in the predicted prevalence of preterm birth across racial groups, as well as the proportion of births in the lowest and highest quintiles of neighborhood proactive police stops (Figure 2). Because of sample size limitations, we only present results for Black and White individuals.

As a sensitivity analysis, we removed census tracts in the French Quarter, which is a largely nonresidential area that we observed had very high levels of police stops. We reconstructed quintile measures of annual rates of total and proactive police stops removing the French Quarter to evaluate bias in our main estimates. We repeated our main models using these measures, excluding births in the French Quarter (Figure C, available as a supplement to the online version of this article at <https://ajph.org>).

## RESULTS

There were 9102 births in New Orleans during 2018 to 2019, of which 1190 (13%) were preterm. There was a large Black-White racial gap in preterm birth with prevalences of 15.8% among Black people and 8.0% among White people. This racial inequity is also meaningful on the absolute scale; there were 841 Black preterm births and 197 White preterm births. Those who had preterm births were less likely to have attained greater than a bachelor's degree and more likely to have had their birth financed by Medicaid compared with those who had full-term births (Table 1).

There were notable differences in the neighborhood rate of police stops across Black and White birthing people. Black birthing people ( $n = 4485$ ; 58.4% of births) were exposed to an annual average of 43.7 proactive stops per 100 000 population occurring in their neighborhood of residence, compared with 30.7 stops, on average, in neighborhoods where White birthing people ( $n = 52458$ ; 26.9% of births) lived. The neighborhood contexts in which Black and White birthing people resided also differed in their percentage of residents with less than high-school education (Black mean = 17.9%; White mean = 7.7%), households with child poverty (Black mean = 41.9%; White mean = 15.4%), and unemployment (Black mean = 10.7%; White mean = 5.5%). The maps displayed in Figure 1 show that the concentration of neighborhood proactive policing was largely consistent across both years included in our analysis. Police stops were highest in neighborhoods with larger proportions of Black residents including Central City and parts of the West Bank.

Fully adjusted models among Black birthing people suggest that the prevalence of preterm birth in neighborhoods with the highest rates of proactive policing was 1.41 times that of neighborhoods with the lowest rates (quintile [Q] 5 vs Q1; 95% confidence interval [CI] 5 1.04, 1.93). The associations between Black preterm births and quintiles of neighborhood proactive police stops showed a monotonic increasing pattern with the strength of the association increasing at higher quintiles of neighborhood proactive policing, although CIs comparing rates in the lowest quintile to the second and third quintiles crossed the null (Table 2, covariate estimates in Table A, available as a supplement to the online version of this article at <https://ajph.org>).

By contrast, we observed a monotonic decreasing trend in the association between proactive policing rates and preterm births to White people, and CIs for all point estimates included the null (Table 2). When we additionally

examined the risk of preterm birth across quintiles of total police stops, we observed similar monotonic increasing and decreasing patterns among Black and White people, respectively, although these associations were not statistically significant (Table 2). The diverging Black-White patterns were largely masked in models among birthing people of all racial and ethnic groups, which showed slight increases in the association between preterm birth and quintiles of neighborhood proactive police stops, although point estimates were more attenuated compared with models among Black individuals alone, and all CIs included the null (Table 2). These results were unchanged in our sensitivity analysis that excluded stops and births in the French Quarter (Figure C, available as a supplement to the online version of this article at <https://ajph.org>).

We also tested for racially concordant associations using neighborhood rates of total and proactive police stops of Black and White people in models stratified by birthing person race and ethnicity. Neighborhood rates of total and proactive stops of Black people were not significantly associated with preterm birth in the full sample or among Black or White birthing people, with the exception that White birthing people living in neighborhoods with the secondlowest versus lowest rates of stops of Black people had an increased risk of preterm birth (Q2 vs Q1 risk ratio = 2.00; 95% CI = 1.10,3.68; Figure A, available as a supplement to the online version of this article at <https://ajph.org>).

Neighborhood rates of total and proactive stops of White people were also not significantly associated with preterm birth overall or among Black or White birthing people (Figure B, available as a supplement to the online version of this article at <https://ajph.org>).

We next assessed the degree to which neighborhood proactive police stops contributed to racial inequities in preterm birth. Our model that interacted race and ethnicity with proactive stop rates suggested that its association with preterm birth did not vary significantly across race and ethnicity. However, when we considered the unequal prevalence of the exposure and outcome across race and ethnicity, we did find evidence of a meaningful racial disparity (Figure 2). Whereas 19.2% of Black birthing people lived in neighborhoods with the highest rates of proactive police stops, only 8.4% of White birthing people lived in these areas (Q5). Similarly, 29.1% of White and 16.0% of Black birthing people resided in neighborhoods with the lowest rates of proactive police stops (Q1). Marginal risk of preterm birth was approximately 3 times higher among Black compared with White birthing people at both the highest levels of exposure (Q5 Black = 0.15 [95% CI = 0.08, 0.28]; Q5 White = 0.05 [95% CI = 0.03, 0.11]), and elevated at the lowest levels of exposure (Q1 Black = 0.11 [95% CI = 0.06, 0.21]; Q1 White = 0.07 [95% CI = 0.04,0.13]).

## DISCUSSION

Our study documents elevated risk of preterm birth among Black birthing people who resided in neighborhoods with frequent proactive police stops in New Orleans. Given the overrepresentation of Black birthing people in neighborhoods that are subject to high rates of potentially harmful<sup>11,28</sup> proactive policing, this exposure likely widens the Black-White racial inequity in preterm birth. By contrast, we did not observe a positive association among White birthing people, further suggesting that neighborhood proactive policing serves as a racialized contextual stressor for Black people specifically. In addition to potential impacts on community health equity, proactive policing is an important source of racial inequities in the broader criminal legal system.<sup>29</sup>

Limited research has evaluated neighborhood policing as a determinant of adverse birth outcomes. A recent study in one US city (Minneapolis, MN) found a 100% increase in odds of preterm birth for US-born Black birthing people living in neighborhoods with a disproportionate number of police incident reports.<sup>11</sup> In addition, previous research evaluating immigration enforcement, which may similarly operate as a racialized contextual stressor, found a rise in low birth weight infants born to Latina women after compared with before an immigration raid.<sup>15</sup> Other studies on nearby exposure to fatal police violence have documented associations with preterm birth,<sup>28</sup> pregnancy loss,<sup>30</sup> and depressive symptoms among pregnant people.<sup>10</sup> Future work must address the mechanisms linking aggressive policing practices with adverse birth outcomes. Mental health effects of police stops may be a critical component of these pathways, although limited extant research shows mixed results for women.<sup>7,13,31,32</sup>

Our study linked unique sources of administrative data on police stops and birth records to provide a comprehensive picture of the exposure and outcome in New Orleans. However, most cities do not make data on police stops

publicly available, or only do so only after legal action or civil rights investigations. For research that evaluates these kinds of police actions to progress, municipalities need to collect and maintain comprehensive data on stop-and-search incidents and procedures and allow researchers to access these data.

#### Limitations

While they are uniquely available, the administrative data used in this analysis also impose a few limitations that should be noted. First, the police stop and birth certificate data were only able to be linked at the neighborhood level, so we were unable to individually identify birthing people who were stopped by police. Second, our cross-sectional analysis is only able to examine police stops that occurred in the year of birth, not prepregnancy exposure to police stops, and cumulative life-course exposure may be more relevant for adverse birth outcomes. Third, given that our data on police stops are collected by police, we do not have data on the nature of these stops from the perspective of residents, and more unjust, frequent, and aggressive police stops are likely to have a greater impact on community health.<sup>32,33</sup> Lastly, the stop data used in this study only include encounters reported by New Orleans police and, therefore, underestimate total exposure that could also include unreported stops as well as stops by state or private police forces.

#### Public Health Implications

Our findings linking neighborhood proactive police stops with preterm births in New Orleans are consequential in a political moment when cities across the country are reevaluating the role and scale of policing in response to movements for racial justice, including Black Lives Matter, as well as ongoing scholarship documenting the harms of proactive policing.<sup>3,8,9</sup> The federal consent decree aimed at addressing unconstitutional police conduct in New Orleans has been in place since 2013; however, it may not be having the intended impact if considered within the context of our study findings. Local policy officials in New Orleans and elsewhere must weigh potential negative health impacts and inequities of proactive policing with limited evidence that these strategies prevent criminalized behaviors<sup>1,34</sup> and consider alternative strategies to reduce violence without police.<sup>35</sup> In the midst of an ongoing Black perinatal health crisis,<sup>17</sup> moreover, there is an urgent need to understand and address the ways that structural racism gives rise to racial inequities in reproductive health, including the potential role of proactive policing.

#### ABOUT THE AUTHORS

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#### PUBLICATION INFORMATION

Full Citation: Jahn JL, Wallace M, Theall KP, Hardeman RR. Neighborhood proactive policing and racial inequities in preterm birth in New Orleans, 2018-2019. *Am J Public Health.* 2023; 113(S1):S21 -S28.

Acceptance Date: August 5, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307079>

#### CONTRIBUTORS

J. L. Jahn and M. Wallace designed the study and analytical strategy. J.L. Jahn completed the statistical analyses, conducted data visualization, and led article writing. All authors helped to interpret the findings, as well as prepare and edit the article.

#### ACKNOWLEDGMENTS

This work was supported by the National Institutes of Health under award R01HD103684.



The authors gratefully recognize members of the Measuring and Operationalizing Racism to Achieve Health Equity Lab at the University of Minnesota School of Public Health for their feedback on an early draft of this article. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

#### HUMAN PARTICIPANT PROTECTION

The Tulane University institutional review board approved use of vital statistics data.

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## DETAILS

<b>Subject:</b>	Public health; Medicaid; Police departments; Systemic racism; Assaults; Premature birth; Censuses; Birth; Neighborhoods; Transgender persons; Discrimination; Population density; Violence; Ethnicity; Statistical analysis; Reproductive systems; Vital statistics; Robbery; Police; Reproductive health; Aggression; Information processing; Criminal investigations; Race; Education; Gender identity
<b>Business indexing term:</b>	Subject: Medicaid; Industry: 92212 : Police Protection
<b>Location:</b>	Louisiana; United States--US
<b>Company / organization:</b>	Name: Police Department-New Orleans LA; NAICS: 922120
<b>Classification:</b>	92212: Police Protection
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S21-S28
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307079">https://doi.org/10.2105/AJPH.2022.307079</a>
<b>ProQuest document ID:</b>	2770263338

**Document URL:** <https://www.proquest.com/scholarly-journals/neighborhood-proactive-policing-racial-inequities/docview/2770263338/se-2?accountid=211160>

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**Last updated:** 2023-08-22

**Database:** Public Health Database

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# Incorporating Structural Racism, Employment Discrimination, and Economic Inequities in the Social Determinants of Health Framework to Understand Agricultural Worker Health Inequities

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## ABSTRACT (ENGLISH)

In 2010, the federal government and several state governments began using the social determinants of health (SDOH) framework to highlight contributing factors of health inequities and, in 2022, recognized that structural racism was associated with health inequities. Yet, efforts to eliminate health inequities have disproportionately focused on individualized solutions instead of addressing structural racism. Many racial/ethnic-minority workers have been segregated to low-wage occupations that lack access to paid sick leave, such as agricultural work, which has been associated with health inequities. Research shows these inequities are attributable to structural racism enforced through laws that structure the employment system to disadvantage agricultural workers, who are disproportionately racial/ethnic-minority individuals, which will not be addressed with individualized solutions. In this article, we explain why the current SDOH framework and efforts to eliminate health inequities are inadequate, discuss Yearby's revised SDOH framework that includes structural racism as one of the root causes of health inequities, and illustrate how Yearby's revised SDOH framework better captures the impact of structural racism, which is associated with health inequities for agricultural workers. (Am J Public Health. 2023;113(S1):S65-S71. <https://doi.org/10.2105/AJPH.2022.307166>)

## FULL TEXT

### Headnote

In 2010, the federal government and several state governments began using the social determinants of health (SDOH) framework to highlight contributing factors of health inequities and, in 2022, recognized that structural racism was associated with health inequities. Yet, efforts to eliminate health inequities have disproportionately focused on individualized solutions instead of addressing structural racism.

Many racial/ethnic-minority workers have been segregated to low-wage occupations that lack access to paid sick leave, such as agricultural work, which has been associated with health inequities. Research shows these inequities are attributable to structural racism enforced through laws that structure the employment system to disadvantage

agricultural workers, who are disproportionately racial/ethnic minority individuals, which will not be addressed with individualized solutions.

In this article, we explain why the current SDOH framework and efforts to eliminate health inequities are inadequate, discuss Yearby's revised SDOH framework that includes structural racism as one of the root causes of health inequities, and illustrate how Yearby's revised SDOH framework better captures the impact of structural racism, which is associated with health inequities for agricultural workers. (Am J Public Health. 2023;113(S1):S65-S71. <https://doi.org/10.2105/AJPH.2022.307166>)

Since the formation of the United States to the present day, structural racism has limited agricultural workers' employment opportunities as well as their economic conditions.<sup>1,2</sup> Specifically, laws enacted at federal and state levels have limited racial/ ethnic-minority individuals' employment opportunities, leaving them relegated to low-wage jobs, such as agricultural work, compared with White workers.<sup>1,2</sup> Compounding this inequality, federal and state laws limit agricultural workers' union rights, pay, and benefits compared with the rights provided to White workers.<sup>1,2</sup> These differential conditions caused by structural racism and laws that codified economic inequities have been associated with health inequities in physical and mental health for agricultural workers.<sup>3,4</sup>

#### GAPS IN THE CURRENT SOCIAL DETERMINANTS OF HEALTH FRAMEWORK

The current and most widely used social determinants of health (SDOH) framework includes 5 key areas of social and economic conditions- economic stability, education access and quality, health care access and quality, neighborhood and built environment, and social and community context-that are considered the main factors determining individuals' ability to achieve their full health potential. However, the current framework fails to show racism as a root cause of inequality as well as differences in social and economic conditions between White individuals and racial/ethnic-minority individuals.

Healthy People 2030 includes this SDOH framework and acknowledges structural racism as a key factor in health inequities. Healthy People 2030 also provides overarching goals to eliminate health inequities associated with employment or economic conditions that are centered around reducing the proportion of people living in poverty and increasing employment in working-age people.<sup>5</sup>

However, neither the SDOH framework nor Healthy People 2030 provide recommendations for eliminating structural racism, which is a root cause of health inequities among Black, Indigenous, Asian, and other people of color.<sup>6-11</sup> Thus, the goal of the present essay is to provide evidence on how structural racism, codified by employment laws and manifested by economic inequities, fuels health inequities among racial/ethnic minority individuals. By applying Yearby's revised framework to agricultural workers, we demonstrate how structural racism is illustrated by the limited employment opportunities and poor economic conditions that results in health inequities for this group.<sup>6</sup>

#### STRUCTURAL RACISM AS A DRIVER OF HEALTH INEQUITIES

Williams et al. define racism as

an organized social system in which the dominant racial group, based on an ideology of inferiority, categorizes and ranks people into social groups called "races" and uses its power to devalue, disempower, and differentially allocate valued societal resources and opportunities to groups defined as inferior.<sup>12</sup>(p106)

Jones notes how the social system of racism determines how opportunity is structured, which unfairly disadvantages some racial/ethnic-minority individuals and communities, unfairly advantages White individuals and communities, and saps the strength of the whole society through the waste of human resources.<sup>13</sup> Freeman notes that "law serves largely to legitimize the existing social structure" of racism by focusing exclusively on trying to neutralize the inappropriate conduct of an individual or institutional perpetrator, which legitimizes the existing social structures built to limit racial/ethnic minority individuals' equal access to education, employment, housing, and health care.<sup>14</sup>(p1051) Building on this work, we define structural racism as both the limitation of racial/ethnic-minority individuals' employment opportunities and the way social and economic conditions are organized to advantage White individuals and disadvantage racial/ethnic-minority individuals.<sup>6</sup> Law- including political processes, statutes, regulations, policies, guidance, advisory opinions, cases, and budgetary decisions, as well as the process of enforcing or failure to enforce the law-is one of the tools used to limit racial/ethnic-minority individuals' employment opportunities as well

as to organize social and economic conditions in a racially discriminatory way, which has been associated with health inequities.<sup>6,8-11</sup>

#### INCORPORATING STRUCTURAL RACISM INTO THE FRAMEWORK

Numerous scholars have already proposed methodologies and models to include structural racism as a key factor in health inequities. Ford and Airhihenbuwa created the Public Health Critical Race Praxis methodology, which noted that structural determinism and racial categories are the bases for ordering society, which contributes to racial health inequities.<sup>15</sup> Williams et al. created a model, entitled "the house that racism built," showing how multiple forms of racism can affect health.<sup>16</sup> Yearb/s revised SDOH framework<sup>6</sup> builds on these models.

In revising the SDOH framework<sup>6</sup> to incorporate structural racism, Yearby shows how structural racism and employment laws create differential social and economic conditions between White and racial/ethnic-minority individuals, which are associated with health inequities. We used Yearby's revised framework in this essay to illustrate how structural racism is evident via the limitation on agricultural workers' employment opportunities, which, in turn, creates poor economic conditions for agricultural workers. The combination of limited opportunities and poor economic conditions interact to create conditions that lead to health inequities. Laws that have been enacted to limit agricultural workers' employment opportunities and economic conditions are discussed here and listed in Box 1.

#### AGRICULTURAL WORKERS' INEQUALITY OF OPPORTUNITY

Agricultural workers are essential because they are human beings who plant, pick, process, and pack food for shipment and consumption, which ensures that Americans have access to food, including fresh produce.

Throughout the history of the United States, the government has used law to limit racial/ethnic-minority individuals' employment opportunities, including limiting their ability to work in jobs beyond certain industries. From 1787 until 1865, some White individuals enslaved Black and Indigenous individuals, forcing slaves to do agriculture and domestic work for free.

After the end of slavery, a majority of agricultural workers in the South were Black Americans because many states passed "Black Code" laws prohibiting Black Americans from working in any occupation other than agricultural or domestic service.<sup>1</sup> Solomon et al. note, "if [Black Americans] broke these laws or abandoned their jobs after signing a labor contract, they could be arrested," imprisoned, and forced back into unpaid servitude on White plantations because the 13th Amendment allows for slavery as punishment for a crime.<sup>1</sup> In addition, several laws were passed that prevented Black Americans from migrating to northern states. As a consequence, in the 1930s, approximately 65% of all Black workers in the South were employed as domestic or agricultural workers, while a majority of the agricultural workers in the North and West were White Americans, who were free to work in any industry.<sup>17</sup> Between 1950 and 1990, the agricultural system in the South changed as a result of technological advancements, which reduced the need for agricultural workers. These advancements allowed many Black agricultural workers to shift to other occupations and to also leave the South.

Currently, agricultural workers are largely employed in Western states, including California, Arizona, and Washington.<sup>4,18</sup> Today, agricultural workers in the United States include (1) hired workers and (2) self-employed farm operators and their family members. This article focuses on hired agricultural workers, which includes hired farmworkers that are employed in a variety of occupations—from field crop, nursery, and livestock workers to graders and sorters, agricultural inspectors, supervisors, and hired farm managers.<sup>18</sup> Now a large percentage of hired agricultural workers are foreign-born individuals from Mexico and Central America. For the fiscal year 2017-2018, 77% of all agricultural workers were Latino and 64%, 32%, and 3% of all agricultural workers were born in Mexico, the United States (including Puerto Rico), and Central America, respectively.<sup>19</sup> Agricultural work is one industry in which the federal government and several state governments allow non-US citizens to work legally in the United States under a H-2A visa, but permits employers to pay these workers less than US citizen workers.

The percentage of hired crop farmworkers who are not US citizens has greatly increased—growing from 14% in 1989-1991 to 55% in 1999-2001 and stabilizing slightly under 50% in recent years. Between 2005 and 2020, the number of H-2A visas requested and approved for agricultural workers increased more than fivefold—from approximately 48 000 to more than 275 000 positions. In 2020, the average hourly rate for nonsupervisory workers was \$14.64, but

this rate is not what is typically paid to most racial/ethnic minority agricultural workers.<sup>18</sup> Some agricultural workers, including racial/ ethnic-minority workers with H-2A visas, are paid an adverse effect wage rate, which, on average, can be as low as \$11.71 per hour.<sup>2</sup> Because of increased demand and scarcity of agricultural labor in the United States, many of the agricultural positions are held by H-2A workers whose pay is lower than that of US citizen workers who must be paid minimum wage.<sup>2</sup> As Holmes notes, laws, such as California's Proposition 187, make it legal for farmers to pay non-US citizen agricultural workers only enough for daily survival.<sup>20</sup> In addition, Title IV of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 prohibits the majority of non-US citizens—including lawful permanent residents, asylees and refugees, nonimmigrants, and unauthorized immigrants—from receiving federal public benefits, such as Medicaid and the Supplemental Nutrition Assistance Program.<sup>21</sup> As a consequence, almost a third of agricultural workers have incomes below the poverty level as defined by the US Department of Labor.<sup>4</sup>

Historical and modern-day structural racism, enforced through laws, limits racial/ethnic-minority individuals' employment opportunities by restricting their ability to travel, attain jobs outside of low-wage industries like agriculture, and access public benefits. Specifically, historical structural racism limited Black Americans' equality rights by forcing them to stay in the South and work in agricultural or domestic work, while modern-day structural racism limits non-US citizen agricultural workers' pay and access to public benefits. Each of these restrictions interacts to leave many agricultural workers, who are predominately racial/ethnic minority individuals, in poverty and unable to attain high-wage jobs.

#### AGRICULTURAL WORKERS' ECONOMIC CONDITIONS

During the Jim Crow era (1875-1964), many of the federal laws passed to protect and support workers did not cover agriculture workers or other occupations that were predominantly filled by racial/ethnic-minority individuals. For example, in 1935, the Social Security Act was passed providing old age, survivor's, and disability insurance to workers and their families, yet it excluded agricultural, domestic, and service workers, who were predominantly racial/ethnic-minority individuals.<sup>22</sup> In 1950, amendments to the Social Security Act provided coverage to most agricultural workers and domestic workers, yet many Jim Crow-era laws remain in effect that limit agricultural workers' access to equal pay and paid sick leave.<sup>22</sup>

The National Labor Relations Act of 1935 (NLRA) expanded collective bargaining protections for White workers, allowing them to join unions, which resulted in their higher wages and benefits, such as paid sick leave.<sup>23</sup> The NLRA did not apply to domestic or agricultural workers, who were predominately racial/ethnic-minority individuals, and the government allowed unions to not represent racial/ethnic-minority workers employed in other industries, such as manufacturing.<sup>1</sup> Workers covered by the NLRA who join unions are protected from being fired or punished for collective bargaining activities, such as negotiating for raises or benefits. In 1983, the Migrant Seasonal Agricultural Worker Protection Act was passed, which provided some protections for "migrant and seasonal agricultural workers by establishing employment standards related to wages, housing, transportation, disclosures, and recordkeeping."<sup>24</sup>

For instance, it requires that employers must disclose the terms of employment at the time of recruitment and comply with those terms. However, it did not make the NLRA applicable to agricultural workers. Although agricultural workers are not prohibited from creating unions, farmers do not have to negotiate with the union when bargaining for wages and benefits. Farmers can also fire workers who form unions without consequence, which is not allowed in industries covered by the NLRA. Therefore, many of these workers still do not have high wages or paid sick leave. The Fair Labor Standards Act of 1938 (FLSA) also explicitly exempted agricultural occupations.<sup>1</sup> The FLSA limits the workweek to 40 hours and establishes federal minimum wage and overtime requirements.<sup>25</sup> It also requires employers to keep records of the payroll. In 1966, the minimum wage requirements of the FLSA were applied to agricultural workers, but many workers are still not paid minimum wage. If farmers did not utilize more than 500 man days (any day in which an employee performs agricultural work for at least 1 hour) of agricultural labor in any quarter in the previous calendar year, then the FLSA does not apply to any of the hired workers for the entire year.<sup>25</sup> Moreover, the FLSA minimum wage requirements do not apply to "local hand harvest laborers who commute daily

from their permanent residence, are paid on a piece rate basis in traditionally piece-rated occupations, and were engaged in agricultural less than thirteen weeks during the preceding calendar year."<sup>26</sup> Eighty percent of hired crop workers who hand harvest live in one place, commute daily, and work at a single location within 75 miles of their home. Hence, these workers are not paid minimum wage because the FLSA does not apply to them. In addition, the FLSA requirement for overtime pay does not apply to agricultural workers. Newer laws also limit agricultural workers' economic conditions.

During COVID-19, the federal government enacted several COVID-19 economic relief bills that provided federal public funds. The Coronavirus Aid, Relief, and Economic Security Act of 2020 (CARES Act) provided unemployment benefits and provided direct payments to individuals through refundable tax credits.<sup>27</sup> These benefits provided workers with federal financial assistance; however, they were not available to non-US citizens, especially undocumented workers. Because roughly 50% of agricultural workers are not US citizens, including H-2A visa workers, the expanded employment benefits provided by the CARES Act did not cover them.<sup>28</sup>

Historical and modern-day structural racism, enforced through laws, limits the economic conditions of agricultural workers, who are predominately racial/ ethnic-minority individuals. Employment laws not only advantage White workers, including farm managers, inspectors, and supervisors, as well as those working in other industries, by giving them union rights that boosted their wages, but they also advantage farmers who are predominantly White by limiting their employee costs.<sup>1</sup> However, racial/ ethnic-minority agricultural workers remain in poverty because they do not receive union rights, minimum wage, overtime pay, or paid sick leave. Compounded by the laws that limit agricultural workers' opportunities, each of these employment restrictions interacts to leave many agricultural workers in poor economic conditions, which has been associated with health inequities.

#### AGRICULTURAL WORKERS' HEALTH INEQUITIES

Agricultural workers suffer from a host of health inequities compared with other workers, including diabetes, respiratory disease, and heart disease. In this article, we focus on mental health and pandemic health inequities, because these have been tied to employment conditions in the literature. There is an increasing global concern for the mental health of agricultural workers as national and international studies have linked key risk factors to negative mental health outcomes for agricultural workers, including employment conditions, pesticide exposure, financial difficulties, climate variabilities and drought, poor physical health, and past injuries.<sup>29</sup>

In the United States, psychosocial stressors such as rigid work demands, poor housing conditions, low family income, and living in poverty have been significantly associated with anxiety and depression for Mexican migrant farmworkers.<sup>3</sup> Other significant stressor categories specific to migrant farmworkers that have also been associated with anxiety and depression are social isolation and hazardous, poor, and stressful working conditions.<sup>30</sup> As pay concerns for these workers go unaddressed, the mental health and livelihood of these workers continue to be jeopardized.

Several research studies provided evidence that lack of equality and poor economic conditions were associated with higher rates of H1N1 infections, hospitalizations, and deaths for racial/ ethnic-minority workers across the United States.<sup>31,32</sup> These studies, which included national surveys, showed that racial/ethnic-minority individuals were unable to practice social distancing or stay at home during the H1N1 pandemic because they did not have the freedom to work at home and lacked paid sick leave.<sup>31,32</sup> In fact, Quinn et al. found that a majority of Spanishspeaking Latino workers (63.1%) did not have paid sick leave, compared with 23.2% of Black workers, 26.1% of White workers, and 33.3% of Englishspeaking Latino workers.<sup>31</sup> The study also found that 73.1% of Spanishspeaking Latino workers were only able to do their job in the workplace, compared with 34.3% of Black workers, 45.4% of White workers, and 47.3% of English-speaking Latino workers. As a result, Spanish-speaking Latino workers had an increased exposure to H1 N1 within the workplace that was associated with higher rates of infections, hospitalizations, and deaths.<sup>31</sup>

This association between employment factors and H1N1 infections was supported by a study that tracked self-reported influenza-like symptoms during the 2009 H1N1 pandemic. The researchers found that there was a higher incidence of self-reported influenza-like illness for those who lacked paid sick leave or could only do their job



in the workplace. Of those surveyed, Latino individuals were more likely to lack paid sick leave (40.5%) or could only do their job in the workplace (56.8%), compared with White workers (22.4% and 40.4%) and Black workers (22.0% and 26.2%).<sup>32</sup>

A study conducted by Schoch-Spana et al. showed that Latino farmworkers were also at risk for increased exposure to H1N1 because many of them did not have paid sick leave and could only do their job in the workplace.<sup>4</sup>

Furthermore, even if the workers were sick, they could not afford to lose the wages or jeopardize their jobs by not showing up to work. These inequities in H1N1 infections, hospitalizations, and deaths were particularly notable because Latino individuals traditionally have lower mortality rates than White individuals. In fact, from 2009 to 2013, Latino individuals had a "24% lower all cause death rate and lower death rates for nine of the 15 leading causes of deaths" compared with White individuals.<sup>33</sup><sup>70-1</sup> These inequities in infections have persisted during the COVID-19 pandemic.

Although COVID-19 data disaggregated by occupation are limited, the available data and news stories show that there are agricultural worker health inequities in COVID-19 infections. For instance, in May 2020, all 200 workers on 1 farm in Tennessee were infected with COVID-19, while Yakima County, Washington—a key agricultural area—"had the highest rate per capita infection rate of any county on the West Coast."<sup>34</sup> In addition, there was one study that highlighted agricultural workers' heightened COVID-19 risks. The study estimated that in the first 13 months of the COVID-19 pandemic, cumulative rates (deaths) were 170/137 (2969), 202/902 (3812), and 27/223 (459) among hired agricultural workers, unpaid agricultural workers, and migrant agricultural workers, respectively.<sup>35</sup> Counties with more agricultural workers had significantly higher COVID-19 cases and death incidence rates.<sup>35</sup> Many employment factors have been associated with these inequities in COVID-19 infections, including lack of paid sick leave and gaps in health and safety protections for workers.

## CONCLUSIONS

As illustrated by the conditions of agricultural workers, racial/ethnic-minority workers disproportionately tend to be employed in low-wage jobs that do not provide minimum wage, overtime pay, collective bargaining rights, or paid sick leave. As a result, many racial/ethnic-minority workers remain in poverty, which has been associated with poor physical and mental health outcomes. These problems are not captured in the current SDOH framework and cannot be fixed by using the individualized worker training programs suggested in Healthy People 2030. To eliminate health inequities, the government must aggressively work to end structural racism perpetuated by employment laws and economic inequities as discussed here. Yearby's revised SDOH framework as applied to agricultural workers provides a clear model for government officials to understand the connection among structural racism, employment law, the SDOH, and health inequities. ÅfPU

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## PUBLICATION INFORMATION

Full Citation: Yearby R, Lewis C, Gibson C. Incorporating structural racism, employment discrimination, and economic inequities in the social determinants of health framework to understand agricultural worker health inequities. *Am J Public Health*. 2023;113(S1): S65-S71.

Acceptance Date: October 31, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307166>

## CONTRIBUTORS

R. Yearby created the revised social determinants of health framework and contributed to the conceptions of

structural racism and research on the historical employment laws, as well as drafting and revision of the article. C. Lewis contributed to the research on current employment laws, summarizing the laws in Box 1, and drafting and revising the article. C. Gibson contributed to researching the health data for agricultural workers, creating Box 1, and drafting and revising the article. All authors approved the final version of the article.

#### ACKNOWLEDGMENTS

We acknowledge the work of Danyelle Solomon, Connor Maxwell, Abril Castro, and Daniel Costa concerning historical racism and wage gaps for agricultural workers, as well as the work of the United Farm Workers and Farmworker Justice for agricultural workers' rights. We also want to thank Farzana Kapadia for a rich conversation on this topic and 2 anonymous reviewers for their constructive feedback.

#### CONFLICTS OF INTEREST

The authors have no conflict of interest to disclose.

#### HUMAN PARTICIPANT PROTECTION

There were no human participants involved in this work.

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## DETAILS

<b>Subject:</b>	Federal government; Sick leave; Minority & ethnic groups; Workers; Racism; Slavery; Agriculture; Employment; Economic conditions; Health disparities; Labor law; Health research; Farmworkers; Agricultural research; State government; Employee benefits; Inequality; Health care; Minority groups; Public health; Occupations; Domestic service; Passports & visas; Employment discrimination; Systemic racism; Discrimination
<b>Business indexing term:</b>	Subject: Employment Economic conditions Labor law Workers; Industry: 92812 : International Affairs 81411 : Private Households
<b>Location:</b>	Mexico; United States--US; Central America
<b>Classification:</b>	92812: International Affairs; 81411: Private Households
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S65-S71
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036

<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307166">https://doi.org/10.2105/AJPH.2022.307166</a>
<b>ProQuest document ID:</b>	2770263056
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/incorporating-structural-racism-employment/docview/2770263056/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/incorporating-structural-racism-employment/docview/2770263056/se-2?accountid=211160</a>
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<b>Last updated:</b>	2023-07-10
<b>Database:</b>	Public Health Database

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## FULL TEXT

\_TVM:UNDEFINED\_

## DETAILS

<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Supplement:</b>	Supplement 1
<b>Pages:</b>	S2
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Publisher:</b>	American Public Health Association

Place of publication:	Washington
Country of publication:	United States, Washington
Publication subject:	Public Health And Safety, Medical Sciences
ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Credits
ProQuest document ID:	2770262914
Document URL:	<a href="https://www.proquest.com/scholarly-journals/credits/docview/2770262914/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/credits/docview/2770262914/se-2?accountid=211160</a>
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Last updated:	2023-01-28
Database:	Public Health Database

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# Cigarette Use Among Older Adults: A Forgotten Population

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## ABSTRACT (ENGLISH)

The number of adults aged 65 years and older is expected to more than double worldwide over the next several decades, and for the first time in recorded history, older adults will outnumber children (<https://bit.ly/3D4p0im>). Despite these unprecedented population shifts, older adults are significantly underrepresented in biomedical research, especially in the field of nicotine and tobacco science (<https://bit.ly/3shUSul>). This focus on younger cohorts has obscured the reality that combustible tobacco use (i.e., smoking) has remained virtually unchanged for older adults for nearly two decades in the United States (Figure 1). Meanwhile, smoking prevalences among youths and young adults in the United States are at the lowest levels ever recorded. One explanation for these differences in prevalence trajectories could be that, since at least 2005, quit rates among older smokers have remained stagnant (<https://bit.ly/3Nax XeF>).<sup>1</sup> Aligning with this observation is

evidence suggesting that traditional tobacco control policies (i.e., pricing, smoke-free policies, information campaigns, bans on advertising, health warning labels, cessation treatments) are not affecting older smokers the same as younger cohorts, as represented in an analysis of smoking behavior in Europe between 2004 and 2013 (<https://bit.ly/3VVVs2y2>). Additionally, older smokers may have less knowledge of quitlines or other local smoking cessation services<sup>2,3</sup> and more misconceptions about the relative harms of nicotine and combustible tobacco.<sup>2</sup> Older adults are also less likely to use noncombustible nicotine products (<https://bit.ly/3z3iZAY>). The lack of attention paid to older smokers does not match the incredible burden of disease and death that this population carries. Tobacco-related disease is age-related disease as evidenced by older smokers incurring 12 times greater health care expenses than middle-aged smokers (<https://bit.ly/3eXhLR8>).<sup>4</sup> As noted by the American Cancer Society, cancers associated with smoking are most often diagnosed after the age of 65 years and include lung, kidney, bladder, and stomach cancer (<https://bit.ly/3F7gtxB>). Although most people start smoking in the early part of their life, most suffering and deaths associated with tobacco use occur far later. Unfortunately, older adult smokers are not represented in the most basic methodological details of nicotine and tobacco research. For example, in other fields of study, "older adults" are often defined as those who are 65 years and older and may be further delineated as the young old (65-74 years), middle old (75-84 years), and old old (> 85 years).<sup>5</sup> However, research on tobacco use does not adhere to this definition, with studies defining "older adults" across a wide range of ages (e.g., 25 years or older; <https://bit.ly/3TIjwAr>). Beyond this, many studies explicitly exclude anyone older than 65 years from participation (<https://bit.ly/3VP032T>). These inconsistencies in definitions and study inclusion criteria can confound what we know about tobacco use among older adults.

## FULL TEXT

The number of adults aged 65 years and older is expected to more than double worldwide over the next several decades, and for the first time in recorded history, older adults will outnumber children (<https://bit.ly/3D4p0im>). Despite these unprecedented population shifts, older adults are significantly underrepresented in biomedical research, especially in the field of nicotine and tobacco science (<https://bit.ly/3shUSul>). This focus on younger cohorts has obscured the reality that combustible tobacco use (i.e., smoking) has remained virtually unchanged for older adults for nearly two decades in the United States (Figure 1).

Meanwhile, smoking prevalences among youths and young adults in the United States are at the lowest levels ever recorded. One explanation for these differences in prevalence trajectories could be that, since at least 2005, quit rates among older smokers have remained stagnant (<https://bit.ly/3NaxXeF>).<sup>1</sup> Aligning with this observation is evidence suggesting that traditional tobacco control policies (i.e., pricing, smoke-free policies, information campaigns, bans on advertising, health warning labels, cessation treatments) are not affecting older smokers the same as younger cohorts, as represented in an analysis of smoking behavior in Europe between 2004 and 2013 (<https://bit.ly/3VVVs2y2>). Additionally, older smokers may have less knowledge of quitlines or other local smoking cessation services<sup>2,3</sup> and more misconceptions about the relative harms of nicotine and combustible tobacco.<sup>2</sup> Older adults are also less likely to use noncombustible nicotine products (<https://bit.ly/3z3iZAY>).

The lack of attention paid to older smokers does not match the incredible burden of disease and death that this population carries. Tobacco-related disease is age-related disease as evidenced by older smokers incurring 12 times greater health care expenses than middle-aged smokers (<https://bit.ly/3eXhLR8>).<sup>4</sup> As noted by the American Cancer Society, cancers associated with smoking are most often diagnosed after the age of 65 years and include lung, kidney, bladder, and stomach cancer (<https://bit.ly/3F7gtxB>). Although most people start smoking in the early part of their life, most suffering and deaths associated with tobacco use occur far later. Unfortunately, older adult smokers are not represented in the most basic methodological details of nicotine and tobacco research. For example, in other fields of study, "older adults" are often defined as those who are 65 years and older and may be further delineated as the young old (65-74 years), middle old (75-84 years), and old old (> 85 years).<sup>5</sup> However, research on tobacco use does not adhere to this definition, with studies defining "older adults" across a wide range of ages (e.g., 25 years or older; <https://bit.ly/3TIjwAr>). Beyond this, many studies explicitly exclude anyone older than 65 years from participation (<https://bit.ly/3VP032T>). These inconsistencies in definitions and study inclusion criteria

can confound what we know about tobacco use among older adults.

Adding to these disparities is the reality that older smokers face a range of socially and medically complex challenges. In the United States, older smokers are more likely to be American Indian/Alaska Native, Black, or multiracial; to have less than a high school education; and to earn less than \$25 000 a year (<https://bit.ly/3TpJzfP>). The intersection of age and race is notable, particularly when examining smoking cessation behaviors. Older Black men are less likely to stop smoking as they age than are older White men despite starting smoking later in life.<sup>6</sup> Older Black smokers are also disproportionately excluded from lung cancer screening guidelines despite this population facing a higher risk of lung cancer.<sup>7</sup> Older adults in the United States are less likely to use the Internet for health-related information seeking,<sup>8</sup> which may heighten inequalities in health information access. Compounding these health equity issues are the multitude of comorbid health conditions associated with tobacco smoking, that could increase the likelihood of age-related psychosocial and physical health conditions such as chronic pain, dementia, and social isolation or loneliness.

One rarely discussed option for addressing the health of aging smokers is harm reduction. The topic of tobacco harm reduction has become a lightning rod for disagreement because of ongoing concerns that novel nicotine products such as electronic cigarettes (e-cigarettes) could damage the health of nonsmokers, including youths. Although efforts to prevent the uptake of tobacco and nicotine use among young people are critical, they should not supersede a focus on the lives of older smokers. Prioritizing dependence prevention over harm reduction is not ethically justified.<sup>9</sup> Like harm reduction approaches for other substance use disorders and geriatric patients facing chronic health conditions, such as obesity, tobacco harm reduction philosophy respects the autonomy and health goals of older adults who might be ambiguous about smoking cessation. Such smokers could benefit from learning that reducing the number of cigarettes smoked can significantly lower their mortality risk (<https://bit.ly/3guzMqj>) or that the predominant cause of cancer is combustible tobacco, not nicotine.

Although previous research indicates that the public largely does not have a good understanding of harm reduction as it relates to nicotine products (<https://bit.ly/3TH4MSV>), emerging ethical frameworks cautiously support the adoption of noncombustible nicotine products, such as electronic cigarettes, as a harm reduction alternative to smoking.<sup>10</sup> Clinicians working with older adults should consider emphasizing the differential risks associated with smoking compared with noncombustible products (<https://bit.ly/3Sr6KFe>). Messages can support the cessation of all nicotine and tobacco products while simultaneously providing education about differential product risk and adhering to principles of informed consent and consumer autonomy (<https://bit.ly/3Sr6KFe>). Furthermore, clinicians working with older adults may wish to develop graphical risk messaging, as people are more likely to accurately perceive tobacco product risk and to share that information with others when risk messaging is graphics-based as opposed to text-based (<https://bit.ly/3f2pqgS>).

Future work should explore whether this type of risk messaging is effective for older adult smokers. Likewise, clinicians and others providing cessation support to older adults should tailor their messaging to this population, with attention to acknowledging behavioral stage, beliefs about the harms of smoking and benefits of quitting, supporting motivation and self-efficacy, and ensuring adequate and timely social support.<sup>11</sup> Clinicians and research teams should be reminded that older adult smokers want to quit smoking and can still experience benefits from cessation (<https://bit.ly/3TOgEII>).<sup>11,12</sup>

Efforts to rectify the age-related disparities we have described are imperative and must include strategic approaches for educating and motivating older smokers to reduce or stop their use of smoked tobacco. Older adults are not a homogenous group, and intervention efforts must consider social and environmental factors contributing to their health behaviors. Unfortunately, funding opportunities and public health interventions are rarely tailored to older adults, leaving a significant gap in what we understand about the older smoker's experience or what interventions best help older adults. Key research gaps include the degree of nicotine dependence among older smokers and its relationship with quitting smoking. In addition, operational definitions used to define smoking history such as the 30 or more pack-years used in lung cancer screening eligibility<sup>7</sup> should be evaluated to better understand whether such definitions are perpetuating health inequalities among Black and other minority older adult smokers. Finally,



understanding the efficacy and effectiveness of noncombustible nicotine products, such as e-cigarettes, and how they might aid older adults' smoking cessation attempts is warranted. Certainly, there are challenges to adopting a harm reduction framework, and continued surveillance of the long-term effects of e-cigarettes and other noncombustible tobacco products among older adults is needed.

Older smokers deserve to know that it is never too late to improve their health and that quitting smoking can add years to their lives regardless of age (<https://bit.ly/3guzMqj>). Future research efforts focused on developing novel, age-tailored interventions are critical for public health, including efforts to address smoking among older people historically marginalized because of age, race, education level, and income. Otherwise, the status quo will continue, and the suffering and early death of millions of older adult smokers will persist. >4jPH

#### CORRESPONDENCE

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#### PUBLICATION INFORMATION

Full Citation: Kleykamp BA, KulakJA. Cigarette use among older adults: a forgotten population.

Am J Public Health. 2023;113(1):27-29.

Acceptance Date: October 10, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307151>

#### CONTRIBUTORS

B.A. Kleykamp wrote the first draft of the editorial. Both authors revised and finalized the editorial.

#### CONFLICTS OF INTEREST

During the past 36 months, B.A. Kleykamp has received compensation for full-time work from the US Food and Drug Administration-supported public-private partnership ACTION (<https://www.action.org>) and the American Society of Addiction Medicine (ASAM). B.A. Kleykamp is also the owner of BAK and Associates, a research consulting and science writing firm. Contracts include work for nonprofits, ASAM, the ECRI Institute, the health technology assessment company Hayes, Inc./ Symplr, the real-world evidence company STATinMED, the government contractor Palladian Associates, and the health care consulting company PinneyAssociates. The work for PinneyAssociates was completed in 2021 and focused on regulatory submissions related to psychedelic drugs. None of this work was funded by the nicotine or tobacco industries. B.A. Kleykamp has also received honorarium payments totaling US\$700 for articles published in Filter (<https://filtermag.org/about-the-influence-foundation>) and PBS Next Avenue (<https://www.nextavenue.org/about-us>). J.A. Kulak has no conflicts of interest to declare.

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## DETAILS

<b>Subject:</b>	Intervention; Older people; Age related diseases; Information dissemination; Young adults; Effectiveness; Adults; Public health; Tobacco; Medical screening; Harm reduction; Smoking cessation; Smoking; Electronic cigarettes; Lung cancer; Cigarettes; Age; Nicotine; Medical research; Definitions; Labels; Health services; Advertising; Drug addiction; Treatment methods; Health care expenditures; Disease; Cancer; Warning labels; Biomedicine; Gastric cancer; Cigarette smoking
<b>Location:</b>	United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	27-29
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington

Publication subject:	Public Health And Safety, Medical Sciences
ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
ProQuest document ID:	2760582625
Document URL:	<a href="https://www.proquest.com/scholarly-journals/cigarette-use-among-older-adults-forgotten/docview/2760582625/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/cigarette-use-among-older-adults-forgotten/docview/2760582625/se-2?accountid=211160</a>
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Last updated:	2023-08-28
Database:	Public Health Database

Document 18 of 39

# Pornography Use and Public Health: Examining the Importance of Online Sexual Behavior in the Health Sciences

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## ABSTRACT (ENGLISH)

In 2020, AJPH published "Should public health professionals consider pornography a public health crisis?" by Nelson and Rothman.<sup>1</sup> The impetus for this work was clear: in the relatively recent past, 17 states have drafted or passed resolutions calling widespread pornography use a public health crisis, with many US politicians taking the position that pornography use is a threat to public health. The reasons for this contention (i.e., that pornography use is a threat to public health) are varied, though proponents of such a position often contend that pornography is a threat to families, impedes brain development in adolescents, affects brain functioning in adults, is inherently addictive, and promotes a wide variety of illegal sexual activities.<sup>1</sup>

Through their critical review, Nelson and Rothman's work clearly demonstrates that such a position is untenable. Most, if not all, of the contentions made by such legislation and resolutions are entirely unsupported by current research, and pornography use does not meet standard criteria associated with threats to public health (i.e., it is not an acute event requiring immediate response; it does not immediately or directly lead to death, morbidity, or adverse health consequences; it does not overwhelm the capacity of local health care systems).<sup>1</sup> In short, such resolutions

are wholly unsupported in both their factual claims and general arguments. Moreover, since 2020, no new states have drafted or passed such resolutions, which may be attributable to the rise of a true public health crisis in 2020. The impact of Nelson and Rothman's work is both obvious and subtle. Among obvious impacts, their work has been cited widely in a short period of time, generated intense public attention, inspired several op-eds and opinion pieces, and served as a starting point for thousands of conversations via social media (see <https://apha.altmetric.com/details/73766659/citations> for a summary of the popular media impact of this work). Central to much of this attention has been their conclusion that pornography use is not a public health crisis.

Yet, an equally important implication of the work is overlooked. Nelson and Rothman's work, while showing that pornography is not a public health crisis, demonstrates that pornography use is a topic to be studied by public health. Whereas some disciplines have largely refused to consider pornography use as a topic relevant for inquiry (e.g., *American Psychologist*, the flagship journal of the American Psychological Association, has published nothing on the topic for more than 30 years), public health has engaged with this activity substantively. More directly, Nelson and Rothman demonstrate that seeking to understand pornography use and its effects is a valid domain of inquiry for public health and the health sciences more broadly.

## FULL TEXT

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### THE SCOPE OF PORNOGRAPHY USE IN THE UNITED STATES

Several recent US nationally representative studies indicate that pornography use is a common recreational activity-equivalent with other digitally mediated behaviors (e.g., video games, social media)-with a majority of men and a sizable plurality of women reporting regular use of pornography.<sup>2-4</sup> Similarly, most US adolescents have seen pornography and indicate that their sexual behaviors may be influenced by pornography exposure and frequency of use.<sup>4</sup>

As previous systematic reviews have shown,<sup>5</sup> there is clear evidence that pornography use, like most sexual behavior, is driven by pleasure-seeking motives. People use pornography to satisfy sexual drive and desire, especially when other sexual options are limited. Not surprisingly, then, for most people, pornography use and concomitant masturbation are normal recreational behaviors that are likely part of a variety of generally healthy sexual behaviors.<sup>5</sup>

The effects of pornography use are mixed.<sup>6</sup> Use is linked to greater sexual objectification of partners, which may be negative in some circumstances.<sup>5</sup> However, it is also associated with greater future openness to and engagement in a range of sexual behaviors and to greater sexual experimentation.<sup>5</sup> In some cases, these links are likely positive (sexual openness being related to greater sexual satisfaction more generally), though there are also associations between pornography use and preferences for or experimentation with more violent and potentially abusive sexual behaviors.<sup>4</sup> Similarly, pornography use is linked to both higher and lower sexual satisfaction,<sup>7</sup> depending on the context of use (dyadic vs solitary).<sup>5</sup> Finally, recent evidence suggests that pornography use is generally unrelated to sexual functioning.<sup>8</sup> More simply, there is very little evidence that pornography use alone inhibits sexual functioning or performance, though this topic remains hotly debated.<sup>8</sup> Collectively then, there is limited evidence that pornography use always or even consistently leads to inherently negative outcomes, but, rather, its effects seem variable depending on a range of individual and sociocultural factors.

Despite the general absence of widespread negative effects stemming from pornography use, such is often encountered in mental health treatment settings.<sup>9</sup> Perhaps the most common reason that practitioners might encounter pornography use as a clinical concern is compulsive use of pornography. Whereas many people use pornography regularly without any reported adverse consequences, there is substantial evidence that pornography use may become out of control, excessive, or impairing for some users.<sup>10</sup> Though there is no psychiatric or mental health diagnosis of "pornography addiction," many people report that they feel as if they cannot control their pornography use or that their pornography use has caused substantial psychosocial functioning impairments.<sup>11</sup> A recent US national sample found that 10.3% of men and 7% of women at least somewhat agree with the statement "I am addicted to pornography"<sup>12</sup> and that between 25% and 30% of the past-year pornography users reported potential issues in regulating their pornography use.<sup>11</sup> Moreover, the 11th edition of the International Classification of Diseases (ICD-11) does include a novel diagnosis of compulsive sexual behavior disorder<sup>13</sup> that may subsume compulsive or excessive pornography use, and there is strong reason to suspect that excessive pornography use will be among the most frequent target behaviors associated with the diagnosis.<sup>14</sup> Not surprisingly, then, pornography use is often a reason for individuals seeking treatment, a target behavior for change in psychotherapy and pharmacotherapy interventions, and a commonly encountered issue by mental health practitioners.<sup>9,15,16</sup>

Importantly, there are circumstances wherein pornography use might present as a clinical concern even when it is not deemed excessive or compulsive. For various reasons, people often find the use of pornography to be morally objectionable. However, such condemnation does not always stop people from viewing pornography, and there are now several studies confirming that many people use pornography while still disapproving of it.<sup>17,18</sup> The use of pornography while morally disapproving of pornography gives rise to what past work has labeled moral incongruence. A number of US studies show that, in some circumstances, moral disapproval of pornography amplifies links between use and self-reported addiction,<sup>19</sup> and the use of pornography among those who find it morally wrong is also linked to a greater incidence of depression, lower levels of happiness, lower levels of sexual satisfaction, and greater general distress.<sup>17,18</sup> Ultimately, these effects of moral incongruence have led researchers and clinicians to caution about the importance of accurately assessing the reasons behind someone's decision to seek treatment of problematic pornography use.<sup>14,15</sup>

#### WHERE DO WE GO FROM HERE?

As Nelson and Rothman's work clearly demonstrates, pornography use is a valid domain of scientific and health-related research. Yet, given the relative novelty of this research domain, particularly in public health and allied fields, there is a need for systematic approaches to understanding this behavior and its effects. Accordingly, here we lay

out a series of recommendations for how public health and allied fields might systematically seek to understand pornography use and its effects.

First, we contend that a key aspect to promoting a better understanding of pornography use and its effects is a change in basic assumptions about what behaviors and domains of human functioning are considered rigorous scientific pursuits by the health sciences. Sexual health research has faced stigma in numerous domains,<sup>20</sup> and scientists and health professionals researching such topics are often perceived as unserious or strange.<sup>21,22</sup> Indeed, the recommendations that follow from this point all, in some way or another, presuppose a recognition of research about pornography use and its effects as valid domains of scientific and public health inquiry.

Second, we recommend increased efforts to ensure clinical competence in recognizing, assessing, and treating pornography-related concerns. Such a recommendation is especially salient given the inclusion of compulsive sexual behavior disorder in the ICD-11, which may be applied in cases of excessive pornography use.<sup>13</sup> In short, we need better clinical training for mental health clinicians in recognizing both problematic pornography use and normal pornography use. To address this need, national societies and associations, state and regional licensing boards, and specialty organizations are poised to effect immediate change. Among most health and educational professions, continuing education is a mandatory component of ongoing licensure, providing unique and constantly available opportunities to increase clinical competence in these areas.

Given the frequency with which practitioners already encounter pornography use in clinical settings, it is likely that many health professionals already discuss pornography use with their clients. However, as is the case with many sexual behaviors, particularly those that are stigmatized likely because of social mores or traditional sexual values, many clients may feel uncomfortable volunteering information about their pornography use or disclosing sexual preferences. Given such qualms, we recommend that tactful but direct assessments of pornography use be incorporated in normal health screenings as they may provide an opportunity for people to disclose concerns that may have otherwise gone unmentioned. Currently, several measures have been validated in clinical and nonclinical populations, which we have cited throughout this document.<sup>11,14</sup> Akin to alcohol and substance use disorders, routine screening for problematic pornography use would hold many advantages for addressing co-occurring mental health issues among treatment-seeking clients and normalize querying pornography use and other sexual behaviors as a standard part of health care.

Third, we need improved sexual education related to pornography use for both adolescents and the public at large. As previous works have clearly demonstrated, many people use pornography for sexual education purposes.<sup>23</sup> Yet, there is little sexual education material that directly addresses pornography use itself.<sup>24</sup> For many people, particularly adolescents and young adults (aged 18-25 years), it seems that pornography is often functioning as a form of sexual education rather than a topic addressed by comprehensive sexual education. This represents a failing of US sexual education more broadly, as pornography alone is likely not the best or most accurate means of educating oneself about sex or the health risks associated with specific behaviors (e.g., condomless sex). Accordingly, there is a clear need for incorporation of pornography use and pornography-related behaviors into standard, comprehensive sexual education materials during adolescence and in more general sexual health recommendations for the public.

Building on this, given the widespread use of smartphones among US adolescents (95%) and the few safeguards set in place to restrict access to pornography use for adolescents, further work is needed to examine the role of pornography in sexual script formulations on its viewers. Such a need is even more apparent given recent work suggesting that increased pornography consumption is associated with decreased condom use among US adults.<sup>3</sup> Though the links between pornography viewing and condomless sex are less clear in adolescent populations, adolescents are regularly viewing pornography that depicts condomless sex. This speaks to a potential need for limited access to pornography for minors (those younger than 18 years in the United States). One possible means of accomplishing such an aim could be age verification software for pornographic Web sites, like those used in the United States and abroad as a means of restricting access to Web sites that offer gambling, alcohol, and cannabis products.

Fourth, as pornography use is a common and perhaps normal part of modern sexuality, we recommend the consistent integration of pornography use measures into mainstream public health and allied professional research. A simple means of accomplishing this is the regular inclusion of basic questions about the frequency and recency of pornography use in new and ongoing research projects and national surveys for which pornography use might be of relevance. This inclusion of such materials is likely especially relevant for public health research related to sexual behaviors in general, sexual health broadly (including sexually transmitted infections), addictions and addictive behaviors, and relationships. Furthermore, we recommend that researchers begin to use a standardized set of questions when assessing the frequency and recency of pornography use as a means of increasing greater generalizability across studies. An example of such items is available in Appendix A (available as a supplement to the online version of this article at <https://ajph.org>).

Ultimately, these recommendations demonstrate a need for new funding mechanisms for pornography-related research across disciplines. As previous works have pointed out,<sup>6</sup> it is simply impossible for the scientific and health community to fully understand the effects of pornography without adequate funding. Yet, at present, bills drafted by various states decrying pornography as a public health crisis have not resulted in any substantive funding increases for pornography research. More bluntly, despite widely professed concerns about pornography use, legislatures seem unwilling to put forth the money to support robust research efforts in this domain.

Without established funding priorities for pornography-related research from relatively unbiased agencies, a compromised research agenda could be established, particularly if partisan or ideologically motivated actors were to initiate funding in this domain. The result of biased actors filling the gap left by more traditional scientific funding agencies would likely be a flood of research born from ideology, absent of objectivity and oriented toward predetermined conclusions. Admittedly, pornography use does not currently neatly fit within the research domain criteria for the National Institute of Mental Health, nor does it explicitly comport with the priorities of most US federal funding agencies. Even so, as we have noted throughout this piece, pornography use is clearly salient to public health and allied disciplines, and, thus, it should be funded as such.

## CONCLUSIONS

Pornography use is common, and Nelson and Rothman's influential work in *AJPH* clearly demonstrates that, although pornography may not be a public health crisis, this behavior is a salient concern for the field of public health and the health sciences more broadly. All available evidence suggests that pornography is and will continue to be a normal aspect of human sexuality, and, as such, it should be studied rigorously across the behavioral and health sciences.

Based on this, there is a clear and present need for the health sciences and allied professions to

1. designate pornography use an area in need of rigorous academic inquiry;
2. enhance training opportunities for clinicians and professionals who might encounter pornography use in their practice;
3. incorporate pornography use in comprehensive sexual education materials for adolescents and in public health outreach and messaging campaigns around sexual behavior;
4. include questions related to pornography use in ongoing and future research related to sexual behaviors, addiction, sexual health, and relationships; and
5. increase public funding for pornography-related research.

Until these recommendations are met, it is likely that the true public health implications of pornography use will remain poorly understood, despite the clear relevance of the topic to the health sciences. ÂfPU

## CORRESPONDENCE

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## PUBLICATION INFORMATION

Full Citation: GrubbsJB, Floyd CG, Kraus SW. Pornography use and public health: examining the importance of

online sexual behavior in the health sciences. *Am J Public Health*. 2023;113(1): 22-26.

Acceptance Date: October 4, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307146>

#### CONTRIBUTORS

J.B. Grubbs and S.W. Kraus contributed equally to the conceptualization, design, writing, and revisions of this work.

C. G. Floyd provided critical revisions. All authors approved the final article.

#### ACKNOWLEDGMENTS

The authors received no direct funding for this work. J.B. Grubbs and S.W. Kraus receive funding from the Kindbridge Research Institute and the International Center for Responsible Gaming. J.B. Grubbs also receives funding from the Problem Gambling Network of Ohio. S.W. Kraus also receives funding from The Nevada Problem Gambling Project.

The authors would like to thank Kimberly Nelson and Emily Rothman for providing helpful information regarding current legislative processes associated with pornography and public health.

#### CONFLICTS OF INTEREST

All authors report no conflicts of interest.

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[org/10.1080/15546128.2018.1437100](https://doi.org/10.1080/15546128.2018.1437100)

## DETAILS

**Subject:** Research; Legislation; Mental health; Public health; Medical personnel; Social networks; Diagnosis; Health sciences; Psychotherapy; Clinical competence; Sexual behavior; Bibliometrics; Pornography & obscenity; Pornography; Mass media effects; Morbidity; Brain; Crises; Threats; Social media; Health risks; Health services; Internet; Mental health services; Health behavior; Adolescent development; Adolescents; Adults

**Business indexing term:** Subject: Social networks

**Location:** United States--US

**Publication title:** American Journal of Public Health; Washington

**Volume:** 113

<b>Issue:</b>	1
<b>Pages:</b>	22-26
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, &PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Commentary
<b>ProQuest document ID:</b>	2760580879
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/pornography-use-public-health-examining/docview/2760580879/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/pornography-use-public-health-examining/docview/2760580879/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-05-19
<b>Database:</b>	Public Health Database

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# Environmental Justice From Pennsylvania to Paris: A Public Health of Consequence, January 2023

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[ProQuest document link](#)

## ABSTRACT (ENGLISH)

Mitigating the impact of environmental disasters and climate change on vulnerable groups of people calls for an environmental justicebased approach that makes "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income" a top priority.<sup>1</sup> In 2011, Gracia and Koh presciently wrote that promoting environmental justice "requires reaffirming, revitalizing, and reinvigorating past national commitments" to how we plan and sustain laws, policies, and practices.<sup>2</sup>(pS14) An environmental justicebased approach to ensuring "greater access to health care, clean air and water, healthy and affordable food, community capacity building through grants and technical assistance, and training to educate the health workforce about environmentally associated health conditions"<sup>2</sup>(pS15) for all is the path to bridging environmental justice and health equity.<sup>3</sup> In this editorial, I highlight the historical and current calls for an environmental justice approach to preparing for and responding to man-made as well as natural environmental disasters.

## FULL TEXT

Mitigating the impact of environmental disasters and climate change on vulnerable groups of people calls for an environmental justicebased approach that makes "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income" a top priority.<sup>1</sup> In 2011, Gracia and Koh presciently wrote that promoting environmental justice "requires reaffirming, revitalizing, and reinvigorating past national commitments" to how we plan and sustain laws, policies, and practices.<sup>2</sup>(pS14) An environmental justicebased approach to ensuring "greater access to health care, clean air and water, healthy and affordable food, community capacity building through grants and technical assistance, and training to educate the health workforce about environmentally associated health conditions"<sup>2</sup>(pS15) for all is the path to bridging environmental justice and health equity.<sup>3</sup> In this editorial, I highlight the historical and current calls for an environmental justice approach to preparing for and responding to man-made as well as natural environmental disasters.

### DONORA, PENNSYLVANIA

Ask now, and it is unlikely that many people know where Donora, Pennsylvania, is or what it signifies. In late October 1948, a heavy smog rising from steel and zinc factories enveloped Donora and caused at least 20 deaths and close to 6000 mild and moderate cases of respiratory distress immediately after the smog settled.<sup>4</sup> The preliminary US Public Health Service (USPHS) report on the immediate impacts of the Donora smog pointed to increased mortality and morbidity among the elderly and those with preexisting cardiopulmonary conditions.<sup>5</sup> Adding to these findings, a followup study provided evidence of the unequal distribution of mortality and morbidity-those who were poor, not White, of limited English proficiency, and living in substandard housing were overrepresented among the dead and the ill immediately after the smog and during follow-up investigations.<sup>6</sup>

Today we recognize what happened in Donora as an example of environmental injustice in which the commercial concerns of the steel and zinc industries superseded concerns about the health and well-being of factory workers. Moreover, without any federal oversight, these industries were able to operate factories with little to no regulatory oversight.

While Donora was most certainly not the only man-made environmental disaster in the United States during this time, it stands out for being a driving force behind the enactment of the federal Clean Air Act in 1963. The Clean Air Act was the first federal legislation concerned with "controlling" air pollution and authorized the USPHS to support research into techniques for monitoring and controlling air pollution. As Vernon MacKenzie,<sup>7</sup> chief of the Division of Air Pollution in the USPHS, wrote,

Air pollution can no longer be dismissed with excuses and half-way measures. Through the congressional action in enacting the Clean Air Act, we have made a commitment to bring an end to the steady increase in the national air pollution problem. We must keep that commitment.<sup>7</sup>49041

### PLANNING, PREVENTING, AND RESPONDING

Fast forward and, according to the National Oceanic and Atmospheric Administration, Hurricane Ian was the 15th environmental disaster to cause at least \$1 billion in damage as of October 11, 2022 (<https://bit.ly/3yKUAzY>). To date, more than 100 people have died in Florida as a result of the hurricane, making it the deadliest hurricane to hit Florida in more than 85 years (<https://bit.ly/3eCRAiw>). One of the questions that will likely be raised in the months to come is whether local preparedness as well as response were appropriate and implemented in a timely manner. Such questions are of greater relevance now, and as Schmeltz et al. (p. 15) write about in this issue of AJPH, there are indeed gaps in preparing for and responding to climate change hazards. While their article focuses on extreme heat events, the findings are applicable to a range of extreme weather events and environmental disasters. Their review of Heat Action Plans in California suggests that the current planning focuses on emergency response and warrants redirection to focus on preventing negative health outcomes. A review of the organization and governance of extant Heat Action Plans in California also indicates a greater need to focus on preparedness for extreme heat events as well as coordinating with local and state departments of health to devise a public health preparedness plan and response.

Health departments and local stakeholders are needed to foster environmental justice and protect vulnerable people.<sup>8</sup> The need for such coordination is supported by Schwarz et al., who found that people experiencing homelessness and were either younger or elderly or had an underlying mental health burden were especially vulnerable to heat waves and more likely to seek care in an emergency department for health care during extreme heat events.<sup>9</sup> Planning and practice that seeks to ensure resources are equitably allocated to those most likely to experience greatest exposure to environmental harms is necessary to ensure health equity and environmental justice.<sup>10</sup>

#### HOW MUCH DOES 1.5°C REALLY MATTER?

As confirmed by the International Panel on Climate Change's Special Report on Global Warming, a 1.5°C (2.7°F for those in the United States) increase in the average global temperature will cause an escalation of natural environmental disasters across the world.<sup>11</sup> This increase will yield more extreme weather in the forms of heat waves and polar vortices, more and longer periods of droughts, worsening floods and heavy rains, decreased availability of fresh water, rising sea levels, and shrinking polar ice caps. The list is long, and the consequence of each one of these environmental disasters threatens the security of our global community, particularly for those with the fewest resources and in the most vulnerable situations. This past year alone, we witnessed large wildfires and severe heat waves across the United States and Europe; flooding in Bangladesh, India, Pakistan, Brazil, and in the Appalachian (Kentucky) region in the United States; and another above-average hurricane and tropical storm season in the Atlantic region.

#### UPHOLDING OUR OBLIGATION TO THE PARIS ACCORDS

With the Clean Air Act of 1963, the creation of the Environmental Protection Agency (EPA) in 1970, and the Paris Accords of 2015, there were slow but steady efforts to motivate state, federal, and global actions to reduce greenhouse gas emissions and slow increases in global temperatures to achieve a climate-neutral world by 2050. In affirming the 1963 commitment to bringing an end to the "national air pollution problem," in 2015, the Obama administration issued a broad and comprehensive Clean Power Plan under the Clean Air Act to rein in power plant emissions and provide states opportunities to identify and implement plans to switch to cleaner energy options. Under the Trump administration, the vast majority of rules enumerated in the Clean Power Plan were rolled back (<https://nyti.ms/3gaIYA0>). And while the Biden administration has sought to undo these reversals, in some instances, it may take years to fully undo these rollbacks.

Most recently, the US Supreme Court ruled in *West Virginia v. Environmental Protection Agency (EPA)* that the EPA could not put state-level caps on carbon emissions as clearly laid out in the 1970 Clean Air Act, but that this authority rested with the US Congress. In so ruling, the Court opined that the EPA lacked the authority to pursue its primary mission of limiting pollution attributable to toxic and harmful substances and lacked authority to pursue goals set under the Clean Power Plan.

#### POLICIES, NOT POLITICS

The West Virginia v. EPA ruling poses significant threats to our ability to meet our obligations to the Paris Accords and the global community to reduce our greenhouse gas emissions and slow the climate crisis. For the public health community, this ruling threatens progress in achieving health equity as well as in promoting environmental justice and ignores the substantial evidence base on the physical and mental health harms associated with environmental disasters. So, this editorial serves as a call to all in the public health community to advocate and agitate for climate justice, for environmental justice and health equality for all of humanity. In the words of Jake Edwards of the Onondaga Nation Council of Chiefs: "We all need the same things: clean air and clean water. We have a lot of work to do, but if we can combine our strengths, we can fight for what's right" (<https://bit.ly/3VLwejM>).

#### CORRESPONDENCE

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#### PUBLICATION INFORMATION

Full Citation: Kapadia F. Environmental justice from Pennsylvania to Paris: a public health of consequence, January 2023. *Am J Public Health*. 2023;113(1):12-14.

Acceptance Date: October 18, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307156>

#### CONFLICTS OF INTEREST

The author has no conflicts of interest to disclose.

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## DETAILS

<b>Subject:</b>	Air pollution; Climate change; Emissions; Outdoor air quality; Public health; Environmental equity; Grants; Food; Health disparities; Environmental justice; Environmental impact; Technical assistance; Health care access; Disasters; Disaster management
<b>Location:</b>	Pennsylvania; Florida; United States--US; California; West Virginia
<b>Company / organization:</b>	Name: Environmental Protection Agency--EPA; NAICS: 924110
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	12-14
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, &PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Commentary
<b>ProQuest document ID:</b>	2760580872
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/environmental-justice-pennsylvania-paris-public/docview/2760580872/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/environmental-justice-pennsylvania-paris-public/docview/2760580872/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-08-31
<b>Database:</b>	Public Health Database

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Anonymous

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## FULL TEXT

\_TVM:UNDEFINED\_

## DETAILS

<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	3
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Table Of Contents
<b>ProQuest document ID:</b>	2760580871
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/table-contents/docview/2760580871/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/table-contents/docview/2760580871/se-2?accountid=211160</a>
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# Wastewater Surveillance-"Messy" Science With Public Health Potential

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## ABSTRACT (ENGLISH)

Wastewater testing for infectious diseases blossomed during the COVID-19 pandemic.<sup>1</sup> Public health agencies are using wastewater data to augment traditional case and syndromic disease surveillance systems.<sup>2</sup> In this issue of AJPH, Kotlarz et al. (p. 79) report on the correspondence between COVID-19 disease trends observed with wastewater analysis, clinical testing, and syndromic surveillance in Raleigh, North Carolina, in 2020. They found moderate to strong correlations in COVID-19 trends across these data sources with wastewater influent and clinical testing disease signals preceding disease signals from syndromic surveillance and wastewater solids.

Wastewater analysis is an emerging surveillance tool that has potential benefits but also presents challenges compared with existing disease surveillance approaches. We find it useful to think about wastewater surveillance in the paradigm of a SWOT (strengths, weaknesses, opportunities, and threats) analysis (Figure 1). Kotlarz et al. identified some of these issues as pros and cons in the first figure in their article.

Wastewater analysis as a disease surveillance tool has several potential advantages over traditional surveillance methods. Wastewater analysis theoretically provides information about all of the individuals contributing to the wastewater-in essence, pooled testing of a community. Kotlarz et al. measured disease biomarkers in wastewater samples that may have contained contributions from more than 500 000 individuals living in Raleigh. Compared with individual clinical testing, wastewater analysis is efficient and likely cost saving-one study estimated that it was 1.7% of the total cost of clinical testing.

## FULL TEXT

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Wastewater analysis is an emerging surveillance tool that has potential benefits but also presents challenges compared with existing disease surveillance approaches. We find it useful to think about wastewater surveillance in the paradigm of a SWOT (strengths, weaknesses, opportunities, and threats) analysis (Figure 1). Kotlarz et al. identified some of these issues as pros and cons in the first figure in their article.

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methods. Wastewater analysis theoretically provides information about all of the individuals contributing to the wastewater—in essence, pooled testing of a community. Kotlarz et al. measured disease biomarkers in wastewater samples that may have contained contributions from more than 500 000 individuals living in Raleigh. Compared with individual clinical testing, wastewater analysis is efficient and likely cost saving—one study estimated that it was 1.7% of the total cost of clinical testing.<sup>3</sup>

Unlike syndromic and case-based disease surveillance, wastewater analysis does not rely on an individual having access to or seeking health care. As the title to the popular children's book by Taro Gomi proclaims, *Everyone Poops*. For this reason, wastewater surveillance can increase health equity if deployed in populations with less access to clinical testing or health care. Marginalized, rural, and resource-poor communities and their associated public health institutions stand to benefit from timely wastewater disease data that can inform local decision-making and the community members. As more individuals turn to home-based rapid tests and as the frequency of mild or asymptomatic COVID-19 cases increases, syndromic and case-based disease surveillance may further underestimate disease prevalence. In these situations, wastewater analysis will still identify trends in community disease burden, such as during the recent Omicron variant-fueled waves of COVID-19 infections.<sup>4</sup>

Although wastewater surveillance is an excellent complement to traditional disease surveillance, it has limitations. Wastewater samples positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral RNA cannot tell us who in the community is infected. However, there are many reports of wastewater surveillance triggering enhanced clinical testing to identify infected individuals, such as happened in Yellowknife, Canada.<sup>5</sup> Kotlarz et al. also recognize that wastewater analysis cannot distinguish between individuals with new and those with convalescing infections. Nor do we know with confidence who is contributing to a community's wastewater. Populations are dynamic, and individuals have varied toileting behaviors. Some individuals residing in a community will leave for work or recreation, and visitors from outside the community will make "deposits" into the wastewater system. There is also substantial variation in the amount of virus an infected individual deposits into the system—not all infected individuals shed virus in their feces, viral shedding may last from days to weeks, and shedding intensity varies over many magnitudes<sup>6</sup>—likely because of a combination of host (e.g., age, illness severity, prior immunity) and virus (e.g., variant, infective dose) characteristics.

The tidal wave of enthusiasm for wastewater surveillance in the research and public health communities presents an opportunity to build on the successes of this approach. As exemplified by the Raleigh wastewater study authors' affiliations, implementing wastewater surveillance fosters multidisciplinary and multiorganizational collaborations. Scientists, public utilities operators, engineers, epidemiologists, and others worked together to conduct the wastewater study. Partnerships like these are critical for addressing complex public health problems. Wastewater analysis can and should look beyond estimates of COVID-19 disease trends. Wastewater surveillance detected a subclinical outbreak of polio in Israel in 2013 and informed targeted vaccine campaigns.<sup>7</sup> Less than a decade later, wastewater surveillance in New York State helped define the spread of a vaccine-derived poliovirus outbreak following its detection in a hospitalized patient.<sup>8</sup> The wastewater partnerships and infrastructure developed during the COVID-19 pandemic likely made the rapid pivot to wastewater testing for polio possible and can enable other critical disease (e.g., monkeypox) surveillance activities.

Community circulation of SARS-CoV-2 and poliovirus are only the beginning of what we can learn from wastewater analysis. With advances in molecular biology and genetic sequencing, laboratories are sequencing wastewater to track SARS-CoV-2 variants,<sup>9</sup> measuring levels of antimicrobial resistance genes,<sup>10</sup> and looking for novel viruses that could cause the next pandemic. The utility of wastewater analysis goes beyond infectious disease surveillance: scientists are testing wastewater for many biomarkers of public health importance, such as pharmaceutical metabolites<sup>11</sup> and markers of exposure to air pollution.<sup>12</sup>

Wastewater surveillance is a particularly attractive public health tool for communities with limited access to clinical testing or health care. However, these same communities may also lack laboratory infrastructure, human resources, and external partnerships as well as centralized sanitation systems. Hence, there is an opportunity for community-engaged research to design wastewater analysis approaches that meet the needs of these communities. Strategies

that build local capacity, emphasize simplified analytic tests, and cultivate partnerships between local stakeholders can maximize the potential of wastewater disease surveillance across a diversity of settings.

Wastewater analysis as a disease surveillance modality faces potential threats. As with other public health programs, the availability of resources (i.e., funding) will influence the sustainability of wastewater surveillance initiatives. The Centers for Disease Control and Prevention has provided laboratory capacity grants to many states to enhance their wastewater surveillance programs. Wise investment of these funds in public-academic and public-private partnerships can build wastewater analytic capacity and sustain implementation activities.

Although measuring levels of SARS-CoV-2 RNA in wastewater is relatively easy by some standards (in four hours we taught a wastewater treatment plant operator to do this with high fidelity), interpreting wastewater disease data is complex. The public health significance of a wastewater SARS-CoV-2 signal requires contextualization, an understanding of the limits of the approach, and further analysis of its correspondence with traditional disease surveillance metrics, such as hospitalization rates. Although Kotlarz et al. reported significant correlations between the wastewater and clinical signals during their study, there were also instances when these surveillance methods disagreed. As public health officials gain experience using wastewater data, it will be important to continue to evaluate wastewater's performance compared with traditional surveillance data sources, develop visualization and analytic tools to support its use, and provide opportunities for sharing best practices.

In summary, Kotlarz et al. and others have demonstrated the public health potential of wastewater testing, particularly in the context of the COVID-19 pandemic. The groundswell of enthusiasm in the research and public health sectors suggests that wastewater testing will continue to integrate with more established public health disease surveillance approaches. Although wastewater testing has challenges that inspire creative problem solving, we believe that its advantages make it a compelling tool for public health surveillance. ÅfPU

#### ACKNOWLEDGMENTS

The authors received support from the Office of the Director, National Institutes of Health (NIH; grant U01DA053903), the National Science Foundation (NSF; grant 2154934), and the Centers for Disease Control and Prevention (CDC; contract 75D30120C09531).

Note. The content of this editorial is solely the responsibility of the authors and does not necessarily represent the official views of the NIH, NSF, or the CDC.

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#### PUBLICATION INFORMATION

Full Citation: Keck JW, Berry SM. Wastewater surveillance-"messy" science with public health potential. *Am J Public Health*. 2023;113(1):6-8.

Acceptance Date: September 28, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307141>

#### CONTRIBUTORS

The authors contributed equally to the conceptualization and writing of this editorial.

#### CONFLICTS OF INTEREST

S.M. Berry reports ownership interest in Salus Discovery LLC. J.W. Keck has no conflicts of interest to declare.

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## DETAILS

<b>Subject:</b>	Severe acute respiratory syndrome coronavirus 2; Water treatment; Medical laboratories; Public health; Viruses; Coronaviruses; Disease control; Infectious diseases; Health surveillance; COVID-19 vaccines; Trends; Community; Disease prevention; Correspondence; Pandemics; Biomarkers; Poliomyelitis; COVID-19; Surveillance; Water sampling; Wastewater; Threat evaluation; Wastewater analysis; Cost analysis; Surveillance systems
<b>Business indexing term:</b>	Industry: 92312 : Administration of Public Health Programs 22131 : Water Supply and Irrigation Systems 62151 : Medical and Diagnostic Laboratories
<b>Location:</b>	United States--US
<b>Company / organization:</b>	Name: Centers for Disease Control & Prevention--CDC; NAICS: 923120
<b>Classification:</b>	92312: Administration of Public Health Programs; 22131: Water Supply and Irrigation Systems; 62151: Medical and Diagnostic Laboratories

<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	6-8
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Commentary
<b>ProQuest document ID:</b>	2760580825
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/wastewater-surveillance-messy-science-with-public/docview/2760580825/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/wastewater-surveillance-messy-science-with-public/docview/2760580825/se-2?accountid=211160</a>
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<b>Last updated:</b>	2023-08-25
<b>Database:</b>	Public Health Database

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# Embracing Advanced Methodology to Improve Population Health

Vaughan, Roger, DRPH, MS<sup>1</sup> is an associate editor for AJPH and is with the Department of Biostatistics at The Rockefeller University Hospital, New York, NY

## ABSTRACT (ENGLISH)

AJPH has long endorsed the application of novel and powerful state-of-the-art methodological approaches to advance population health. In 2004, we asked David Murray<sup>1,2</sup> and Allan Donner,<sup>3</sup> two pioneers in the development and application of group or cluster randomized trials, to provide extensive primers on their design, application, and analysis, and invited them to help keep these tools in our analytic toolbox by providing methodological updates in 2017.<sup>4,5</sup>

In 2018, we embraced the notion of returning "cause" to our public health vocabulary, and employing causal inference methods to our data when appropriate. Miguel Hernan<sup>6</sup> and others<sup>7</sup> presented a compelling case that while, for many good historical reasons, we kept our expectation of finding and stating causes to a minimum and similarly kept our language away from the term, that it was time to acknowledge that we are indeed after causes. And while we may not be in a design or analytic space to suggest cause, we should not shy away from the application of methods for causal inference when appropriate and should strive to push our research as far down the causal pathway as possible. In 2023, AJPH is again promoting the adoption of advanced methodologies to improve population health with the presentation of three methodologies and approaches.

## FULL TEXT

AJPH has long endorsed the application of novel and powerful state-of-the-art methodological approaches to advance population health. In 2004, we asked David Murray<sup>1,2</sup> and Allan Donner,<sup>3</sup> two pioneers in the development and application of group or cluster randomized trials, to provide extensive primers on their design, application, and analysis, and invited them to help keep these tools in our analytic toolbox by providing methodological updates in 2017.<sup>4,5</sup>

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### METHODOLOGICAL ADVANCES

First, Wang and Chakraborty (p. 49) present an outstanding review of a method that overcomes some of the downsides of traditional randomized controlled trials, which often tend to compare one novel treatment to standard or usual care, where participants remain in their assigned treatment groups over the life of the trial. Such trials can often last months or years and can be prohibitively expensive. The sequential multiple assignment randomized trial (SMART) and other such adaptive or dynamic treatment strategies allow investigators to reassign patients to additional intervention arms depending upon response to the previous intervention. The review paper offers an overview of methods and applications and provides links to R code and methods for sample size calculations for SMARTs as well as for the statistical analysis of such trials. A supportive commentary by Seewald in this issue also extends the conversation and provides further insights into the application of SMART designs (Seewald p. 37).

Second, Liu et al. (p. 60) expertly present the design and analysis considerations for a whole class of interventions that recognize that spatially and temporally static interventions are not always optimal. These "just-in-time adaptive interventions" (JITAs) seek to provide the most effective intervention type at just the right time and place; in a smoking cessation program, a JITA approach might send reminders to a participant to check their patch or chew replacement therapy gum during periods of high craving, while sending alerts to practice meditation, to exercise, or

participate in healthy and alternative behaviors during other times, and perhaps deliver no intervention when all internal and external conditions are optimal for cessation so as not to overburden the patient. Liu et al. describe a design approach, microrandomized trials (MRTs), that are employed to help determine the type and duration of those spatially and temporally optimal interventions. Liu et al. use two published examples of the implementation and analysis of MRTs and provide tables with comprehensive links to published methods and R, SAS, or Stata code for both sample size calculations for, and statistical analysis of, MRTs, whose results can be used to populate the content of JITAIs.

Third, Bauer et al. (p. 40) describe a Bayesian estimation method to help identify testing disparities and inform the magnitude of testing deficiency in the context of small area estimation, using severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as an example. Bauer et al. present a two-step sampling method that has a number of advantages over traditional approaches. First, just as "all politics are local," all public health is local as well, and the method is designed to be implemented in smaller, local environments where testing data and information may be sparse.

Second, it can help, in real time, predict the number of tests that will be needed to better inform the supply chain needs and can incorporate the often-dynamic parameters of a pandemic rather than relying on fixed and perhaps outdated inputs. In a public health catch-22, areas with fewer available tests may report lower rates, thereby reinforcing the false need for fewer tests. As in the article by Hernan,7 in which he observes that the terror evoked by the term "causal inference" may keep many away from implementing causal methods, uttering the word "Bayesian" may similarly keep investigators at bay. Fortunately, Bauer et al. (p.40) provide links to the necessary R code on GitHub along with a practice data set for easy implementation.

#### PUSH-PULL

Methodologies and population health often operate in a symbiotic push-pull relationship, in which stubborn health issues push the development of novel design and analytic methodologies, and new methodologies allow for interrogations to get pulled into new areas and offer potential solutions. We hope that by presenting these methods in user-friendly formats that it makes it easier to enter the population health push-pull conversation and continue to advance health.

#### CORRESPONDENCE

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#### PUBLICATION INFORMATION

Full Citation: Vaughan R. Embracing advanced methodology to improve population health. *Am J Public Health*. 2023;113(1):35-36.

Acceptance Date: October 19, 2022.

DOI: <https://ajph.org/10.2105/AJPH.2022.307155>

#### CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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## DETAILS

<b>Subject:</b>	Severe acute respiratory syndrome coronavirus 2; Intervention; Public health; Design; Methods; Statistical analysis; Design analysis; Inference; Methodological approaches
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	35-36
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Commentary
<b>ProQuest document ID:</b>	2760580818
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/embracing-advanced-methodology-improve-population/docview/2760580818/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/embracing-advanced-methodology-improve-population/docview/2760580818/se-2?accountid=211160</a>

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**Last updated:** 2023-02-10

**Database:** Public Health Database

Document 23 of 39

## Credits

Anonymous

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## FULL TEXT

\_TVM:UNDEFINED\_

## DETAILS

**Publication title:** American Journal of Public Health; Washington

**Volume:** 113

**Issue:** 1

**Pages:** 2

**Publication year:** 2023

**Publication date:** Jan 2023

**Publisher:** American Public Health Association

**Place of publication:** Washington

**Country of publication:** United States, Washington

**Publication subject:** Public Health And Safety, Medical Sciences

**ISSN:** 00900036

**Source type:** Scholarly Journal

**Language of publication:** English



Document type: Credits

ProQuest document ID: 2760580793

Document URL: <https://www.proquest.com/scholarly-journals/credits/docview/2760580793/se-2?accountid=211160>

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Last updated: 2023-01-04

Database: Public Health Database

Document 24 of 39

# A Community Health Worker–Based Intervention on Anthropometric Outcomes of Children Aged 3 to 21 Months in Urban Pakistan, 2019–2021

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## ABSTRACT (ENGLISH)

**Objectives.** To evaluate the impact of a community health worker-based "in-home growth monitoring with counseling" (IHGMC) intervention on anthropometric outcomes in Pakistan, where 38% of children younger than 5 years are stunted. **Methods.** We used an individual, single-blind, step-wedge randomized controlled trial and a pure control group recruited at endline. We based the analysis on an intention-to-treat estimation using the coarsened exact matching (CEM) method for sample selection among treatments and the control. We conducted the baseline in July 2019 and completed endline in September-October 2021. We recruited 1639 households (treated: 1188; control: 451) with children aged 3 to 21 months who were residing in an urban informal settlement area. The CEM sample used for analysis numbered 1046 (treated: 636; control: 410). The intervention continued for 6 months. **Results.** Compared with the control group, the height-for-age z-score in the IHGMC group increased by 0.58 SD (95% confidence interval [CI] = 0.33, 0.83;  $P = .001$ ) and the weight-for-age z-score by 0.43 SD (95% CI = 0.20, 0.67;  $P < .01$ ), measured at endline. **Conclusions.** IHGMC substantially improved child anthropometric outcomes in disadvantaged localities, and this impact persisted during the COVID-19 pandemic.

## FULL TEXT

### Headnote

**Objectives.** To evaluate the impact of a community health worker-based "in-home growth monitoring with counseling" (IHGMC) intervention on anthropometric outcomes in Pakistan, where 38% of children younger than 5 years are stunted.

**Methods.** We used an individual, single-blind, step-wedge randomized controlled trial and a pure control group recruited at endline. We based the analysis on an intention-to-treat estimation using the coarsened exact matching

(CEM) method for sample selection among treatments and the control. We conducted the baseline in July 2019 and completed endline in September–October 2021. We recruited 1639 households (treated: 1188; control: 451) with children aged 3 to 21 months who were residing in an urban informal settlement area. The CEM sample used for analysis numbered 1046 (treated: 636; control: 410). The intervention continued for 6 months.

Results. Compared with the control group, the height-for-age z-score in the IHGMC group increased by 0.58 SD (95% confidence interval [CI] = 0.33, 0.83;  $P = .001$ ) and the weight-for-age z-score by 0.43 SD (95% CI = 0.20, 0.67;  $P < .01$ ), measured at endline.

Conclusions. IHGMC substantially improved child anthropometric outcomes in disadvantaged localities, and this impact persisted during the COVID-19 pandemic.

Trial Registration. AER-RCT registry (AEARCTR-0003248). (*Am J Public Health*. 2023;113(1):105-114.

<https://doi.org/10.2105/AJPH.2022.307111>)

Globally, 1 in 4 children younger than 5 years suffers from linear growth faltering, 1 with the highest prevalence in South Asia and sub-Saharan Africa.<sup>2</sup> Stunting (low height-for-age z-score [HAZ]  $< -2$ ) remains a critical public health challenge as it reduces lifetime earnings, hinders cognitive development, and leads to high mortality rates.<sup>3</sup> The COVID-19 pandemic has raised concerns about reversals to improvements in childhood nutrition.<sup>4</sup> These concerns have been met with a renewed emphasis on the importance of mobilizing resources for nutrition<sup>5</sup> and an urgency to increase resilience to malnutrition during times of crises,<sup>6</sup> such as a pandemic.

Research suggests that primary caregivers play a key role in child development.<sup>7</sup> Caregivers are the first point of contact for children, and their engagement is crucial to ensure adequate physical, cognitive, social, and emotional development. Consequently, community health worker (CHW) programs, globally<sup>8</sup> and in Pakistan,<sup>9</sup> leverage regular contact with primary caregivers to improve child health outcomes. Existing CHW-based public health delivery programs, which have shown promise in maternal and child health<sup>10</sup> by encouraging health-care-facility utilization by caregivers, have produced modest gains in child health (typically lower than a 0.25 SD gain in HAZ).<sup>11-13</sup> Several limitations remain, as these programs predominantly focus on resource and knowledge constraints but provide little attention to behavioral interventions such as engaging caregivers with continuous feedback on the growth measures of their children.<sup>14,15</sup> Programs that use cash transfers to address resource constraints show limited impact.<sup>16</sup> Physical growth promotion programs mostly operate through facility-based growth monitoring<sup>17</sup> and rarely focus on regular home-based growth surveillance by CHWs, with the exception of a handful of small sample studies.<sup>12,18</sup> Programs that simply integrate growth charts into the community-based interventions—without regular growth monitoring—do not see any impact because caregivers often fail to comprehend growth trajectories.<sup>19</sup> The complementarity of regular growth monitoring and counseling for caregivers is essential, as it improves the understanding of child care inputs and physical development, particularly in marginalized communities.

The few studies that explored behavioral interventions have shown limited effect on child growth. One of the first rigorous studies on regular growth monitoring with a growth chart, the South Indian Trial,<sup>18</sup> did not find any additional benefit from growth monitoring. The study setting was small (12 villages in Tamil Nadu), focused on weight measures, and was executed by 1 selected mother in the village. Its impact measures also did not isolate the impact of growth monitoring from that of the growth chart. A related study, conducted in Zambia,<sup>20</sup> focused on home-based growth monitoring (lifesized posters installed in homes to demonstrate children's age-appropriate height) and community-based growth monitoring along with nutritional supplements. This study found modest positive effects on growth among previously malnourished children; however, the study suffered from a lack of professionally measured anthropometrics at regular intervals and did not assess complementarities between monitoring and counseling. Thus far, the existing literature is inconclusive and lacks sufficient evidence in evaluating the impact of regular in-home anthropometric monitoring and counseling executed by trained CHWs.

Motivated by this concern, we tested in-home growth monitoring coupled with nutrition counseling in Pakistan, a lower-middle-income country in South Asia with high levels of childhood stunting: 38% of all children younger than 5 years are stunted, although this figure is lower in urban areas (31%) and for children aged 6 to 8 months (18%).<sup>21</sup> We chose to study the intervention in an informal urban settlement, a setting that hosts marginalized populations but

rarely receives health or nutritional aid. Additionally, our study was conducted during a global pandemic, which—as many experts fear—threatens child nutritional development, especially in areas where health facilities are being closed or partially functional.<sup>22</sup>

## METHODS

Our main sample for the impact analysis came from a randomized controlled trial, which we conducted in Gulshan-e-Sikandarabad, an urban informal settlement located in Karachi, Pakistan. Households with at least 1 child aged 3 to 21 months were eligible for this trial. An independent survey team listed 4166 households, found 1823 of them to be eligible for our trial, and administered a baseline survey (July 2019) to the biological mother and caregiver of the child, capturing demographics, socioeconomics, and child anthropometrics. If more than 1 eligible child was present in the household, the youngest one was chosen. This process continued until 1188 eligible households completed the baseline survey and were randomly allocated to 1 of 3 treatment arms (1:1:1) entailing 396 households in each group, as follows: T1: monthly in-home growth monitoring with counseling (IHGMC); T2: IHGMC with a poster-sized HAZ-based growth monitoring interactive chart; T3: IHGMC plus growth charts (as in T2) complemented with a monthly unconditional cash transfer (fixed amount of Rs 400 [\$11.91 in purchasing power parity]), with a suggestion to use the amount for children's food. This intervention continued for 6 months (September 2019–February 2020) and ended just before the COVID-19 outbreak. The balance table on treatment assignment is reported in Table A10 of Appendix A (available as a supplement to the online version of this article at <http://www.ajph.org>).

An endline survey was administered 13 months after the start of intervention activities (September–October 2020), with a no-contact period of 7 months. The endline survey was timed this way to allow better understanding of the persistence of gains in child health, especially as measured during the pandemic. At this time, we added a pure control group by surveying an additional 451 households, recruited from the subset of eligible households in the original list of 4166 households generated during our initial community census, utilizing the same eligibility criteria of having a child aged 3 to 21 months and presence of the household in the community at the time of baseline. Adding this pure control group allowed us to compare the treatment impact with a no-intervention scenario, going beyond the ambit of the original randomized controlled trial (a detailed timeline is given in online Appendix B).

### Randomization, Matching, and Masking

We initially designed a sample size of 400 households per intervention group to detect an effect size of 0.3 SD in HAZ between any of the 3 treatment arms, with a power of 0.8 and an  $\alpha$  level of 0.05, unconditional on covariates. This statistical power remained similar when we used a matched sample.

We used coarsened exact matching (CEM) to select our sample for analysis from the treatment and control groups, since we added the control group to an ongoing randomized controlled trial. We used CEM to match on household size, child's age at baseline, father's education, mother's education, and language.<sup>23</sup> We improved the matching by reducing the L1 distance (an objective measure of how different the raw, unmatched control and treatment samples are from each other) from 0.94 to 0.57. Details of CEM are provided in online Appendix D, and the balance on observables for the matched sample are shown in Table A11 of online Appendix A.

The nature of our intervention did not allow full masking of participants to the CHWs. Although the team of investigators was masked, the data collection team was not strictly blinded to intervention group assignment since the endline survey asked about some of the treatment-related activities, which allowed them to predict individual treatment allocation (online Appendix E). The detailed procedures on team recruitment and training and on intervention operational protocols are given in online Appendixes H, G, and E, respectively.

### Outcomes

The primary outcome measures were HAZ, where height was measured using infantometers and stadiometers, and weight-for-age z-score (WAZ), where weight was measured using weighing scales (for detailed procedures, see online Appendix G). We calculated HAZ scores using the in-built Stata package "zscore06" (StataCorp LP, College Station, TX) in accordance with the World Health Organization (WHO) Child Growth Standards for children younger than 5 years. Our secondary outcomes were binary indicators for stunted and severely stunted (i.e., 2 SD and 3 SD below the median HAZ score of the reference population, respectively, underlying the WHO Child Growth

Standards) as well as binary indicators for underweight and severe underweight (i.e., 2 SD and 3 SD, respectively, below the median WAZ score from the WHO Child Growth Standards).<sup>24</sup> Another secondary outcome was weight-for-height z-score (WHZ), which captured the weight of the child compared with their height as well as 2 binary variables: wasting (i.e.,  $WHZ < -2$  SD) and severely wasted (i.e.,  $WHZ < -3$  SD). We measured height and weight in duplicates, following the WHO Multicenter Growth Reference Study method.<sup>25</sup> Additional variables analyzed were caregiver knowledge, quality of diet, and the home environment (online Appendix F).

### Statistical Analysis

All our analyses followed an intention-to-treat (ITT) estimation on the matched sample. CEM yielded a total sample of 1046 households across the control and treatments (198 in T1, 208 in T2, 230 in T3, and 410 in the control), with a matching control:T1:T2:T3 ratio of 1:0.48:0.51:0.56. Our ITT estimation generated causal effects of treatment on outcome variables. ITT estimates minimize bias through selective take-up of the intervention, providing lower bound impact estimates. We employed ITT regression analysis using binary variables to designate treatment status (versions with individual- and household-level covariates are reported in Tables A15 through A23 of online Appendix A) to evaluate the impact of the 3 treatments, using Stata 14 with Huber-White robust standard errors. We used the same strategy for the treatment component-specific analysis (termed "reclassification"), where we estimated the ITT impacts using binary indicators for treatment components: counseling = T1 + T2 + T3 (n = 636); growth chart = T2 + T3 (n = 438); and cash transfer = T3 (n = 230). We present ITT coefficient estimates (means) with 95% confidence intervals (CIs) and P values using outcomes measured at endline. We estimated heterogeneous treatment effects by interacting treatment status with child's gender, marginalized ethnicity dummy, and age at baseline (online Appendix C). Additionally, we used propensity score matching as a robustness check for our estimates.

### RESULTS

Of the 4166 households assessed for eligibility at baseline, 1823 were found eligible, of which 1188 were employed for the intervention (online Figure A7). Of these, 5 households witnessed a death or injury of the child (< 1%) and 202 households (17%) could not be recontacted for program implementation through a combination of weak address systems (typical of informal urban settlements) and migration out of the neighborhood. Thus, our program implementation sample was 981 households (83% of baseline sample). Of these, we successfully reinterviewed 790 households at endline (81% of implementation sample); 58 households refused to be reinterviewed (5%), 11 exceeded our interview rescheduling threshold of 3 attempts (1%), 9 were located but were absent despite multiple attempts (1%), and 113 had moved out of the community (10%).

Our total available endline sample was 1241 households: 790 households from the original randomized controlled trial sample and 451 recruited to serve as the control. After we matched using CEM, our final analysis sample was 1046 households. The characteristics of these 2 groups were similar: the control arm children were 55% male and 45% female whereas the corresponding numbers in the treatment arms were 52% male and 48% female. Mother's literacy rate in this community was low: 68% of mothers had not attended at least 1 year of schooling across the control and treatment samples. Households in treatment and control were balanced across all 5 neighborhood categories. In terms of ethnicity, the proportion of historically marginalized groups was balanced across the control and treatments at 25% and 24%, respectively. Detailed descriptive statistics for the study sample are given in Table 1.

Our first set of results compared the matched control with any treatment to quantify the impact of treatment at the time of the COVID-19 pandemic (Figure 1). Aggregate treatment estimates showed an increase in HAZ by 0.42 SD (95% CI = 0.23, 0.61;  $P < .001$ ) compared with the control mean of -1.86 SD. The prevalence of stunting was reduced by 10 percentage points (95% CI = -0.17, -0.03;  $P < .001$ ), and the prevalence of severe stunting was reduced by 5 percentage points (95% CI = -0.10, 0.00;  $P = .04$ ) in the treated group compared with the control. We also found improvements in weight-related measures: a 0.25 SD increase in WAZ (95% CI = 0.07, 0.44;  $P = .01$ ), a 6-percentage-point reduction in cases of underweight (95% CI = -0.12, 0.01;  $P = .07$ ), and a 5-percentage-point reduction in cases of severely underweight (95% CI = -0.10, -0.01;  $P = .02$ ). These estimates are robust to alternative matching (i.e., propensity score matching as reported in Table A14 of online Appendix A).

Next, as shown in Figure 2, we observed that T1 showed the largest improvements, with a statistically significant gain in HAZ of 0.58 SD (95% CI 0.33, 0.83;  $P < .001$ ), and reductions in stunting (-10 percentage points; 95% CI -0.19, -0.01;  $P = .02$ ) and severe stunting (-7 percentage points; 95% CI -0.13, -0.01;  $P = .03$ ). We also saw gains in WAZ (0.43 SD; 95% CI 0.20, 0.67;  $P < .001$ ), and reductions in underweight (-9 percentage points; 95% CI -0.16, -0.01;  $P = .03$ ) and severely underweight (-7 percentage points; 95% CI -0.12, -0.02;  $P = .01$ ). Compared with the control, T2 and T3 also largely followed the same direction as T1, although the magnitude of gains in HAZ and WAZ, and the reductions in stunting, severe stunting, underweight, and severe underweight, were not as large as in T1. None of our treatments had a statistically discernible impact at the conventional level on WHZ, wasted, and severely wasted compared with the control. Furthermore, as shown in Figure A1 and Table A3 of online Appendix A, reclassified treatment component-specific estimates demonstrate similar conclusions as estimated before.

Next, we estimated 2-way interactions (Figure 3) to understand if the effect of the treatments was different among girls and boys. The results showed that relative to girls, boys in T3 tended to have a higher HAZ (0.46 SD; 95% CI -0.01, 0.94;  $P = .05$ ) with an associated reduction in severe stunting (-13 percentage points; 95% CI = -0.25, -0.02;  $P = .03$ ). Additionally, male children in T3 saw increased WAZ (0.63 SD; 95% CI = 0.17, 1.09;  $P = .01$ ), and reduced cases of being underweight (-14 percentage points; 95% CI = -0.30, 0.02;  $P = .08$ ) and severely underweight (-19 percentage points; 95% CI = -0.29, -0.08;  $P < .001$ ). Finally, boys in T3 also saw increased WHZ (0.60 SD; 95% CI = 0.10, 1.11;  $P = .02$ ) and a reduction in cases of severe wasting (-14 percentage points; 95% CI = -0.23, -0.04;  $P < .001$ ). We found broadly similar results in reclassified treatment component estimates (Figure A2 and Table A5 of online Appendix A): male children in households that received a cash transfer had higher WAZ (0.61 SD; 95% CI = 0.12, 1.09;  $P = .01$ ) along with a lower probability of being severely underweight (-16 percentage points; 95% CI = -0.26, -0.05;  $P < .001$ ), and higher WHZ (0.61 SD; 95% CI = 0.04, 1.19;  $P = .04$ ) along with a lower probability of being severely wasted (-13 percentage points; 95% CI = -0.23, -0.03;  $P = .01$ ). We did not see a statistically significant increase in HAZ and related decreases in the probability of stunting. The other program components (IHGMC and growth chart) did not suggest any statistically significant difference by gender. Heterogeneity effects by child age and caste were inconclusive (Figures A3-A6 and Tables A6-A9 of online Appendix A).

Finally, we investigated the measures of caregiver knowledge, quality of diet, and the home environment that might have contributed to our findings (Table B2 of online Appendix B). There were 2 results of note. First, we found that children in T1 were given a 0.09 SD (95% CI = 0.01, 0.18;  $P = .04$ ) larger quantity of dairy products compared with the control, measured as a standardized difference of an index for consuming multiple dairy food (index creation process detailed in online Appendix F). Second, we found that caregivers in T2 reported improved gender-related attitudes toward care, an increase of 0.17 SD (95% CI 0.01, 0.32;  $P = .04$ ) in a standardized index for multiple categories of child care-related questions, a larger quantity of fish and meat (0.10 SD; 95% CI 0.02, 0.19;  $P = .02$ ), and a greater dietary diversity score (0.35 SD; 95% CI -0.01, 0.72;  $P = .06$ ). However, we note that caregivers in this arm also demonstrated a 0.22 SD decrease (95% CI -0.38, -0.05;  $P = .01$ ) in general health care knowledge.

## DISCUSSION

Our study has 3 major results. First, ours is one of the first studies demonstrating the impact of regular IHGMC by CHWs on young children, and we found a 0.42 SD gain in HAZ. To put this estimate into perspective, a range of comparable studies found increases in HAZ that did not exceed 0.25 SD, with time horizons ranging from a few months to 2 years.<sup>20,26-28</sup> This is an important finding because gains in height are harder to achieve and represent a relatively permanent positive change in health, unlike weight, which tends to respond quicker to a range of inputs. The gains in height that we documented are especially significant because these were realized during the COVID-19 pandemic, when income shocks resulted in severe nutritional deficiency in poor countries.<sup>4</sup> Our sample suffered aggregate welfare and health shocks; 75% of our sample reported that a member of the household lost work and 76% reported a loss in income due to the pandemic.

Second, we found that the simple IHGMC intervention contributed the most to child anthropometric outcomes. Specifically, we found that having IHGMC alone (T1) resulted in a 0.58 SD gain in HAZ, but layering a growth chart and unconditional cash transfer on top of IHGMC yielded positive albeit lower gains in child health. This suggests

that the growth charts added complexity that resulted in these relatively lower gains. In our endline survey-7 months after the intervention-we specifically asked whether the growth chart was still in use and its primary function was understood. Use of the growth chart was not universal in the treatment groups; households reported limited use (14%) of the growth chart in the postintervention period. Moreover, they had questionable understanding of the chart; 60% failed to explain how the chart worked. These facts suggest that more effort may be needed from CHWs in explaining the growth charts to primary caregivers for greater understanding and usability.

Third, we found that the cash arm (T3) had a gendered effect: male children in the cash transfer arm differentially benefited on almost all anthropometric measures. Male children in T3 had higher HAZ, WAZ, and WHZ scores and lower probability of being severely stunted, severely wasted, underweight, or severely underweight. The simple IHGMC and the IHGMC with growth chart, however, did not show a gendered effect. These facts suggest that the simplest intervention of IHGMC tends to work equally well for children, irrespective of gender. Moreover, any program that chooses to add cash transfers must carefully consider gender dynamics in their respective settings. Our study showed that the cash transfer differentially benefited male children; this may be a consequence of local cultural preferences, including son bias.<sup>29</sup> Additional programming and counseling are needed to encourage more gender-equal allocation of resources.

Our results have several implications. First, we have demonstrated the effectiveness of a relatively simple intervention to induce gains in child height and weight by providing monthly nutrition counseling and in-home growth monitoring through direct engagement of caregivers by CHWs. Second, we effectively served households in an informal urban settlement. These communities are typically underserved, having few formal high-quality health facilities-which was exacerbated during the COVID-19 pandemic. Third, our program has the potential for scale in dense urban settings where homes are close to each other and CHWs do not need to carry equipment for long distances. We followed the established CHW model that orients the IHGMC intervention for the possibility of scaling-up with other CHW programs, which abound across the developing world. Our program is cost-effective: the total monthly cost of implementation per child in the IHGMC arm (T1) was \$18 (including intervention, implementation, and administrative costs); the cost per case of stunting averted by the intervention was \$360 (total implementation cost divided by additional cases of stunting averted in T1 compared with the control), which is on the lower end of the range for similar interventions in Pakistan and globally (\$202-\$ 1107).

Our study has 3 limitations. First, we noticed sizable attrition of our sample with unequal survey retention propensity across the treatment groups (Table A13 of online Appendix A). This is a consequence of working in informal settlement areas, which challenged our logistical capability. Working in an urban informal settlement is difficult<sup>28,30</sup> because there are no formal addresses and many dwellers tend to out-migrate (average annual turnovers of 25% have been documented). On the basis of information from key informants, we understood that this high rate of out-migration is reasonable, as the community is predominantly Pashtun immigrants who are highly mobile and frequently change address. Second, this reduced sample likely affected our ability to detect statistically significant differences in subgroup analysis. Finally, our treatment assignment was at the household level. Despite the highly idiosyncratic nature of our program, which delivered household-specific counseling and made child-specific measurements, households in our treatment group may have shared some insights from their experiences with households in their network. This has the potential to produce a positive spillover effect by contaminating the treatment and control groups, making the impact estimates lower bounds.

Taken together, we have demonstrated that a simple, low-cost, scalable intervention-regular home-based growth monitoring and nutrition counseling by CHWs-has a sizable impact on child HAZ and associated reduction in severe stunting, measured during the COVID-19 pandemic. Our findings suggest that regular IHGMC can increase resilience to malnutrition. These are compelling findings, in terms of tackling both the long-term challenge of child stunting and the short-term impact during this global pandemic, and they provide an important policy tool for low- and middle-income countries. >4JPH

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#### PUBLICATION INFORMATION

Full Citation: Shonchoy AS, Akram AA, Khan M, et al. A community health worker-based intervention on anthropometric outcomes of children aged 3 to 21 months in urban Pakistan, 2019-2021. *Am J Public Health*. 2023;113(1): 105-114.

Acceptance Date: August 29, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307111>

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A. S. Shonchoy conceptualized the research idea, conducted the formal analysis, acquired funding, designed the methodology, and guided the analysis; he administered and supervised the implementation of this study, was involved in the writing of the original draft, and led the revision of the article. A.A. Akram conceptualized the research idea, conducted the formal analysis, acquired funding, designed the methodology, and guided the analysis; he administered and supervised the implementation of this study, managed resources, was involved in the writing of the original draft, and led revision of the article. M. Khan curated the data set, conducted the formal analysis, and managed project resources and the software for analysis; she conducted the data validation, created visualizations, and was involved in the writing of the original draft and the revisions of the article. H. Khalid conducted the formal analysis, acquired funding, designed the methodology, and guided the analysis; she administered and supervised the project and was involved in the writing of the original draft and the revisions of the article. S. Mazhar conducted the investigation, administered the project, and participated in data validation; she was also involved in the writing of the original draft of the article. A. Khan conceptualized the research idea, conducted the formal analysis, acquired funding, designed the methodology, and guided the analysis; he administered and supervised the project, managed project resources and the software, led the data validation and analysis, and was involved in the writing of the original draft of the article. T. Kurosaki conducted the formal analysis, acquired funding, designed the methodology, and led the investigation; he also supervised the implementation of this study, and was involved in the writing of the original draft and the revisions of the article.

#### ACKNOWLEDGMENTS

We are grateful to the Center for Economic Research in Pakistan for research support and Sukoon Water for implementation support. Our sincere gratitude goes to our funders for funding our research: the World Bank, the Shahid Hussain Foundation, Lahore University of Management Sciences, and Hitotsubashi University.

We received useful feedback on our manuscript from Nathan Congdon, Jocelyn Finley, Ashley Fox, Alaka Holla, Ghazala Mansuri, Atonu

Rabbani, Kanako Yamashita-Allen, Aisha Yousufzai, Mazvita Zanamwe, and the conference participants of the Southern Economic Association Conference in 2020.

#### CONFLICTS OF INTEREST

We declare that we have no conflicts of interest.

#### HUMAN PARTICIPANT PROTECTION

Ethical approval to conduct this study was obtained from the institutional review board at Interactive Research and

Development (Karachi approval no. IRD\_IRB\_2018\_09\_003). Oral consent was obtained from all caregivers before the survey was administered.

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## DETAILS

<b>Subject:</b>	Pandemics; Childrens health; COVID-19; Anthropometry; Households; Intervention; Nutrition; Counseling; Children; Disadvantaged; Medical workers; Workers; Age; Medical personnel; Clinical trials; Behavior modification; Public health; Children & youth; Caregivers; Coronaviruses; Body measurements
<b>Location:</b>	Pakistan; South Asia
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	105-114

<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307111">https://doi.org/10.2105/AJPH.2022.307111</a>
<b>ProQuest document ID:</b>	2760580773
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/community-health-worker-based-intervention-on/docview/2760580773/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/community-health-worker-based-intervention-on/docview/2760580773/se-2?accountid=211160</a>
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<b>Last updated:</b>	2023-09-08
<b>Database:</b>	Public Health Database

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# A Novel Bayesian Spatial–Temporal Approach to Quantify SARS-CoV-2 Testing Disparities for Small Area Estimation

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## ABSTRACT (ENGLISH)

**Objectives.** To propose a novel Bayesian spatial-temporal approach to identify and quantify severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing disparities for small area estimation. **Methods.** In step 1, we used a Bayesian inseparable space-time model framework to estimate the testing positivity rate (TPR) at geographically granular areas of the census block groups (CBGs). In step 2, we adopted a rank-based approach to compare the estimated TPR and the testing rate to identify areas with testing deficiency and quantify the number of needed tests. We used weekly SARS-CoV-2 infection and testing surveillance data from Cameron County, Texas, between March 2020 and February 2022 to demonstrate the usefulness of our proposed approach. **Results.** We identified the CBGs that had experienced substantial testing deficiency, quantified the number of tests that should have been conducted in these areas, and evaluated the short- and long-term testing disparities. **Conclusions.** Our proposed analytical framework offers policymakers and public health practitioners a tool for understanding SARS-CoV-2 testing disparities in geographically small communities. It could also aid COVID-19 response planning and inform intervention programs to improve goal setting and strategy implementation in SARS-CoV-2 testing uptake. (AmJ Public Health. 2023;113(1 ):40-48. <https://doi.org/10.2105/AJPH.2022.307127>)

## FULL TEXT

### Headnote

**Objectives.** To propose a novel Bayesian spatial-temporal approach to identify and quantify severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing disparities for small area estimation. **Methods.** In step 1, we used a Bayesian inseparable space-time model framework to estimate the testing positivity rate (TPR) at geographically granular areas of the census block groups (CBGs). In step 2, we adopted a rank-based approach to compare the estimated TPR and the testing rate to identify areas with testing deficiency and quantify the number of needed tests. We used weekly SARS-CoV-2 infection and testing surveillance data from Cameron County, Texas, between March 2020 and February 2022 to demonstrate the usefulness of our proposed approach. **Results.** We identified the CBGs that had experienced substantial testing deficiency, quantified the number of tests that should have been conducted in these areas, and evaluated the short- and long-term testing disparities. **Conclusions.** Our proposed analytical framework offers policymakers and public health practitioners a tool for understanding SARS-CoV-2 testing disparities in geographically small communities. It could also aid COVID-19 response planning and inform intervention programs to improve goal setting and strategy implementation in SARS-CoV-2 testing uptake. (AmJ Public Health. 2023;113(1 ):40-48. <https://doi.org/10.2105/AJPH.2022.307127>)

Since the COVID-19 pandemic started, a growing body of literature has revealed disparities in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing. For example, minority communities of Blacks and Hispanics had lower testing rates.<sup>1</sup> Language barriers and lack of health insurance have also been identified as barriers to SARS-CoV-2 testing.<sup>2,3</sup> Geographical disparities in SARS-CoV-2 testing have been recognized in many studies.<sup>4,5</sup> SARS-CoV-2 testing rates were lower in rural states and higher in well-off suburbs with predominantly White populations.<sup>6,7</sup> Most studies have adopted an ecological analysis of SARS-CoV-2 testing in US counties to examine testing disparities geographically and the association between testing and various area-level contextual factors. Although many found evidence of testing disparities, they rarely quantified the testing gap; in other words, they rarely answered the question: How many tests should be done to remove the disparity?

One exception is Dryden-Peterson et al.,<sup>8</sup> who proposed a rank-based approach to quantify the number of tests needed by zip code tabulation areas in Massachusetts to bridge the disparities in SARS-CoV-2 testing. This approach makes minimal assumptions about data distribution and other factors contributing to testing and infection patterns (e.g., vaccination and nonpharmaceutical interventions). Moreover, ranks are performed to compare areas relative to each other in the study region, so this approach could be more informative to local public health departments for planning and resource allocation.

Although such a rank-based approach is appealing, some issues are also noted, particularly in the context of small area estimation.<sup>9</sup> First, when the geographic areas are small or the relevant population is small, the observed test

positivity rate (TPR)-usually calculated as the ratio of the number of positive cases to the number of tests conducted on a daily or weekly basis-would be highly variable and often as extreme as 0% or 100%. In some situations, such as when there are zero tests performed in a specific area or time frame, it is impossible to accurately estimate the number of positive infections (e.g., TPR would be 0/0 mathematically). Second, from a practical perspective, the rank-based approach to examining testing disparity would be more useful if the assessment could be made prospectively, as opposed to retrospectively. For example, if the testing gap (by rate or by number) could be quantified for the weeks ahead, it could greatly support local health departments and health practitioners in setting goals for resource allocation, community outreach and engagement, and educational programs.

The National Institutes of Health-funded Rapid Acceleration of Diagnostics-Underserved Populations (RADx-UP) projects, which focus on enhancing SARS-CoV-2 testing among health disparate populations, could also benefit from the quantification of testing gaps. Indeed, our motivation for developing the proposed 2-step Bayesian spatial-temporal approach arose from the gaps and limitations related to small geographical areas experienced by authors and key community stakeholders in their practice and research responses to the COVID-19 pandemic.

We illustrate the rank-based algorithm proposed by Dryden-Peterson et al.<sup>8</sup> in detail and demonstrate the issues of directly applying this approach for small area estimation. We apply our approach to SARS-CoV-2 testing and infection surveillance data from Cameron County, Texas, where over 90% of the population is Mexican American.<sup>10</sup> Cameron County is also one of the study sites of an ongoing RADx-UP project.<sup>11</sup>

## METHODS

We illustrate the issues of the existing rank-based algorithm in small area estimation and describe our proposed Bayesian spatial-temporal approach.

### Rank-Based Approach

To illustrate the algorithm proposed by Dryden-Peterson et al.,<sup>8</sup> we used mock data from Table 1 and adapted values from the actual Cameron County COVID-19 surveillance database between March 2020 and February 2022. Let  $m_{it}$  denote the number of SARS-CoV-2 tests reported in area (e.g., zip code tabulation areas)  $i$  ( $i = 1, \dots, I$ ) at time point  $t$  ( $t = 1, \dots, T$ ), and  $y_{it}$  denote the number of detected positive cases. To assess the testing disparity, we needed measures of the testing intensity  $r_{it}$  (representing the supply aspect) and the epidemic intensity  $p_{it}$  (representing the demand aspect). The observed testing intensity was quantified as the testing rate per 10000 population, calculated as  $r_{it} = (\hat{m}_{it} / \hat{N}_{it}) \times 10\,000$ , with  $N_{it}$  being the population size.

The epidemic intensity is measured by the TPR, calculated as  $p_{it} = y_{it}/m_{it}$  using the observed testing and case numbers. For a given time point  $t$ , we ranked areas in the study region by the testing intensity  $r_{it}$  (e.g., from the lowest to the highest) and by the epidemic intensity  $p_{it}$ . Our rationale for the rank-based comparison was that if the supply met the demand, the rank of the supply would match the rank of the demand; otherwise, the rank of the supply would be lower than the rank of the demand. In the context of SARS-CoV-2 testing disparities, an area would be considered to have a testing deficiency if its rank of epidemic intensity (i.e.,  $p(t)$ ) was higher than its rank of testing intensity (i.e.,  $r(t)$ ). We calculated the number of tests needed to remove the deficiency as the additional number of tests required to achieve the matching ranks after accounting for the different population sizes by area.

The algorithm can be seen more clearly using the data in Table 1. We present SARS-CoV-2 testing and case data from 6 census blockgroups (CBGs) in Cameron County. The observed testing frequency ranged from 0 to 20, and the number of positive cases ranged from 0 to 5. We first calculated the test intensity rates (we used per 10 000 population because the CBG-level population size was small) and the TPRs. For example, for area GEO1, the test intensity rate was 168.1 (calculated as  $[20/1190] \times 10\,000$ ), and TPR was 0.1 (2/20). At first, we considered only the areas GEO1-GEO5 because GEO6 presented a special issue that we will describe later.

We ranked the 5 areas respective to the testing rate and TPR from lowest to highest. For area GEO1, because its rank of testing rate (i.e., fifth) was higher than its rank of TPR (i.e., first), there was no testing deficiency. For area GEO5, its rank of testing rate (i.e., first) was lower than that of its TPR (i.e., fifth), and hence there was a testing deficiency. To calculate the needed tests, one would first locate the area with the testing rate rank matching the corresponding TPR. For GEO5 with TPR ranking fifth, we located the area with the testing rate ranking fifth-GEO1 -

because the testing rate for GEO1 was 168.1 per 10 000 population and so should be the expected testing rate for GEO5. After accounting for the population size in GEO5, the expected test frequency was  $168.1 \times 880/10\ 000 = 14.8$ . The difference between the expected and the observed test frequency was then  $14.8 - 1 = 13.8$ , or 14 tests, rounding up. Therefore, there were testing disparities in GEO5, and 14 additional tests should have been performed to address the deficiency.

Although easily implemented by software such as Excel, this algorithm fails to accommodate the case of GEO6, as it has zero tests and zero cases. On one hand, one may argue that zero cases suggest no expected infection, and hence there was no testing deficiency for this area. On the other hand, one could argue that areas with zero tests indicate the highest testing deficiency and hence should be prioritized for testing. Moreover, for area GEO5, the observed TPR of 100% lacks accuracy because of the small number of tests performed (i.e., 1). These issues motivated our proposed Bayesian 2-step approach.

#### Proposed Bayesian 2-Step Approach

The 2-step approach we propose addressed the estimation and prediction of testing disparity in the context of small area estimation. It has broader applications beyond COVID-19 testing and could be used as a routine analytical framework for infectious disease surveillance systems.

**Proposed 2-step approach.** In step 1, we employed the Bayesian inseparable space-time models originally proposed in Knorr-Held,<sup>12</sup> which has been popular in disease-mapping models,<sup>13</sup> including models of COVID-19 outcomes.<sup>14</sup> These models provided the estimated TPR, denoted by  $p_{it}$  for area  $i$  and time  $t$ , with accuracy for small area estimation improved by borrowing information across time and space.<sup>15,16</sup> We assumed the observed number of positive cases  $Y_{it}$  to follow a binomial distribution with the parameter  $p_{it}$ :

$$(1) Y_{it} \sim \text{Binomial}(m_{it}, p_{it}),$$

where  $m_{it}$  denoted the total tests performed in area  $i$  and time  $t$ . On the logit scale, we decomposed the positive rate  $p_{it}$  additively as

$$(2) \text{logit}(p_{it}) = I + X_{it}b + U_i + V_i + C_t + g_t + d_{it}.$$

Here,  $X_{it}$  denotes a vector of potential risk factors or barriers for area  $i$  at time  $t$ , which could include area-level characteristics, such as the percentage of the population without health insurance, or the percentage of the population vaccinated—if such data were available. The parameter vector  $\exp(b)$  estimated the odds ratio of infection associated with those risk factors. The main spatial effect was modeled as the Besag-York-Mollié model,<sup>17</sup> with a structured spatial component  $u$  and an unstructured spatial component  $v$ . We assumed the structured component to have an intrinsic conditional autoregressive model and the unstructured component to have a normal distribution  $N(0, \sigma^{-2}I)$ , where  $I$  indicates the identity matrix, and  $\sigma^{-2}$  the corresponding variance parameter.

We modeled the main temporal effect additively with a structured temporal effect  $W$  and an unstructured temporal effect  $y$ , assuming  $W$  to have a second-order random walk (to impose temporal smoothing) and  $y$  to have a normal distribution:  $N(0, \sigma_y^2)$ . The space-time interaction term  $\delta$  can take 4 different forms as the product of 1 of the spatial main effects (i.e.,  $u$  and  $v$ ) and 1 of the temporal main effects (i.e.,  $W$  and  $y$ ). More details of the model specification can be found in the supplementary materials (available as a supplement to the online version of this article at <http://www.ajph.org>). We used a conditional predictive ordinate for model selection.<sup>18</sup> Our main interest was the estimated  $p_{it}$  but not the individual spatial or temporal component. The inseparable model provided the smoothing needed for the observed TPR with an extreme value (e.g., 100%); moreover, it allowed our imputation of the TPR for areas with 0 tests performed (i.e.,  $m_{it}=0$ ). This can be done by setting the observed  $Y_{it}$  to NA and the corresponding  $m_{it}$  to 1 when fitting the model. We chose the noninformative priors used previously.<sup>12</sup> We used the posterior mean and the 95% credible intervals (95% CrI) when making our inference of the estimated TPR.

In step 2, we ranked the areas using the estimated TPRs from step 1 and then assessed the testing deficiency and calculated the additionally needed tests in the same way as the rank-based approach.

Prospectively predicting the testing gap using the proposed 2-step approach for testing planning. The Bayesian inseparable space-time models allow short-term prediction of the TPR for future events. We emphasize that the

prediction is regarding future events and should not be confused with the fitted values from statistical modeling, which are often called the "predicted values." For example, Lieberman-Cribbin et al.<sup>19</sup> used "prediction" to present the estimated positivity rate from fitting a Poisson regression model, which differed from the prediction we are proposing. The predicted TPRs, denoted by  $p_{t+1}$  or  $p_{t+2}$ , would be obtained from the Bayesian model in step 1. The testing deficiency would be performed by comparing the ranks using predicted TPRs to the ranks of testing intensity at current time  $t$ . Other ways to quantify the infection intensity instead of the TPR, such as case acceleration rates or the "doubling rate" of cases for the past weeks, can also be used in ranking.

We assessed the testing gap in 3 ways, reflecting the immediate, short-term, and long-term disparities. We tested the immediate testing disparity by comparing the predicted TPR  $p_{t+1}$  at week  $t+1$  to the current testing rate  $\hat{p}_t$  at week  $t$ . The rank difference between these 2 rates would give the expected tests and hence the testing deficiency. Because the testing rate often fluctuated every week, we compared the predicted TPR to the average testing rate from the previous month for the short-term testing disparity. Finally, we compared the predicted TPR to the average testing rate across the entire study window (i.e., from the time the pandemic started to the time of analysis) for ranking to obtain the long-term testing disparity.

We implemented the proposed method in R version 3.6.3 and R package INLA (R Foundation for Statistical Computing, Vienna, Austria).<sup>20</sup> R code to implement the proposed approach is available at <http://bit.ly/3UPLmLI>, along with a simulated data set.

## RESULTS

We have demonstrated our proposed 2-step approach to SARS-CoV-2 testing disparities in Cameron County, Texas. Cameron County is located in the Lower Rio Grande Valley in south Texas on the US-Mexico border and is among the poorest of US counties, with more than 30% of its residents living in poverty.<sup>10</sup> The prevalence of several chronic disease conditions that have been identified as comorbidities that increase the risk of COVID-19 infection and severity is also exceptionally high, with type 2 diabetes more than 27% and obesity more than 50%.<sup>21-23</sup> More than 90% of the population is Mexican American,<sup>10</sup> and similar to other minority groups, this population has seen disproportionately high infection and fatality rates since the first local reported cases of COVID-19 on March 18, 2020.

Several COVID-19 mitigation responses led by local public health departments and government-academic partnerships for community-based intervention programs have focused on improving SARS-CoV-2 testing and vaccination in Cameron County. The mitigation strategies targeted small, defined areas of the county where populations with health disparities (e.g., low income, low educational attainment, crowding) reside. When conducting education and outreach (particularly door-to-door) efforts, information about the testing pattern at granular spatial levels such as the CBGs is more desirable. The CBG-level population size was approximately 1900 on average and ranged from 208 to 14481; the small population size posed special challenges to providing accurate estimates of infection and testing.

A total of 667 052 SARS-CoV-2 testing records were reported in Cameron County between March 18, 2020 and February 10, 2022. Of these, 70 795 (10.6%) were positive. We were able to geocode the majority (89.9%) of the testing records to obtain the corresponding CBG. We included only the polymerase chain reaction (PCR) tests (71.7% of all reported tests) in quantifying the testing gap because SARS-CoV-2 infection was confirmed only by the PCR test. We included 222 CBGs in our analysis (shown in Section A, available as a supplement to the online version of this article at <http://www.ajph.org>, for the geography). The data-processing flowchart is presented in Section B (available as a supplement to the online version of this article at <http://www.ajph.org>). The weekly trend of SARS-CoV-2 infection and testing patterns for Cameron County as a whole had 4 distinctive peaks (shown in Section C, available as a supplement to the online version of this article at <http://www.ajph.org>). However, we observed substantial variation in both infection and testing rates at the CBG level.

We applied our proposed approach to weekly CBG-level testing data. Based on the conditional predictive ordinate, we considered the Bayesian inseparable model with type II interaction the best, so we used it for inference. Detailed results from all models can be found in Sections E through G (available as a supplement to the online version of this

article at <http://www.ajph.org>). Figure 1 presents the temporal trends of the observed TPRs (black dots) and model-based TPRs (blue line, with 95% CrIs in a lighter shade) from 6 selected CBGs. Areas 1 and 2 represent CBGs with relatively large population sizes (~14000 and ~13 000, respectively; we do not include the exact population size to avoid identification of specific areas), and the TPRs were fairly stable and followed the overall pattern at the county level. Areas 3 through 6 represented CBGs with much smaller population sizes: from approximately 300 to approximately 1000 individuals. Given the sparse testing data, the observed TPRs fluctuated substantially from week to week, with many extreme values of 0% and 100%. Moreover, these areas also had weeks when no tests were conducted; hence there is no observed TPR (dots not shown).

Our model fitted the observed data very well: for areas with sufficient tests (areas 1 and 2), the fitted lines followed the observed points very closely. For areas with sparse tests (areas 4-6), model-based estimates provided the needed shrinkage on extreme values of the observed TPR, which better reflected the underlying infection trend. Meanwhile, although the model borrowed information across CBGs, it also preserved any local pattern that deviated from the overall county trend (e.g., in area 3). After we obtained the model-based TPR, we calculated the testing deficiency by week for each CBG. Figure 2 presents the number of additional tests needed during the study time frame, in which the county-level TPR was overlaid (red line) with the y-axis scale on the right. Figure 2, panel a, displays the number of CBGs (of the total 222) that we identified as having a testing gap, and panel b presents the variation of additional tests from these CBGs. Throughout the period, 217 of the 222 CBGs experienced testing deficiency at some point. The testing deficiency ranged substantially and differed by waves. Our analysis also suggested that substantial tests should have been performed even during the low infection period (e.g., February-May 2021).

Figure 3 presents the predicted testing disparity by CBG based on the predicted TPR for the week of February 7, 2022, using all observed data from March 18, 2020 through February 7, 2022. For the immediate testing disparity, we used the testing rate from the preceding week (i.e., January 31 -February 6, 2022) for testing ranks. For short- and long-term disparities, we used the testing rate from the preceding month (i.e., January 10-February 6, 2022) and the average testing rate across the entire study period (i.e., March 18, 2020-February 6, 2022), respectively. Although the areas with immediate or short-term testing deficiencies tended to have increased infection rates, the areas predicted to have long-term testing disparity tended to be more rural and experienced limited access to care (including COVID-19 testing) even before the COVID-19 pandemic.

## DISCUSSION

We have demonstrated our proposed novel Bayesian 2-step approach to identifying SARS-CoV-2 testing disparities and quantifying testing deficiencies in the context of small area estimation. Our analytical framework can provide key information to aid local public health departments in COVID-19 response planning and inform intervention programs, such as RADx-UP, to improve goal setting and strategic implementation of interventions to increase SARSCoV-2 testing uptake.

### Strengths

Our proposed analysis has several advantages over those proposed in other studies for identifying SARS-CoV-2 testing disparities. First, we developed a novel statistical framework and a data-driven approach to understanding testing disparity in the context of small area estimation. To our knowledge, this is the first study to evaluate population-level SARSCoV-2 testing deficiencies with the spatial granularity of CBGs. Second, we provided a sophisticated spatial-temporal approach to better estimate infection intensity (e.g., TPRs) with sparse or no testing data, so that one can assess testing disparities more accurately. Third, we went beyond the qualitative assessment of whether there are testing gaps. We provided valuable quantification of the additional tests needed. Fourth, our proposed spatial-temporal framework has the flexibility to accommodate the ever-changing dynamics related to COVID-19 when assessing testing disparity, which is particularly important.

The World Health Organization suggests that 10 to 30 tests should be performed for every positive case to control the spread of disease.<sup>24,25</sup> Such simple calculations using the test and case ratio do not account for the changing intensity of the pandemic and may increase testing disparity across demographic subgroups or geographical areas.

For example, CBGs that have not received sufficient tests would show lower infection rates, which would suggest even lower testing needs. More importantly, the ability of communities to implement the suggested number of tests depends on the availability of the tests, different tool kits, testing facility capacities, staffing, and many other factors. Finally, by using a Bayesian analytical framework, we were able to predict testing deficiency based on the local testing and infection patterns. This fills an important gap in the current research of SARS-CoV-2 testing disparities, in which testing gaps have always been identified retrospectively.

We argue that, in practice, the quantification of testing gap and deficiencies prospectively provides more useful and needed information for COVID-19 response.

#### Limitations

Our article has some limitations. First, we used only PCR-reported positive tests in our analysis. PCR is the most accurate SARS-CoV-2 testing method and, indeed, was used for the majority of the tests in the SARS-CoV-2 surveillance data used in this analysis. As other over-the-counter tests and testing methods become more available, testing results may not be captured in official epidemiologic surveillance databases, which will affect testing gap assessment. We consider this deficit a reporting issue commonly seen in surveillance systems. Purportedly, if every SARS-CoV-2 test result was captured by a surveillance database, our approach would be able to estimate the testing gap. Second, we were not able to incorporate the SARS-CoV-2 transmission modes and contact-tracing information in quantifying the needed tests, which would be highly informative in identifying who should be tested and where testing might be most convenient. However, as this pandemic has shown, contact tracing data are extremely challenging to collect<sup>26</sup> and generally have been unavailable for analytical purposes at the population level. Third, about 10% of the testing records could not be geocoded, as they either had missing addresses or used a post office box.

#### Conclusions

From an implementation science perspective, we believe that our proposed analytical framework offers policymakers and practitioners a tool for understanding SARS-CoV-2 testing disparities in geographically small communities. Local public health officials and practitioners often desire spatial granularity, such as which street blocks they should go to for the community educational program or door-to-door visits to promote COVID-19 testing. Our proposed analytical framework provides a data-driven approach for this decision-making process. Community leaders, with this understanding and the knowledge of which small geographically bounded areas to prioritize, can address testing disparities with coordinated multilevel interventions by enhancing access to testing, improving outreach to assist in education and navigation to testing, and implementing effective large and small media messages to promote testing tailored to the population. Future research on the use of this approach and the derived data to drive these decisions should be rigorously evaluated to determine whether testing gaps across locations are eliminated in health disparate populations. ,4jPH

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#### PUBLICATION INFORMATION

Full Citation: Bauer C, Li X, Zhang K, et al. A novel Bayesian spatial-temporal approach to quantify SARS-CoV-2 testing disparities for small area estimation. *Am J Public Health*. 2023;113(1):40-48.



Acceptance Date: September 10, 2022.

#### CONTRIBUTORS

C. Bauer conceptualized and designed the analysis. C. Bauer, X. Li, and K. Zhang analyzed the data and wrote the initial draft of the article. M. Lee, E. Guajardo, and B. Reininger acquired the data. M. Lee, S. Fisher-Hoch, J. McCormick, M. E. Fernandez, and B. Reininger revised the article. M. E. Fernandez and B. Reininger acquired financial support for the project. All authors interpreted the results.

#### ACKNOWLEDGMENTS

This work was partially supported by the National Institutes of Health RADx-Underserved Populations (RADx-UP) initiative (grants 3UL1TR00316702S1 and UL1 TR003167-02S6).

We acknowledge the important contribution of epidemiologists and staff in providing expertise, valuable feedback, and guidance during the revision from Cameron County Public Health. These staff include Daniel Piñon (health disparities epidemiologist), Raquel Castillo (chief epidemiologist), and Ashley Rui (health emergency preparedness program director). We also thank all the officials of the counties for their tireless efforts in setting up and operating testing facilities, software for COVID-19 testing appointments, and all the other work necessary in epidemic control.

#### CONFLICTS OF INTEREST

The authors report no conflicts of interest.

#### HUMAN PARTICIPANT PROTECTION

The University of Texas Health Science Center School of Public Health institutional review board approved this study (no. HSC-SPH-20-1372).

#### Sidebar

¾See also Vaughan, p. 35, Seewald, p. 37, Wang and Chakraborty, p. 49, and Liu et al., p. 60.

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## DETAILS

### Subject:

Infections; Health surveillance; Public health; COVID-19; Surveillance; Severe acute respiratory syndrome coronavirus 2; Policy making; Viral diseases; COVID-19 diagnostic tests; Intervention; Coronaviruses; Bayesian analysis; Pandemics; Spacetime; Estimation; Algorithms; Censuses

<b>Location:</b>	Texas; United States--US; Cameron County Texas
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	40-48
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307127">https://doi.org/10.2105/AJPH.2022.307127</a>
<b>ProQuest document ID:</b>	2760580763
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/novel-bayesian-spatial-temporal-approach-quantify/docview/2760580763/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/novel-bayesian-spatial-temporal-approach-quantify/docview/2760580763/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-03-01
<b>Database:</b>	Public Health Database

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# SARS-CoV-2 Infection, Hospitalization, and Death in Vaccinated and Infected Individuals by Age Groups

# in Indiana, 2021–2022

Tu, Wanzhu; Zhang, Pengyue; Roberts, Anna; Allen, Katie S; Williams, Jennifer; Embi, Peter; Grannis, Shaun

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## ABSTRACT (ENGLISH)

**Objectives.** To assess the effectiveness of vaccine-induced immunity against new infections, all-cause emergency department (ED) and hospital visits, and mortality in Indiana. **Methods.** Combining statewide testing and immunization data with patient medical records, we matched individuals who received at least 1 dose of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccines with individuals with previous SARS-CoV-2 infection on index date, age, gender, race/ethnicity, zip code, and clinical diagnoses. We compared the cumulative incidence of infection, all-cause ED visits, hospitalizations, and mortality. **Results.** We matched 267 847 pairs of individuals. Six months after the index date, the incidence of SARS-CoV-2 infection was significantly higher in vaccine recipients (6.7%) than the previously infected (2.9%). All-cause mortality in the vaccinated, however, was 37% lower than that of the previously infected. The rates of all-cause ED visits and hospitalizations were 24% and 37% lower in the vaccinated than in the previously infected. **Conclusions.** The significantly lower rates of all-cause ED visits, hospitalizations, and mortality in the vaccinated highlight the real-world benefits of vaccination. The data raise questions about the wisdom of reliance on natural immunity when safe and effective vaccines are available. (Am J Public Health. 2023;113(1):96-104. <https://doi.org/10.2105/AJPH.2022.307112>)

## FULL TEXT

### Headnote

**Objectives.** To assess the effectiveness of vaccine-induced immunity against new infections, all-cause emergency department (ED) and hospital visits, and mortality in Indiana. **Methods.** Combining statewide testing and immunization data with patient medical records, we matched individuals who received at least 1 dose of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccines with individuals with previous SARS-CoV-2 infection on index date, age, gender, race/ethnicity, zip code, and clinical diagnoses. We compared the cumulative incidence of infection, all-cause ED visits, hospitalizations, and mortality. **Results.** We matched 267 847 pairs of individuals. Six months after the index date, the incidence of SARS-CoV-2 infection was significantly higher in vaccine recipients (6.7%) than the previously infected (2.9%). All-cause mortality in the vaccinated, however, was 37% lower than that of the previously infected. The rates of all-cause ED visits and hospitalizations were 24% and 37% lower in the vaccinated than in the previously infected. **Conclusions.** The significantly lower rates of all-cause ED visits, hospitalizations, and mortality in the vaccinated highlight the real-world benefits of vaccination. The data raise questions about the wisdom of reliance on natural immunity when safe and effective vaccines are available. (Am J Public Health. 2023;113(1):96-104. <https://doi.org/10.2105/AJPH.2022.307112>)

Strong and consistent evidence shows that mRNA vaccines BNT162b2 and mRNA-1273 and the Janssen vaccine JNJ-78436735 confer considerable protection to fully vaccinated individuals against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, severe illnesses requiring hospitalization, and mortality.<sup>1-6</sup> However, vaccine effectiveness is not 100%, and the risk of breakthrough infections remains, especially with newer variants.<sup>7,8</sup> Furthermore, data and opinions diverge on the extent of the waning immunity provided by the mRNA vaccines.<sup>9,10</sup> While a population-based observational study suggested that immunity waned in individuals within 2 months after completing the 2-dose sequence of the BNT162b2 vaccine,<sup>11</sup> a randomized clinical trial showed that 6 months after vaccination, the BNT162b2 vaccine's effectiveness against SARSCoV-2 infection remained strong at higher than 86%; its effectiveness against the severe disease was 96.7%.<sup>12</sup>

Natural immunity induced by SARS-CoV-2 infection also protects against reinfection. Systematic reviews of immunological evidence suggested that SARS-CoV-2-specific immunity appeared soon after infection.<sup>13,14</sup> Extensive observational studies confirmed the significantly reduced risk for subsequent infection by more than 80% for at least 6 to 12 months in individuals with previous infection.<sup>15-17</sup> Data are mixed on the relative levels of protection conferred by vaccination versus infection.<sup>18-20</sup> Less understood is the real-world time course of the protective effects of previous infection and vaccination against new infection acquisition and all-cause mortality and hospitalization in persons of different age groups. Unlike COVID-19-specific outcomes used by earlier studies, all-cause emergency department (ED) visits, hospitalizations, and mortality cover a broader spectrum of health consequences of the disease.

In this observational cohort study, we leveraged public health immunization data and electronic medical record data from a statewide health information exchange and state health department to examine the incidence rates of SARS-CoV-2 infection, all-cause ED visit, hospitalization, and death in individuals who had been vaccinated compared with those with previous infections in a real-world population.

## METHODS

We derived data used in this research from the Indiana Network for Patient Care (INPC), one of the largest health information networks in the United States.<sup>21</sup> Briefly, the INPC is a central repository of clinical and administrative health data from 38 health systems representing 117 hospitals and 18 486 physician practices, commercial laboratories, and public health departments across Indiana. At the emergence of the pandemic, the Indiana Health Information Exchange expanded the INPC system to receive daily feeds of SARS-CoV-2 test results from all statewide testing locations and daily death records through the Indiana State Department of Health and Family Social Services Administration.<sup>22</sup> Furthermore, all COVID-19 vaccine data contained in the Indiana immunization registry were combined with testing and outcomes data.

### Study Design

We derived the observational study cohort from the INPC and the Indiana statewide testing data. The cohort consisted of matched pairs of vaccine recipients and unvaccinated individuals with SARS-CoV-2 infections. See Figure A (available as a supplement to the online version of this article at <https://ajph.org>) for a schematic depiction of the comparison groups. Eligible participants were Indiana residents aged 12 years or older with at least 1 previously recorded health care encounter with the INPC between January 1, 2016, and February 9, 2022; the requirement of a previous encounter ensured a more complete capture of the characteristics of the study participants. Patient medical records in INPC and test data were linked, de-duplicated, and aggregated using a global algorithm.<sup>23</sup> Vaccine data from the state immunization registry were imported into the health information exchange and integrated with laboratory test data.

Observation of infected participants started 30 days after the initial infection and ended at the end of follow-up or vaccination, whichever came first. Similarly, observation of vaccinated participants started 30 days after the initial vaccination and ended with the conclusion of follow-up or infection, whichever came first. We applied the 30-day time window of exclusion to both groups to ensure equal surveillance and comparability.

### Matched Cohorts

A vaccine recipient's index date was defined as 30 days after the first SARS-CoV-2 vaccination. In an individual with a previous SARS-CoV-2 infection, we defined the index date as 30 days after the initial infection. In both situations, the initial infection and vaccination represented the first point of viral exposure, whereas the 30-day window approximated the time of immunity development. We matched each vaccine recipient with an infected participant on the index date ( $\pm$  15 days), age, gender, race/ethnicity, zip code, and the number of coexisting conditions that had been identified by the Centers for Disease Control and Prevention (CDC) as "conclusive" or "suggestive" risk factors for severe COVID-19 (<https://bit.ly/3gTvA3w>; complete lists of CDC-identified comorbid conditions also appear in the footnotes to Table 1). The construction of the matched cohort is depicted in Figure 1.

### Outcome Events of Interest

The primary outcome events of interest were SARS-CoV-2 infection in those vaccinated or reinfection for the

previously infected participants, all-cause ED visits, hospitalizations, and deaths. All outcome events in the study were identified and extracted from the INPC, and deaths were derived from the State of Indiana death records.

### Statistical Analysis

Before comparing the outcome event rates, we examined the balance in demographic and clinical characteristics between the vaccine recipients and infection cases to ensure that the 2 groups were comparable and well matched. We used survival analyses to estimate the cumulative incidence rates of SARS-CoV-2 infection for the vaccinated and reinfection for those with previous infections. We similarly estimated the cumulative rates for hospitalization, ED visit, and death.

The index date (i.e., the time zero) represented 30 days after the initial exposure, either to the vaccine or the virus; protection from vaccine-induced and naturally acquired immunity would come after the index date. Matched pairs were censored when an infected participant received a vaccination or a vaccine recipient became infected. Time to mortality that was not observed before the end of the observation window, February 9, 2022, was censored (i.e., the patient was alive at the conclusion of the observation period). Time to infection or reinfection, ED visits, and hospitalization was censored at the time of the event, at the end of the observation window, or when the matched individual was censored, whichever came first. For vaccine recipients and individuals with previous infection, we computed the times from the index date to the outcome events or censoring. Cumulative incidence rates were calculated as  $1 - S(t)$ , where  $S(t)$  is the estimated survival function. We used the log-rank test to perform comparisons of the cumulative incidence rates.

We conducted all analyses with R software version 4.1.2 (R Foundation for Statistical Computing, Vienna, Austria). We considered P values less than .05 statistically significant.

## RESULTS

From the INPC, we identified 2 798 709 unique vaccine recipients and 736193 individuals with documented SARS-CoV-2 infection between November 29, 2020, and February 9, 2022. From these, we matched 267 847 vaccine recipients with the same number of infected participants (Figure 1). The demographic and clinical characteristics of the 2 groups of participants are presented in Table 1.

### Infection, All-Cause Care Utilization, and Death

Cumulative incidence rates of events of interest were estimated and are presented graphically in Figure 2. Panel A shows a significantly higher cumulative incidence of infection or reinfection in vaccine recipients than those with previous infection ( $P < .001$ ). Six months after the index date, the cumulative infection rate in the vaccinated was 6.7% (95% confidence interval [CI] = 6.6%, 6.9%), more than twice the rate in those with previous infections at 2.9% (95% CI 5 2.9%, 3.0%).

Figure B (available as a supplement to the online version of this article at <https://ajph.org>) shows that the cumulative incidence of all-cause ED visits was significantly lower in vaccinated individuals ( $P < .001$ ). At 6 months, 6.6% (95% CI 5 6.5%, 6.7%) of the individuals with previous infection and 5.0% (95% CI 5 4.9%, 5.1%) of the vaccinated individuals had recorded ED visits. Figure C (available as a supplement to the online version of this article at <https://ajph.org>) shows that the all-cause hospitalization rate was also significantly lower in the vaccinated ( $P < .001$ ). Six months after the index date, 1.9% (95% CI 5 1.8%, 1.9%) of the previously infected individuals and 1.2% (95% CI 5 1.1%, 1.3%) of the vaccinated had recorded hospitalization. Figure D (available as a supplement to the online version of this article at <https://ajph.org>) shows that the mortality rate was also significantly lower in the vaccinated ( $P < .001$ ). Six months after the index date, mortality rates were respectively 0.51% (95% CI 5 0.48%, 0.54%) in the previously infected and 0.32% (95% CI 5 0.29%, 0.34%) in the vaccinated.

### Age-Stratified Analysis

We performed additional analyses to examine the event rates in individuals of different age groups. Results are presented in Figures B through F (available as supplements to the online version of this article at <https://ajph.org>). While similar patterns generally held in all age strata, the magnitudes of the estimated incidence rates varied across age groups. In children aged 19 years or younger, vaccine effectiveness against new infections was considerably less than natural immunity acquired from earlier infections (Figure B, section A).

Compared with other age groups, children had the highest incidence rates of new infections. For instance, the 6-month cumulative incidence rates of infection were, respectively, 8.1 % (95% CI 5 7.6%, 8.5%) and 5.2% (95% CI 5 4.8%, 5.5%) for the vaccinated and previously infected. Notably, despite the higher rate of infections observed in the vaccinated children, at 6 months, the rate of all-cause ED visits in the vaccinated children was significantly lower (5.0% for the vaccinated [95% CI 5 4.6%, 5.3%] vs 6.9% for the previously infected [95% CI 5 6.5%, 7.3%]). The rate of all-cause hospitalization was also lower in the vaccinated (0.3% for vaccinated [95% CI 5 0.3%, 0.4%] vs 0.6% for the previously infected [95% CI 5 0.5%, 0.8%]; Figure C, sections B and C). Mortality rates were extremely low (< 0.1 %) in both vaccinated and previously infected children; the difference was not statistically significant (P 5 .5).

In adults aged 20 to 39 years, rates of incidence infection were higher among vaccine recipients (7.8%; 95% CI 5 7.6%, 8.0%) than persons with previous infections (3.2%; 95% CI 5 3.0%, 3.3%) at 6 months (Figure C, section A). However, the 6-month rate of all-cause ED visit was higher in those with previous infections (7.6%; 95% CI 5 7.4%, 7.8%) than in the vaccinated (5.4%; 95% CI 5 5.2%, 5.6%). Similarly, the 6-month rate of hospitalization was significantly higher in the previously infected (2.1%; 95% CI 5 2.0%, 2.2%) than the vaccinated (1.2%; 95% CI 5 1.1 %, 1.3%). The mortality rate was also higher in the previously infected (0.08%; 95% CI 5 0.07%, 0.10%) than the vaccinated (0.04%; 95% CI 5 0.03%, 0.07%; Figure C, sections B-D).

In adults aged 40 to 59 years, the cumulative incidence rate of infections was higher among the vaccinated (6.1%; 95% CI 5 5.9%, 6.3%) than the previously infected (2.2%; 95% CI 5 2.0%, 2.3%) at 6 months (Figure D, section A). However, the rate of ED visits was significantly lower in the vaccinated (4.6%; 95% CI 5 4.4%, 4.8%) than the previously infected (5.4%; 95% CI = 5.2%, 5.6%). All-cause hospitalization rate was also lower in the vaccinated (1.0%; 95% CI 5 0.9%, 1.1 %) as compared with the infected (1.4%; 95% CI 5 1.3%, 1.5%). All-cause mortality rate was similarly lower in the vaccinated (0.2%; 95% CI 5 0.2%, 0.3%) than in the infected (0.3%; 95% CI 5 0.3%, 0.4%; Figure D, sections B-D).

In adults aged 60 to 79 years, the cumulative incidence of infections was higher in the vaccinated (3.2%; 95% CI 5 2.9%, 3.5%) than the previously infected (1.9%; 95% CI 5 1.7%, 2.1%) at 6 months (Figure E, section A, available as a supplement to the online version of this article at <https://ajph.org>). However, the rate of all-cause ED visits was lower in the vaccinated (4.6%; 95% CI 5 4.3%, 4.9%) than the previously infected (5.7%; 95% CI 5 5.3%, 6.0%). Rate of all-cause hospitalization was also lower in the vaccinated (2.4%; 95% CI 5 2.2%, 2.6%) than in the previously infected (3.3%; 95% CI 5 3.0%, 3.5%). All-cause mortality rate was similarly lower in the vaccinated (1.4%; 95% CI 5 1.2%, 1.5%) than in the previously infected (2.2%; 95% CI 5 2.0%, 2.4%; Figure E, sections B-D). Finally, in adults aged 80 years or older, the vaccinated had a lower rate of hospitalization at 6 months (6.2%; 95% CI 5 4.9%, 7.4%) than the previously infected (7.6%; 95% CI 5 6.3%, 9.0%). All-cause mortality rate was also lower in the vaccinated (8.7%; 95% CI 5 7.3%, 10.1%) than the previously infected (12.9%; 95% CI 5 11.2%, 14.5%; Figure F, sections C and D).

## DISCUSSION

We compared the incidence rates of SARS-CoV-2 infections, all-cause ED visits, hospitalizations, and deaths in the vaccinated and previously infected individuals living in the state of Indiana by combining medical record data and comprehensive testing and vaccination data from a statewide health information exchange and the state department of health. The analysis included 267 847 pairs of vaccine recipients and individuals with previous infections, aged between 12 and 110 years, matched on age, gender, CDC-defined COVID-19 risk scores, and dates of initial exposure (to the vaccines or the virus itself).

The study data showed that vaccination provided superior protection against all-cause ED visits, hospitalizations, and all-cause mortality compared with the levels of protection conferred by previous SARS-CoV-2 infections. Previous studies have shown that mRNA vaccines are highly effective in preventing COVID-19-related hospitalizations and mortality.<sup>3,24,25</sup> However, to our knowledge, no studies have directly compared the real-world protective effects of recent (i.e., 6 months) natural and vaccine-induced immunity against all-cause mortality and hospitalization in a statewide population. The study showed that while people of all age groups benefited from

vaccination, reduction in mortality was especially impressive in older adults aged 60 years or older. Interestingly, at least in the study population and at time of this analysis, natural immunity appears more effective in preventing new infections, a finding that is also reported in an earlier observational study.<sup>26</sup> Still, the significant reductions in all-cause health events (i.e., 24% reduction in ED visits, 37% reduction in hospitalization, and 37% reduction in mortality) in the vaccinated group are quite notable, especially considering the higher infection rate in the vaccine recipients during the same period. For states with large populations, a difference of such magnitudes could translate to hundreds or even thousands of lives saved.

Compared with COVID-19-specific outcomes, all-cause hospitalization and mortality rates used in the current analysis may be more informative on the health consequences of SARS-CoV-2 infection and protective effects of vaccination.<sup>27</sup> As the study indicates, the strong natural immunity acquired from a previous infection does not appear to fully compensate for the detrimental effects of the initial infection. Therefore, our findings reinforce the importance of vaccination as an essential public health measure to counter the health impacts of the SARS-CoV-2 pandemic. The significantly higher all-cause mortality observed in individuals with previous infection suggested that reliance on natural immunity to avoid negative SARS-CoV-2 health consequences is not a prudent strategy given the safe and readily available vaccines.

In this research, we have employed a matched cohort study design, an approach used by other large population-based vaccine-effectiveness studies.<sup>3</sup> Compared with alternative methods, such as the test-negative design,<sup>28</sup> matched cohorts directly emulate the structure of a clinical trial. Although the design provides no guarantee of a causal interpretation, estimation and inference are straightforward.<sup>29</sup> The convenience of the analysis, however, comes at the expense of matching costs: among other things, many vaccinated and infected individuals were excluded from the analysis for lack of an appropriate match. We carefully selected the matching variables to minimize biases associated with excluding otherwise eligible participants. For the index date, we opted to use the date of the initial SARS-CoV-2 exposure plus 30 days to accommodate the temporal uncertainty in immunity development: previous studies showed that full immunity was conveyed by the vaccines 7 to 14 days after the second dose,<sup>30</sup> whereas robust humoral and cellular immune response occur 5 to 15 days following the onset of symptoms, and antibodies peak within the first few weeks.<sup>13,31,32</sup>

Well-matched cohorts, however, do not preclude the possibility of remnant differences between the comparison groups, especially in characteristics not captured by the matching variables. For example, in the present context, one might suspect that the lower mortality among the vaccine recipients was attributable to their tendency for risk-averse behaviors, such as maskwearing, hand sanitizing, and social distancing.<sup>33</sup> But such an interpretation was not supported by the data showing a higher incidence of infection among vaccine recipients. In addition, the outcome of primary interest, all-cause mortality, is an objective metric that can be readily captured in both vaccinated and previously infected groups with equal accuracy. As a result, we contend that, despite the study's observational nature, the comprehensive real-world data source, the large sample size, the temporally matched participant characteristics, and the consistent findings across different age groups lend credibility to the investigation.

While the findings related to the ED visits, hospital admissions, and deaths align with previous research,<sup>4,5,18,34</sup> few real-world population-based studies have compared the effectiveness of protection against SARS-CoV-2 for natural infections and vaccinations.<sup>35,36</sup> Although our results suggest that natural immunity provides greater protection against subsequent infections than vaccines, residual confounding attributable to health-seeking behavior may still have an impact on these results.<sup>37</sup> If the rate of symptomatic testing for SARS-CoV-2 infection is greater among vaccinated individuals (a quantity unmeasured in our study), vaccine effectiveness would be underestimated. The matched cohort design, while effective for comparing the relative proactive effects of natural and vaccine-induced immunity, presents significant challenges for examining the effects of different vaccines or vaccine doses, as well as their response to specific variants of SARS-CoV-2. In this research, we did not examine the differences among vaccine types, doses, and viral variants, which had distinct temporal patterns in the pandemic, to avoid an over-complication of the matching process. Notwithstanding this limitation, we showed that the all-cause mortality



rate was 37% lower in vaccine recipients compared with individuals with previous infections 6 months after the index date. The reductions in ED visits and hospital admissions were respectively 24% and 37%. The findings highlight the real-world benefits of vaccination and allude to the health consequences of SARS-CoV-2 after the initial exposure. *AJPH*

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#### PUBLICATION INFORMATION

Full Citation: Tu W, Zhang P, Roberts A, et al. SARS-CoV-2 infection, hospitalization, and death in vaccinated and infected individuals by age groups in Indiana, 2021-2022. *Am J Public Health*. 2023; 113(1):96-104.

Acceptance Date: September 1, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307112>

#### CONTRIBUTORS

W. Tu, P. Zhang, P. Embi, and S. Grannis conceptualized and designed this study. W. Tu, P. Zhang, A. Roberts, P. Embi, and S. Grannis were responsible for acquisition, analysis, or interpretation of data. Primary writing for this article was completed by W. Tu with critical revision by P. Embi, S. Grannis, and P. Zhang. All statistical analysis was completed by P. Zhang and W. Tu. Administrative, technical, and material support was provided by K. S. Allen and J. Williams.

#### ACKNOWLEDGMENTS

We would like to thank the Regenstrief Institute Inc for their support of faculty and staff effort.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest related to this study.

#### HUMAN PARTICIPANT PROTECTION

This study was reviewed and approved as exempt by the Indiana University institutional review board before data collection and analysis.

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## DETAILS

### Subject:

Indexes; Laboratories; Infections; Emergency medical care; Medical records; COVID-19 vaccines; Minority & ethnic groups; Public health; Emergency medical services; COVID-19; mRNA vaccines; Vaccines; Observational studies; Mortality; Severe acute respiratory syndrome coronavirus 2; Immunization; Viral diseases; Ethnicity; Hospitalization; Coronaviruses; Age groups; Immunity; Respiratory diseases

<b>Location:</b>	Indiana; United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	96-104
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>ProQuest document ID:</b>	2760580761
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/sars-cov-2-infection-hospitalization-death/docview/2760580761/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/sars-cov-2-infection-hospitalization-death/docview/2760580761/se-2?accountid=211160</a>
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<b>Last updated:</b>	2023- 08-04
<b>Database:</b>	Public Health Database

Document 27 of 39

# Extreme Heat Governance: A Critical Analysis of Heat Action Plans in California

## ABSTRACT (ENGLISH)

Extreme heat events have adverse effects on population health, causing heat-related illnesses, such as heat exhaustion and heat stroke, but also exacerbating underlying medical conditions, such as cardiac and respiratory diseases, through various mechanisms.<sup>1</sup> In the United States, from 2000 to 2010 there were approximately 28 000 recorded heat-related hospitalizations, and between 2004 and 2018, an average of about 700 people died because of heat-related illnesses, making heat the deadliest weather-related hazard in the United States.<sup>2,3</sup> These figures do not represent heat morbidity and mortality that were not attributable by International Classification of Diseases (Geneva, Switzerland: World Health Organization) Ninth Revision (1980) or 10th Revision (1992) code to a confirmed diagnosis of heat-related illnesses, which likely results in underreporting.<sup>4</sup> Additionally, the health consequences of extreme heat are amplified by sociodemographic vulnerabilities and our built environment. As extreme heat events continue to increase in frequency and intensity, individuals, communities, and the municipalities in which they live will need to prepare and adapt.

Health impacts from high ambient temperatures have led many municipalities to develop plans to respond to extreme heat events. These plans are sometimes referred to as excessive heat emergency plans, heat-health response plans, or heat action plans (HAPs). Many European countries implemented HAPs following the 2003 European heat wave.<sup>5</sup> In the United States, a number of cities have developed HAPs,<sup>6,7</sup> although the vast majority of US cities and regions rely only on local National Weather Service offices to issue heat advisories based on heat index forecasts that may not be linked to local HAPs.<sup>8</sup>

In 2020, the US Centers for Disease Control and Prevention (CDC) released a technical report on the summary and strategies for HAPs and ascribed their focus to emergency response planning or long-term planning for extreme heat. The report identifies that plans can stand alone or be an annex to an all-hazards plan and specifically identifies emergency preparedness and management activities when coordinating plans.<sup>9</sup> Although the CDC report is not a step-by-step guide or an all-inclusive approach to how to specifically prepare or coordinate a HAP, the reference to emergency operations plans and the location of HAPs in all-hazards mitigation plans suggest that extreme heat is an event that consistently requires an emergency response and is best understood in that context. However, climate change will increase the likelihood and frequency of extreme weather events, such as extreme heat, and these events have increased substantially over the past decades and will continue to affect regions of the globe regularly.<sup>10</sup> We argue that the increasing frequency and regularity of these events move them from emergencies to an issue to be planned for with preventive health plans.

## FULL TEXT

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In 2020, the US Centers for Disease Control and Prevention (CDC) released a technical report on the summary and strategies for HAPs and ascribed their focus to emergency response planning or long-term planning for extreme heat. The report identifies that plans can stand alone or be an annex to an all-hazards plan and specifically identifies emergency preparedness and management activities when coordinating plans.<sup>9</sup> Although the CDC report is not a step-by-step guide or an all-inclusive approach to how to specifically prepare or coordinate a HAP, the reference to emergency operations plans and the location of HAPs in all-hazards mitigation plans suggest that extreme heat is an event that consistently requires an emergency response and is best understood in that context. However, climate change will increase the likelihood and frequency of extreme weather events, such as extreme heat, and these events have increased substantially over the past decades and will continue to affect regions of the globe regularly.<sup>10</sup> We argue that the increasing frequency and regularity of these events move them from emergencies to an issue to be planned for with preventive health plans.

Since the terrorist attacks of September 11, 2001, the public health legal frameworks that emphasized preparedness have shifted to a concept that emphasized emergencies. This framing emphasizes an emergency as an event that overwhelms the capacity of the health care system.<sup>11</sup> One of the defining characteristics of an emergency is its unpredictability or its unforeseeability. Given that these events will be more frequent, the health and public health systems must move the approach to extreme heat events from emergency to more traditional public health governance structures, usually located in departments of public health or in close coordination. This move supports two very important conceptual shifts. First, it situates the effects of the climate crisis more clearly in the regular governance structures of the state as a longterm policy consideration. Second, it supports the transition of our public health care systems to a climateresilient model. Keeping the frameworks entirely in offices of emergency services abrogates the duty of the state to grapple with the climate crisis as a longterm reality.

Public health departments can be ideal partners and leaders in addressing climate and health issues, particularly those at the local jurisdiction. They are usually the designated government agency that is tasked with protecting the health of communities, are a trusted voice with close ties to the communities they serve, and have a proven ability to confront and overcome complex health issues, such as climate change.<sup>12</sup> Guidance on HAPs is not new but has not been implemented equally across regions. Additionally, even information about extreme heat on local and regional government Web sites can be sparse, and coverage is not always the same.<sup>13</sup>

We used local public health jurisdictions in California to examine how HAPs are organized and implemented to protect populations from the health impacts of extreme heat. We argue that extreme heat events should be in the jurisdiction of public health response and that these organizations are key to leading or closely supporting efforts to reduce the health impacts associated with extreme heat.

#### EXAMINATION OF HEAT ACTION PLANS

To examine the current governance structure of HAPs, we conducted a desk review between August and December 2021 that focused on collecting publicly available written HAPs in California. We defined a "public health jurisdiction" as the lowest level of jurisdiction with public health authority in the state. California has 61 public health jurisdictions; 58 of these are run by a county and three are run by a city.

We conducted online searches using the same keywords for each public health jurisdiction (county/city name 1 heat plan and/or extreme heat; county/city name 1 excessive heat emergency; county/city name 1 extreme weather). We performed searches in Google and on county Web sites with search functions. We gathered and stored Web site links and copies of plans. When the online search did not yield any results, we contacted departments of public

health and emergency services to request written plans. We included a plan when (1) a government agency issued it at the public health jurisdiction level, and (2) it was a standalone HAP, or the response to extreme heat was a main topic in a multihazard plan (e.g., California's Local Hazard Mitigation Plan). We did not include public health jurisdictions that did not have an available plan online or that did not respond to our request, under the assumption that a written plan was not publicly available.

We developed a checklist of core elements for HAPs based on previously developed guidelines. The checklist was influenced mainly by the World Health Organization's "Heat-Health Action Plans: Guidance" but also included criteria to reflect recent reviews of HAPs; improvements in climate surveillance, monitoring, and forecasting; specific needs for vulnerable populations; and effective communication of heathealth information.<sup>7,9,14-18</sup> The checklist consisted of nine core elements that we identified as important for a successful HAP:

1. An identified lead body to coordinate HAP with clear guidance on heat-risk governance;
2. An accurate (to locality) heat-health warning system, including threshold for action based on local health data;
3. Identification and outreach plans (communication and intervention) specifically targeted to vulnerable populations;
4. A communication guide for heatrelated health information, including general public education and awareness campaigns with an emphasis on health behavior and health promotion;
5. Preparedness for social and health systems, including staffing capacity, infrastructure, and health care, including specific procedures for emergency medical services, hospitals, nursing homes, and caretakers ofvulnerable populations;
6. Strategies for short- and mediumterm reduction in indoor heat exposure, including passive and active cooling;
7. Long-term planning addressing urban design and building, energy, and transportation policies that reduce heat exposure and projections of future changes in heat morbidity and mortality from shifting demographics and societal conditions;
8. Real-term (syndromic) surveillance of heat-health outcomes for emergency and rapid response, including coordination between responding agencies; and
9. An evaluation of the HAP, including a comprehensive set of metrics for evaluation and evidence of effectiveness.

Our review of HAPs in California identified 37 (60%) public health jurisdictions with at least one core element identified in the plans. Of these, 24 (65%) jurisdictions had one to three core elements identified, and only seven (19%)jurisdictions had four or more core elements identified. We were unable to identify or access a HAP for 24 public health jurisdictions (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>). Of all the plans we identified, no plans were located in departments of public health. We gathered all plans from either county government Web sites or the county agency dedicated to emergency management.

Even with plans partially completed, many of the core elements provided limited information. For example, all plans that contained core element 2- comprehensive heat-health warning systems-only included information from National Weather Services' advisories or used the National Weather Services' HeatRisktool. There was no evidence that plans reviewed local epidemiological data in the development of locationspecific heat-health warning systems for their communities. Similarly, plans that were partially completed were addenda or annexes to local hazard mitigation plans, which included information on populations that were generally vulnerable to severe weather hazards, including extreme heat.

Approximately 12 (32%) plans included a description of a "lead body" and some form of "communication plan" to get messages to the public concerning extreme heat events-either before or during the event. Few plans identified ways they specifically "prepared key stakeholders" or identified "short- and medium-term strategies" or "long-term strategies" for reducing exposure to extreme heat in their jurisdiction. There was no evidence that any HAPs contained information regarding "real-time surveillance."

## CONCLUSIONS

Anthropogenic climate change and its consequences are often described as an emergency or crisis, particularly when it comes to the impacts on public health and the exacerbation of social and health inequities.<sup>19</sup> We are not

discounting the use of the word "emergency" when describing the threat of global climate change. It implies correctly that urgent action is needed to address the human health impacts of climate change.<sup>20</sup> The action, however, is not to avoid the disruptions of anthropogenic climate change but to prepare for them and to manage them as an ongoing characteristic of life in the Anthropocene. The emergency is a collective failure to act, not the extreme heat. Our overall objective is to start to better determine and clarify the policies and governance structures that we can use to accomplish an effective adaptation and to identify gaps that require fundamental changes to governance structures and laws to reduce the magnitude of and prepare for climate hazards, such as extreme heat.

Previous studies examining HAPs have done so at the municipal level,<sup>7,21,22</sup> with mixed results, and others have been assessed at the national, state, or regional level.<sup>15,16,23</sup> These studies emphasize the large variability in how HAPs are implemented and assessed at various levels of governance and the ad hoc approach to the issue. High ambient temperatures and extreme heat events are explicitly linked to negative public health outcomes. Although the effects of extreme heat can affect multiple sectors of society, it is the effect on human health and the infrastructure that supports human health that is of primary concern. Public health departments are key to assessing population health, creating policies and plans, and improving health outcomes. Heat-related illnesses associated with extreme heat are preventable, and human health is a unifying organizing principle for considering the impacts of extreme heat and organizing planning for it. We recommend that the governance structure of HAPs focus on the health implications of extreme heat events, as health outcomes are strongly tied to local health department activities and missions and are equipped to coordinate responses over the long term and coordinate closely with emergency management to address immediate responses to extreme heat events.

We acknowledge that the ongoing COVID-19 pandemic has highlighted significant gaps in our public health infrastructure. Climate change is a current and long-term crisis that will further exacerbate structural weaknesses in our public health system and will need significant investment and resources to overcome. To achieve this, programs such as the CDC's Building Resilience Against Climate Effects and the workforce capacity-building Climate Corps can better fund and staff public health agencies to address climate and health issues. This transition from an emergency framing to a public health framing cannot be an abrupt one, as the Intergovernmental Panel on Climate Change has identified in its most recent report on mitigation that the transitions involved in climate adaptation and mitigation will produce tensions and raise justice and equity concerns that must be managed.<sup>24</sup> This requires planning, consensus building, and a clear understanding of context. Emergency operations and management will still need to coordinate and respond to the immediate needs of the community, but preparation and preventive measures through departments of public health will be key to building resilience in communities to future extreme heat events.

In addition, although we identify vulnerability assessment and outreach plans in the core elements of a HAP, we should note that developing plans is one part of the process; community engagement and implementation are other important factors in HAP effectiveness. Health departments have experience in including communities in planning; public health frameworks' reliance on the social determinants of health and health equity makes public health a natural location for this coordination activity.

To achieve results in governance related to extreme heat in California, coordination among various stakeholders will be needed—no individual or single agency can achieve this alone. In a recent report highlighting adaptation to extreme heat in California, one of the first priority policies the authors identified was a lack of central authority providing coordination, technical assistance, and strategic funding to address extreme heat. Los Angeles, California, recently appointed a chief heat officer, and there is current (as of this writing) legislation in California, AB-2076, that will establish the statewide Extreme Heat and Community Resilience Program.

Departments of public health should be prioritized and provided with strategic funding for technical assistance in addressing the health concerns of extreme heat. Another priority policy identified that local hazard planning, such as local hazard mitigation plans, are likely not preparing municipalities to address extreme heat in their communities.<sup>25</sup> Although local hazard mitigation plans are not emergency preparedness plans, many of the elements of HAPs can be found there. There should be a clear distinction between emergency disaster



preparedness and public health preparedness, with the latter emphasizing prevention and preparedness in public health agencies to support or lead efforts in developing successful HAPs.

Some limitations of our review stem from information bias on the availability of HAPs and the use of local hazard mitigation plans and other emergency preparedness plans as proxies for HAPs. We acknowledge that health departments are not currently resourced to play this role and that there are significant legal, political, and governance issues that need to be explored and resolved. We urge public health law and policy scholars and practitioners to begin this urgent work. Public health departments can be a natural home for this work. Public health has a strong commitment to health equity, employs population perspectives and systems thinking in its work, and has experience working in communities. Our analysis of HAPs in California makes clear that the ad hoc approach to this issue is not working and that leadership at the state and regional levels is required. ÅjPU

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#### PUBLICATION INFORMATION

Full Citation: Schmeltz MT, Smith JA, Olmos I, Quintero E. Extreme heat governance: a critical analysis of heat action plans in California. *Am J Public Health*. 2023;113(1):15-19.

Acceptance Date: August 30, 2022.

#### CONTRIBUTORS

M.T. Schmeltz and J.A. Smith developed the study concept and design and drafted the article. M.T. Schmeltz, I. Olmos, and E. Quintero collected and analyzed the data. All authors interpreted the data and contributed to the final draft of the article.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

#### Sidebar

##### ABOUT THE AUTHORS

SJs, See also Kapadia, p. 12.

SOFTCOVER, 100 PAGES, 2021 ISBN 978-0-87553-312-6

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Landesman's Public Health Management of Disasters: The Practice Guide, 5th Edition

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This new edition is both a comprehensive textbook and an essential tool for those who have a role in disaster management. Every chapter now includes extensive sections on Covid-19 covering all of public health's responsibility as it relates to a pandemic.

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## DETAILS

<b>Subject:</b>	Communication; Mortality; Climate change; Emergency preparedness; Public health; Jurisdiction; Illnesses; Government agencies; Long term planning; Emergency services; Counties; Cities; Extreme weather; Classification; Morbidity; Ambient temperature; Emergency management; Meteorological services; Respiratory diseases; Weather; Municipalities; Emergency procedures; Emergency plans; Coronary artery disease; Urban environments; Disease control; Heart diseases; Health hazards; Heat; Emergency response; Emergencies; Built environment; Extreme heat; Regions; Prevention; Long-term planning; Hazard mitigation; Mitigation; Revisions; Heat stroke; Heat waves; Hazard identification
<b>Business indexing term:</b>	Subject: Long term planning; Industry: 62423 : Emergency and Other Relief Services
<b>Location:</b>	United States--US; California
<b>Company / organization:</b>	Name: World Health Organization; NAICS: 923120
<b>Classification:</b>	62423: Emergency and Other Relief Services
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	15-19
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences

ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Commentary
DOI:	<a href="https://doi.org/10.2105/AJPH.2022.307117">https://doi.org/10.2105/AJPH.2022.307117</a>
ProQuest document ID:	2760580702
Document URL:	<a href="https://www.proquest.com/scholarly-journals/extreme-heat-governance-critical-analysis-action/docview/2760580702/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/extreme-heat-governance-critical-analysis-action/docview/2760580702/se-2?accountid=211160</a>
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Last updated:	2023-02-10
Database:	Public Health Database

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# Erratum In: "The Opioid Industry Documents Archive: A Living Digital Repository"

Anonymous

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## FULL TEXT

In: Alexander GC, Mix LA, Choudhury S, et al. The Opioid Industry Documents Archive: a living digital repository. AmJ Public Health. 2022;112(8):1126-1 129. <https://doi.org/10.2105/AJPH.2022.306951>

When originally published, an author was omitted from the byline. On page 1126, the byline should read:

G. Caleb Alexander, MD, MS, Lisa A. Mix, MLA, Sayeed Choudhury, MSE, Rachel Taketa, MLIS, Cecilia Tomori, PhD, Maryam Mooghali, MD, MSc, Anni Fan, Sarah Mars, PhD, Dan Ciccarone, MD, MPH, Mark Patton, MS, Dorie E. Apollonio, PhD, MPP, Laura Schmidt, PhD, Michael A. Steinman, MD, Jeremy Greene, MD, PhD, Kelly R. Knight, PhD, Pamela M. Ling, MD, MPH, Anne K. Seymour, MS, Stanton Glantz, PhD, and Kate Tasker, MLIS

This change does not affect the paper's conclusions.

<https://doi.org/10.2105/AJPH.2022.306951e>

## DETAILS

Publication title:	American Journal of Public Health; Washington
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Volume:	113
Issue:	1
Pages:	E1
Publication year:	2023
Publication date:	Jan 2023
Publisher:	American Public Health Association
Place of publication:	Washington
Country of publication:	United States, Washington
Publication subject:	Public Health And Safety, Medical Sciences
ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Corrections/Retraction
ProQuest document ID:	2760580701
Document URL:	<a href="https://www.proquest.com/scholarly-journals/erratum-opioid-industry-documents-archive-living/docview/2760580701/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/erratum-opioid-industry-documents-archive-living/docview/2760580701/se-2?accountid=211160</a>
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Last updated:	2023-01-04
Database:	Public Health Database

Document 29 of 39

## Two Decades of Progress in Undergraduate Public Health: Where Do We Go From Here?

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## ABSTRACT (ENGLISH)

It has been two decades since the Institute of Medicine wrote that "all undergraduates should have access to education in public health."<sup>1</sup>(p144) This recommendation was aspirational. Nevertheless, it catalyzed a movement to develop undergraduate majors and minors in public health as well as extend public health education to community colleges, clinical health professionals, and an expanding audience of students domestically and globally.<sup>2</sup>

In their article in this issue of AJPH, Leider et al. (p. 115) report on the status of public health bachelor's degree education in the United States and provide useful data on the number of graduates, debt, and employment. As indicated in the article, undergraduate public health education has grown rapidly over the past two decades, with more than 18 000 bachelor's degrees conferred in 2020. There are now more bachelor's degrees granted each year than MPH degrees. As demonstrated in the article, the graduates reflect the racial and ethnic diversity that is needed in the future public health workforce.

The work of the past two decades has laid the groundwork for the future. Undergraduate public health education is now integrated into the fabric of bachelor's degree education not only in institutions with graduate public health education but also in what have been called "stand-alone" institutions that offer undergraduate public health majors but not graduate work.

The Council on Education for Public Health now accredits stand-alone programs as well as undergraduate programs as part of graduate programs and schools of public health.<sup>3</sup> The Association of Schools and Programs of Public Health has established the Undergraduate Network for Education in Public Health, which now includes more than 200 member institutions. The association sponsors an annual undergraduate public health conference that is open to network members as well as nonmembers.

## FULL TEXT

It has been two decades since the Institute of Medicine wrote that "all undergraduates should have access to education in public health."<sup>1</sup>(p144) This recommendation was aspirational. Nevertheless, it catalyzed a movement to develop undergraduate majors and minors in public health as well as extend public health education to community colleges, clinical health professionals, and an expanding audience of students domestically and globally.<sup>2</sup>

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### WHERE DO WE GO FROM HERE?

Now that undergraduate public health education is fully established in the mainstream of public health and undergraduate education, it is important to ask where undergraduate public health education goes from here. In particular, how can bachelor's degree graduates help fulfill the current and future needs of public health practice? The data presented by Leider et al. indicate that bachelor's degree graduates are obtaining their first employment primarily in not-for-profit and for-profit institutions as opposed to governmental public health agencies. The COVID-19 pandemic provides an opportunity to increase the interest of undergraduates in the field of governmental public

health because it has brought to national attention the enormous needs for governmental public health and provided strong justification for sustained investments.

The growth of undergraduate public health education provides an opening to integrate public health education into the development of a national public health system. For this to occur, it is important to ask the following question: What are the barriers and what are the opportunities?

The MPH has been the dominant public health degree for more than a century, and understandably many governmental public health positions require an MPH degree. This has been a barrier to bachelor's degree employment. A high priority in the near future is to better delineate the roles of bachelor's degree graduates and MPH graduates in governmental public health and reflect these differences, especially in entry-level job descriptions. Key to the entry of undergraduate public health majors into the governmental public health workforce is the opportunity to gain experience in public health departments. In the past, these opportunities have been limited and often reserved for MPH students. In addition, new curricula aimed at the needs of public health practice can better connect academia and practice.

#### POTENTIAL FUTURE INITIATIVES

There are a number of collaborative initiatives in the next few years that could help move undergraduate public health education into a new phase that emphasizes the growth and development of the governmental public health workforce and continues to expand the reach of undergraduate public health education. Examples are as follows:

- \* Expansion and development of academic public health departments: academic health departments have great potential to serve the needs of public health practice as well as academia. A growing number have been developed and nurtured over the past two decades with the encouragement of the Council on Linkages Between Academia and Public Health Practice.<sup>5</sup> A broad initiative to increase participation by health departments and by a wide range of undergraduate and graduate students, along with a stable and increasing level of federal and local financial support, could be pivotal to the future development of a national public health system.

- \* Expansion of Centers for Disease Control and Prevention (CDC) fellowships to include undergraduates: expansion of CDC fellowships to fully include undergraduates would provide important opportunities for career development in governmental public health. It would also send an important message that undergraduate public health education is now a full-fledged partner in the future public health system.

- \* Development of certificate programs in areas of need: the needs of the public health workforce require new curricula in the form of free-standing certificates often linked to certification examinations. For instance, the CDC is developing the disease intervention specialist certification. Preparation for this certification can be facilitated by offering free-standing certificate curricula at community colleges and four-year institutions. Other areas of need such as public health information systems might also benefit from certificate programs.

#### THE FUTURE OF UNDERGRADUATE PUBLIC HEALTH EDUCATION

Accomplishing these goals will require collaboration from the full range of public health organizations, including the Association of Schools and Programs of Public Health, the American Public Health Association, the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, and the Council on Linkages. It will be important to focus on the future of undergraduate public health education as these organizations take on the bigger issue of developing a national public health system. Distinguishing between bachelor's- and master's-degree requirements in entry-level job descriptions would be a good starting point because it would focus the attention of public health practice as well as academia on the need to connect bachelor's degree public health education with the needs of the public health workforce.

Leider et al. do an excellent job of bringing together degree conferral and employment data on bachelor's degrees. Unfortunately, parallel data on the broader educational impact of the undergraduate public health movement are not available.

Public health is increasingly becoming a core undergraduate discipline. The goal for all undergraduates to have access to education in public health has not been fully accomplished, but it is no longer aspirational. Extensive anecdotal experience strongly suggests that students from a wide range of majors are increasingly engaging in

introductory public health coursework or pursuing a minor in public health. The interest in public health among nursing, medicine, pharmacy, and other clinical disciplines is growing rapidly. An additional reservoir of interest in public health education exists at the community college level, where the majority of students now come from minority populations, and coursework in public health is still very limited. The population health management movement is increasingly integrating public health principles into the delivery of health care to populations.<sup>6</sup>

The past two decades have demonstrated that fundamental educational change is possible as public health has increasingly been integrated throughout undergraduate education. The next two decades provide an opportunity to develop a national public health system with public health bachelor's degree and certificate graduates fully integrated into the emerging system.

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#### PUBLICATION INFORMATION

Full Citation: Riegelman RK. Two decades of progress in undergraduate public health: where do we go from here? *Am J Public Health.* 2023;113(1): 9-11.

Acceptance Date: October 2, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307145>

#### CONFLICTS OF INTEREST

The author is a series editor and author in Jones and Bartlett Learning's EssentialPublic Health series.

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## DETAILS

**Subject:** Public health; Collaboration; Curricula; Employment; Community colleges; Schools; Job descriptions; Certification; Health behavior; Health education; Councils; Workforce; College students; Access to education; Careers; Scholarships & fellowships; Public health education; Departments; Education; Undergraduate education; Public schools; Colleges & universities; Graduate studies; Medical personnel; Ethnic factors; Baccalaureate degrees

**Business indexing term:** Subject: Employment Job descriptions Workforce; Industry: 61121 : Junior Colleges



<b>Company / organization:</b>	Name: Institute of Medicine; NAICS: 541714; Name: Council on Education for Public Health; NAICS: 813920
<b>Classification:</b>	61121: Junior Colleges
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	9-11
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>ProQuest document ID:</b>	2760580680
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/two-decades-progress-undergraduate-public-health/docview/2760580680/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/two-decades-progress-undergraduate-public-health/docview/2760580680/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-09-22
<b>Database:</b>	Public Health Database

# Antiracism and Community-Based Participatory Research: Synergies, Challenges, and Opportunities

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## ABSTRACT (ENGLISH)

Structural racism causes stark health inequities and operates at every level of society, including the academic and governmental entities that support health research and practice. We argue that health research institutions must invest in research that actively disrupts racial hierarchies, with leadership from racially marginalized communities and scholars. We highlight synergies between antiracist principles and community-based participatory research (CBPR), examine the potential for CBPR to promote antiracist research and praxis, illustrate structural barriers to antiracist CBPR praxis, and offer examples of CBPR actions taken to disrupt structural racism. We make recommendations for the next generation of antiracist CBPR, including modify health research funding to center the priorities of racially marginalized communities, support sustained commitments and accountability to those communities by funders and research institutions, distribute research funds equitably across community and academic institutions, amplify antiracist praxis through translation of research to policy, and adopt institutional practices that support reflection and adaptation of CBPR to align with emergent community priorities and antiracist practices. A critical application of CBPR principles offers pathways to transforming institutional practices that reproduce and reinforce racial inequities. (Am J Public Health. 2023;113(1):70-78. <https://doi.org/10.2105/AJPH.2022.307114>)

## FULL TEXT

### Headnote

Structural racism causes stark health inequities and operates at every level of society, including the academic and governmental entities that support health research and practice. We argue that health research institutions must invest in research that actively disrupts racial hierarchies, with leadership from racially marginalized communities and scholars. We highlight synergies between antiracist principles and community-based participatory research (CBPR), examine the potential for CBPR to promote antiracist research and praxis, illustrate structural barriers to antiracist CBPR praxis, and offer examples of CBPR actions taken to disrupt structural racism. We make recommendations for the next generation of antiracist CBPR, including modify health research funding to center the priorities of racially marginalized communities, support sustained commitments and accountability to those communities by funders and research institutions, distribute research funds equitably across community and academic institutions, amplify antiracist praxis through translation of research to policy, and adopt institutional practices that support reflection and adaptation of CBPR to align with emergent community priorities and antiracist practices. A critical application of CBPR principles offers pathways to transforming institutional practices that reproduce and reinforce racial inequities. (Am J Public Health. 2023;113(1):70-78. <https://doi.org/10.2105/AJPH.2022.307114>)

For decades, community activists and a small number of health scholars have been calling for health researchers to not just study racism but be actively antiracist and contribute to transforming our inequitable systems.<sup>1,2</sup> Recently, an increasing number of health scholars and mainstream public health institutions (e.g., the Centers for Disease Control and Prevention, the National Institutes of Health [NIH]) have called for more antiracist health research that

directly confronts and addresses structural racism in both its process and outcomes.<sup>3-7</sup> For example, the NIH launched the UNITE initiative to "identify and address structural racism within the NIH-supported and the greater scientific community."<sup>3</sup> To fulfill these antiracist ambitions, we need bold leadership and expansion of equitable models that disrupt hierarchies embedded in our health research institutions (e.g., the NIH, major universities, nonprofit organizations). These models need to center community voices and support community-academic partnerships to foster racial justice.

Investing in community-based participatory research (CBPR) approaches offers an opportunity for health research institutions to move closer to antiracist principles. CBPR approaches—distinct from the broader term "community-based" research and only a narrow slice of all health research—often actively seek to disrupt racial hierarchies in how they are conducted (i.e., the process) and in the outcomes they seek to affect (i.e., health equity).<sup>2,8-10</sup> Literature reviews demonstrate that CBPR partnerships can have an important positive impact on health outcomes in marginalized communities,<sup>11-13</sup> but these impacts are constrained and limited by pervasive racial inequities embedded in research and funding institutions.<sup>14-17</sup>

The emancipatory roots that underlie CBPR draw from the epistemic traditions of oppressed communities of color and Indigenous communities across the globe that have sought to facilitate community empowerment and agency.<sup>18</sup> The liberatory foundations of CBPR are anchored in Brazilian educator Paulo Freire's dialogical approach to critical consciousness and the cyclical praxis of reflection and action; in Global South movements to end apartheid (e.g., in South Africa) and build knowledge democracy; and in civil rights movements to end White supremacy in the United States.<sup>12,18-20</sup>

Building on these historical roots, since the 1990s a growing community of health scholars has partnered with racially marginalized communities to center their priorities, develop research to address health inequities, and disrupt traditional research models in health research institutions.<sup>6,9,12</sup> Over the past 3 decades, CBPR has evolved into a research approach that—when carried out according to its core principles—embraces antiracism principles and can be a tool to help dismantle structural racism in the United States. Even in this acknowledgment of CBPR's potential as an antiracist tool that can disrupt White supremacy, it was indeed the capital of White scholars that allowed this movement to gain acceptance and grow in academia. We hold these 2 truths to be in tension. We argue that health research institutions should invest in research that funds and is led by racially marginalized communities, helps disrupt racial hierarchies, and contributes to transforming systems, structures, and institutions that are deeply implicated in reproducing racism. We cannot exhaustively cover all of the issues in this essay nor do we have all the answers; however, we hope to help our field move closer to transforming institutional practices that reproduce and reinforce racial inequities.

#### RESEARCH-ANTIRACIST PRINCIPLE SYNERGY

Synergies between a CBPR approach to research and antiracist approaches provide an opportunity for addressing racial inequities in institutions of higher education and traditional research practices. Camara Phyllis Jones, leading scholar of racism and health, has defined racism as

a system of structuring opportunity and assigning value based on the social interpretation of how one looks, that unfairly disadvantages some individuals and communities, unfairly advantages other individuals and communities, and saps the strength of the whole society through the waste of human resources <sup>4</sup>(p231; emphasis added)

Thus, health research that is antiracist would need to restructure opportunities, reassign value, and prevent the waste of human resources. The core principles of CBPR (Box 1) are intended to guide researchers to do exactly that.

CBPR principles aim to restructure opportunities by enhancing opportunities for community members and organizations to build solutions to community challenges, develop research questions, collaborate on data collection and analysis, and implement strategies for addressing inequities.<sup>8,9,12</sup> CBPR's explicit focus on capacity building by all team members provides opportunities for community members to build their research skill set, for academic researchers to learn community-centered skills and knowledge, and for all partners to examine the ways that institutionalized, personally mediated and internalized forms of racism affect collaborative work.<sup>4,12</sup> CBPR teams

are also intentional about expanding space for community members to be experts on the project and topic. Beyond opportunities for individuals, CBPR creates opportunities for entire communities by budgeting financial resources to community-based organizations to strengthen capacity for community change. It also entails a critical evaluation of the balance of resources applied to research and those applied to action to create change based on research findings.

CBPR approaches work to reassign values by valuing and centering community perspectives more explicitly than they are in conventional research practices. CBPR principles emphasize that expertise lies in communities and places high value on the people and perspectives in racially marginalized communities. In practice, CBPR projects and partnerships are frequently the site of advocacy, policy change, and action related to injustices (e.g., environmental racism, incarceration, and policing) prioritized by racially marginalized communities.<sup>13</sup>

Finally, CBPR aims to prevent the waste of human resources by creating a research structure that explicitly challenges the marginalization of scholars and communities of color and the devaluation of their knowledge. Core CBPR practices aim to do this by channeling resources from well-financed predominantly White institutions into racially marginalized communities and by creating explicit opportunities to support community capacity for both research and action.

A CBPR approach also aligns with the leading antiracism framework for health research developed by Ford and Airhihenbuwa<sup>21</sup>: public health critical race praxis (PHCR). PHCR was developed to identify, understand, and undo the root causes of racial hierarchies and applies principles from critical race theory (CRT) to antiracist health research.

PHCR draws on fundamental pillars of CRT to emphasize the acknowledgment of the systemic White supremacy that operates at every level of US society.<sup>21,22</sup> PHCR also pulls from CRT in the recognition that we need to "center the margins" for an effective antiracist praxis. PHCR and CRT are also guided by Crenshaw's and other Black feminist scholars' concept of intersectionality, which was developed in recognition of the combined and often multiplicative impact of intersectional systems (e.g., economic structures, race, culture, and gender)<sup>22</sup> and was later applied to analysis of health outcomes.<sup>23</sup> PHCR and CRT emphasize questioning objectivity, questioning the evidence, and generating knowledge from perspectives that reside outside of the academy.

In Table 1, we show selected core principles and definitions from Ford and Airhihenbuwa's PHCR methodology.<sup>21</sup> For each PHCR principle (drawn from CRT concepts), we demonstrate alignments with guiding principles in CBPR. In Table A (available as a supplement to the online version of this article at <http://www.ajph.org>), we include all the core PHCR principles.

It is important to note that not all CBPR partnerships prioritize the study of racial influences on health outcomes (e.g., "primacy" from PHCR principles in Table 1). Rather, some partnerships focus on disrupting other systems of oppression, such as patriarchy, colonization, and heteronormativity, that often interlock with racism.<sup>23</sup> In addition, it is critical that CBPR partnerships discuss and determine the principles that will guide their work, including the integration of PHCR and CBPR principles relevant for their goals and context. As a result, principles will vary across partnerships.<sup>8</sup> Nonetheless, CBPR's focus on centering marginalized communities and disrupting various forms of inequities is consistent with PHCR principles.

#### CHALLENGES IN OUR CURRENT ENVIRONMENT

"White supremacy is not a shark; it is the water."

-El Guante

The waters of White supremacy in which we swim<sup>24</sup> pose major barriers to actualizing antiracist CBPR partnerships for health. These waters have been created and constructed over centuries to value the lives, institutions, and knowledge of White people and devalue the human dignity and lives of Black, Indigenous, Latinx, Arab, Asian, and other marginalized groups. In this sense, the impact of any programmatic or policy-based intervention is bound by linked oppressive systems.<sup>15</sup> The potential impact of CBPR on health equity is bound by larger oppressive systems' impact on resource and power distribution.

These waters are why both the NIH and US philanthropies dramatically underfund sickle cell disease—a disease

predominantly afflicting Black Americans—compared with similar diseases that have a greater impact on Whites.<sup>15,25</sup> It is why the NIH has hardly invested in research on structural racism, despite it being a fundamental cause of so much death and disease.<sup>5,26</sup> It is why there is limited growth in public health faculty racial diversity, especially at research-intensive institutions and in tenured positions.<sup>27</sup> And it is why the overwhelming majority of budgets and indirect costs for multimillion-dollar racial health inequities research goes to historically and predominantly White research universities with predominantly White faculty instead of to racially marginalized communities, community-based organizations, or historically Black colleges and universities. We highlight a few of the barriers to an antiracist health research agenda.

First, current academic structures incentivize short-term profit for universities and center knowledge production in individual academic faculty members rather than incentivizing long-term investments in communities and community expertise.<sup>14</sup> Academic researchers who would like to conduct antiracist CBPR research are often discouraged because it is too slow, underfunded, perceived as service, or not perceived as rigorous science.<sup>28</sup> Universities often prioritize federal grant funding—especially in decisions about faculty hiring, tenure, and promotion—and thus can sometimes disincentivize academic-based researchers from creating equitable partnerships that share grant dollars with communities.<sup>17</sup> Academic researchers, especially those who are scholars of color, are sometimes forced to exit partnerships because they could not find a job that supported their research or that earned tenure or because they felt the university environment was too toxic.<sup>29</sup> This dynamic is exacerbated by "health equity tourists"—primarily White scholars—who opportunistically seize on expanded health equity funding or publishing opportunities to advance their careers despite a lack of expertise.<sup>30</sup> The commitment to antiracist research and CBPR principles often rests on the individual researchers rather than institutional commitment.

Second, the NIH and other large health research-funding institutions prioritize research that focuses on proximate causes of diseases, biology, and individual health outcomes and have less emphasis on understanding and intervening in the sociopolitical roots of health and inequality. Of the \$41.7 billion in NIH funding in 2020, just 7% fit into the broad NIH-defined category of social determinants of health research.<sup>31</sup> (Most of the research categorized by the NIH as social determinants of health does not engage with the sociopolitical roots of health and does not adequately account for structural racism.<sup>32</sup>) CBPR partnerships aim to follow community priorities for research and intervention, but the pool of funding available severely constrains those choices. For example, in many cases, communities would prioritize ending police harassment and imprisonment of their residents,<sup>26</sup> but the funding agencies with the largest health research budgets continue to focus on proximal causes and medical solutions, rather than addressing the root causes of harm to racially marginalized communities.<sup>31</sup>

Third, there are substantial barriers—attributable to structural racism—that inhibit racially marginalized scholars, first-generation college-educated researchers, and community partners from receiving competitive research grants for large-scale funding.<sup>5</sup> Often (but certainly not always), academic researchers work for predominantly White institutions located outside the communities with whom they partner.<sup>10</sup> They are also often spawned from legacies of educational White privilege or do not belong to communities most affected by racial health inequities. Additionally, scholars from racially marginalized communities are often dissuaded from conducting research in partnership with their own community because it is unfairly perceived as biased.<sup>29,33</sup> Meanwhile, White academics are rewarded for conducting health research with these same communities.<sup>30</sup> Collectively, these inequitable practices systematically advantage White researchers and simultaneously discredit and marginalize scholars of color—a dual function of White supremacy in the academy.

Finally, CBPR partnerships occur in a White supremacy culture that places values on certain forms of knowledge prominent in predominantly White institutions and devalues those coming from institutions in racially marginalized communities. Excellent CBPR research is conducted by researchers at historically Black colleges and universities but does not receive the same recognition and support.<sup>34</sup> Despite the intentions of CBPR principles to center members of racially marginalized communities as experts with valuable knowledge, the society we live in—and our very own research institutions—continues to call on experts based in predominantly White universities to provide input on what is happening in racially marginalized communities.

These are but a few of the structural barriers CBPR partnerships face in living up to their principles. With these in mind, we recognize CBPR principles as aspirational, commonly eroded, or compromised because of the institutional and societal challenges described. They also represent a set of tools and perspectives that can help to chip away at the very structural barriers just described. Indeed, CBPR partnerships have played an important role in shifting institutions and policies, which we describe in several examples in the next section.

#### PARTNERSHIP AND ADVOCACY EXAMPLES

These examples—most of which are unpublished because of some of the barriers described in the preceding section—draw on the experiences of the authors.

##### Advocating in Local Government

A CBPR partnership in Flint, Michigan, played a fundamental role in the Genesee County, Michigan, government declaring racism a public health crisis on June 10, 2020, and the subsequent work to act based on the declaration. Researchers from Michigan State University and the University of Michigan-Flint worked in partnership with the Faith Subcommittee of the Greater Flint COVID-19 Taskforce on Racial Inequities and the community-based organization partners to conduct focus groups and community dialogues that informed a strategic plan for the county government to act on their declaration. This CBPR partnership had an antiracist outcome because it resulted in antiracist policy changes, such as a line item in the budget to support antiracism training, education, and initiatives.

##### Transformation in Universities

To build the cadre of underrepresented scholars of color in health research, the Transdisciplinary Research, Equity and Engagement (TREE) Center at the University of New Mexico is shifting the conditions for CBPR partnerships between scholars of color and communities of color. Scholars of color are supported by an academic and community of color mentor from the development of competitive pilot project proposals to the implementation of interventions in real-world settings as a model for centering community voice and building new lines of inquiry toward racial healing, social justice, and health equity. The TREE Center fosters the development of scholars of color by providing a community of mentors across 12 disciplines in the health and social sciences. A formal training and technical assistance program provides support for academic success (e.g., preparing tenure and promotion portfolios, development, and review of research proposals). The TREE Center also develops tools for engagement with communities that shift power dynamics and advocate changes in university procedures and policies that incentivize CBPR scholars.

##### Changing Funding Models

In the early 2000s, the National Center for Minority Health and Health Disparities convened a group of CBPR experts from across the United States to advise them in establishing a CBPR program at the center (subsequently "institute"). It incorporated a primary recommendation of the advisory group, which was the creation of a 3-phase funding cycle spanning an 11-year period. The 3 phases were (1) an initial 3-year planning and pilot project grant, (2) a 5-year intervention implementation grant, and (3) a 3-year dissemination grant to share findings and lessons learned. This extended timing allowed CBPR partnerships the time and resources needed to genuinely follow CBPR principles. This example of CBPR researchers advocating institutional transformation follows the PHCR and CRT concepts of "disciplinary self-critique" and "structural determinism" in that status quo norms at the NIH are perpetuating inequities in health research processes.

Another example of this is how at the urging of CBPR scholars and environmental justice advocates, the National Institute of Environmental Health Sciences (NIEHS) has experimented with innovations that shift power as part of their Research to Action program. The Environmental Justice: Partnerships for Communication program request for proposals sought to amplify community voices in identifying and defining problems related to environmental exposures, shaping research approaches to the problem, and setting priorities for intervention strategies. Particularly notable was that the study section that NIEHS convened for this funding mechanism included both academic-based researchers and environmental justice advocates to examine the science, the distribution of funds, and whether proposals reflected community priorities. This example follows principles from PHCR and CRT because it shifted the voices of environmental justice advocates from the margins to the center to shift funding processes and outcomes.

Finally, Tribal nations and Native scholars across the United States have recently challenged White supremacy by demanding cultural-centered CBPR and Indigenous-led research through 2 NIH initiatives: the Native American Research Centers for Health and the Intervention Research to Improve Native American Health (IRINAH) funding. A major goal has been to center funding in Native communities and organizations and increase the number of Native scholars and their success in the academy, including increased access to R01 (research project grant) funding. For more about the IRINAH initiative, see the special issue in *Prevention Science*.<sup>7</sup> Although Native scholars have begun to replace their White colleagues as principal investigators, the NIH has not yet adopted a similar initiative for other scholars of color. Like the previous examples, this example of CBPR research draws on PHCR and CRT principles of centering the margins and disciplinary self-critique to create antiracist processes for conducting research.

## RECOMMENDATIONS AND CONSIDERATIONS

In the short term, research funders should shift substantial funds to focusing on structural racism and encouraging research approaches that align with both antiracism and CBPR principles. A recent request for applications from the NIH for projects with the goal of "understanding and addressing the impact of structural racism" focused funding on racism but did not take an explicitly antiracist approach to how funding decisions were made or which types of projects were eligible for funding. These types of funding opportunities are limited and are subject to the whims of new federal leadership because they are not institutionalized. Most universities and research institutions are motivated by funding, and thus if funders transform how they allocate resources they can also transform these academic research institutions.

The examples we have provided show how CBPR researchers can advocate funding mechanisms to facilitate long-term commitments with racially marginalized communities. In addition, ensuring that NIH and other funders' funding decisions are shaped by members of racially marginalized communities—like the NIEHS study section example—can help make sure that funding provides community resources and focuses on fundamental causes of multiple health issues (e.g., systems of incarceration, finance, policing, environmental protection, housing). Longer term, we need to work toward a future in which racially marginalized communities are allocating and receiving public funding and directing antiracist health research that can have an impact on their own communities.<sup>35</sup> This change will require fundamental transformation in how universities operate and how research is defined, originated, and funded. Substantial rethinking and reorientation among research institutions to shift funding allocations will be required to ensure that funds are available to support action to address the inequities that are the focus of the research. The research to action mechanism described in the preceding section is an example of such a funding mechanism. There is a critical need for focused attention to expand and create additional mechanisms for directing funding to support antiracist actions.

### Accountability to Communities of Color

Long-term commitment and community-driven policy change can enhance trust and accountability with communities of color, an essential aspect of antiracist praxis. Universities and other research institutions that are committed to antiracist practices need to build in measures of accountability to communities affected by racism and racial health inequities. Long-term commitment is a key principle of CBPR partnerships, and we need institutional support for larger partnerships between universities and communities and cities to help ensure the long-term sustainability of CBPR research. Such partnerships might be established in the form of community-academic centers or institutes (e.g., the TREE Center or the Detroit Urban Research Center), which extend beyond any single externally funded project. Ideally these would have university funding for core infrastructure support in addition to external funding to foster, promote, and build capacity to conduct antiracist CBPR.

It is essential to build in accountability metrics and mechanisms to ensure a continued focus on social impact to address structural racism. A practical model for social change links research efforts to policy change to transform the racial structures through distributive, procedural, and restorative justice approaches that remediate unfair policies.<sup>13'36'37</sup> Examples include working to ensure that indirect costs received as part of grant funding are equitably invested in communities instead of adding solely to a university's budget, dedicating a portion of project

funds to scholarships for community youths, and demanding that universities divest from companies and other institutions that harm their community through, for example, incarceration or climate change. These forms of accountability can help move research institutions into closer alignment with antiracist and CBPR principles and ultimately help disrupt structural racism and White supremacy. These types of actions-and not just platitudes-can help to build trust over time.

#### Reflection and Adaptation

Given that racism adapts over time, antiracist CBPR approaches will also need to adapt over time. CBPR principles of colearning and capacity building-and openly addressing issues of racism and social classism-require CBPR researchers and community partners to follow guided approaches that allow continued critical self-reflection and collective reflection regarding racial equity in the partnership.<sup>10</sup> Being adaptive means that the current CBPR core principles may and should be revised in the future to better align with community priorities or antiracism ideas. Dialogues will be essential in partnerships, recognizing that racism is shaped by local histories and relationships, and thus will vary not only overtime but by location.<sup>38'39</sup>

In this reflection, we cannot overlook that the development of CBPR approaches has historically been led in academia predominantly by White scholars. Many of the authors of this essay benefit from the waters of White supremacy while simultaneously fighting for the CBPR partnerships and principles that swim against the currents. Given the racism embedded in the academy, White scholars' ideas have been more likely to be legitimized and shared. Furthermore, in some instances the voices of scholars of color are marginalized when they are relinquished to secondary authors or investigators in funded research with communities of color.<sup>29'33</sup> The future of antiracist CBPR needs to own and address this dynamic. Candid reflection and courageous conversations regarding internalized privilege among White scholars and internalized oppression among scholars of color can facilitate processes of healing for racial justice in CBPR.

The possibilities for CBPR have been changing as Indigenous researchers and other scholars of color have advanced to senior positions in predominantly White institutions, as historically Black colleges and universities have made innovations in CBPR principles,<sup>40</sup> and as tribes and communities have demanded equitable distribution of resources and community-prioritized and -led decisions.<sup>7</sup> This is an opportunity to raise the critical nature of antiracism conversations in partnerships and demand change in academia and funding institutions.

#### CONCLUSIONS

Health research urgently needs to follow antiracist research principles. Alignments between a CBPR approach and antiracist approaches provide a path toward addressing historical and contemporary racial inequities embedded in institutions of higher education and in traditional research processes. Achieving racial justice and ameliorating inequities is a call to action for the field of health research to address racism in health research, center scholars and communities of color, and work together as intercultural allies in confronting White supremacy with focused deliberative action toward racial healing, justice, and reconciliation. ,4JPH

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#### PUBLICATION INFORMATION

Full Citation: Fleming PJ, Cacari Stone L, Creary MS, et al. Antiracism and community-based participatory research: synergies, challenges, and opportunities. *Am J Public Health.* 2023;113(1):70-78. Acceptance Date: August 30, 2022.



DOI: <https://doi.org/10.2105/AJPH.2022.307114>

## CONTRIBUTORS

P.J. Fleming led the writing and revisions of the article. P.J. Fleming, L. Cacari Stone, and A.J. Schulz drafted substantial portions of the text. All authors conceptualized the article, contributed ideas, and critically edited and revised the article.

## ACKNOWLEDGMENTS

This work was supported by the National Institute of Minority Health and Health Disparities (grant U54 MD004811-08) for support of the Transdisciplinary Research, Equity and Engagement Center; the National Institute for Environmental Health Research (grants R01ES032389, P30 ES017885); the National Institute of Nursing Research (grant R01NR016123); the National Institute of Minority Health and Health Disparities (grant K01MD015079); and the National Center for Institutional Diversity, University of Michigan.

Note. The content of this editorial is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

## HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because no human participants were involved in this article.

## Sidebar

### BOX1 - Principles for Community-Based Participatory Research

1. Recognizes community as a unit of identity
2. Builds on strengths and resources in the community
3. Facilitates a collaborative, equitable partnership in all phases of research, involving an empowering and power sharing process that attends to social inequalities
4. Fosters colearning and capacity building among all partners
5. Integrates and achieves a balance between knowledge generation and intervention for the mutual benefit of all partners
6. Focuses on the local relevance of public health problems and ecological perspectives that attend to the multiple determinants of health
7. Involves systems development using a cyclical and iterative process
8. Disseminates results to all partners and involves them in the wider dissemination of results
9. Involves a long-term process and commitment to sustainability
10. Openly addresses issues of race, ethnicity, racism, and social class and embodies "cultural humility"
11. Works to ensure research rigor and validity but also seeks to "broaden the bandwidth of validity" with respect to research relevance

Source. Israel et al.,<sup>8</sup> Minkler and Wallerstein,<sup>9</sup> and Israel et al.<sup>12</sup>

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## DETAILS

<b>Subject:</b>	Research facilities; White supremacy; Principles; Public health; Institutions; Collaboration; Human resources; Systemic racism; Participatory research; Marginality; Racism; Leadership; Priorities; Praxis; Discrimination; Health disparities; Community; Health research; Research funding; Community research; Hierarchies; Inequality; Community involvement; Oppression; Society; Medical research; Community participation; Race; Research institutions
<b>Business indexing term:</b>	Subject: Human resources
<b>Location:</b>	United States--US
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	70-78
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>ProQuest document ID:</b>	2760580670
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/antiracism-community-based-participatory-research/docview/2760580670/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/antiracism-community-based-participatory-research/docview/2760580670/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-07-10
<b>Database:</b>	Public Health Database

# Social Disparities in the Duration of Power and Piped Water Outages in Texas After Winter Storm Uri

Grineski, Sara E, PhD; Collins, Timothy W, PhD; Chakraborty, Jayajit, PhD; Goodwin, Eric, MS; Aun, Jacob, MA; Ramos, Kevin D

[ProQuest document link](#)

## ABSTRACT (ENGLISH)

We assessed sociodemographic disparities in basic service disruptions caused by Winter Storm Uri in Texas. We collected data through a bilingual telephone survey conducted in July 2021 (n = 753). Being Black, having children, and renting one's residence were associated with longer power outage durations; being Black was also associated with longer water outages. Our findings highlight the need to plan for and ameliorate inequitable service outages and their attendant health risks in climate change-related extreme weather events such as Uri.

## FULL TEXT

### Headnote

We assessed sociodemographic disparities in basic service disruptions caused by Winter Storm Uri in Texas. We collected data through a bilingual telephone survey conducted in July 2021 (n = 753). Being Black, having children, and renting one's residence were associated with longer power outage durations; being Black was also associated with longer water outages. Our findings highlight the need to plan for and ameliorate inequitable service outages and their attendant health risks in climate change-related extreme weather events such as Uri. (AmJ Public Health. 2023;113(1 ):30-34. <https://doi.org/10.2105/AJPH.2022.307110>)

Winter Storm "Uri" included three arctic fronts that swept across the state of Texas from February 10 through 20, 2021. Treating Uri as a natural intervention, we examine sociodemographic disparities in power and water outage durations associated with the storm.

### INTERVENTION AND IMPLEMENTATION

We treat Uri as a natural intervention because it triggered major societal disruptions. As numerous counties faced extreme low temperatures, 10 million people lost access to electricity<sup>1</sup> because electricity and gas systems were insufficiently winterized, the major electric grid operator (i.e., Electric Reliability Council of Texas) was isolated from the national grid and unable to import power, and some power plants were out of service for planned maintenance.<sup>2</sup> One study inferred that 69% of Texans went without power and 49% went without running water.<sup>3</sup> Power outage conditions directly caused 210 deaths (e.g., from carbon monoxide poisoning); when indirect causes are included, Uri led to an estimated 700 deaths.<sup>2</sup> Texas incurred \$130 billion in economic losses as a result of the storm.<sup>1</sup> To understand the unequal effects of this event, we conducted a 35-minute telephone survey in English and Spanish across eight Texas metropolitan statistical areas in July 2021.

### PLACE, TIME, AND PERSONS

The survey was administered to randomly selected residents 18 years or older in counties representing the following Texas metropolitan statistical areas: Dallas-Fort Worth, Houston, San Antonio, Austin, McAllen, El Paso, Beaumont-Port Arthur, and Lubbock (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>). The sampling frame was proportionally weighted according to the population (n51964). Of

1764 eligible respondents contacted, 896 (50.8%) completed the survey. We excluded 143 respondents who did not complete survey items used to construct three or more of our analysis variables, leaving a final sample size of 753. We collected data on sociodemographic characteristics (independent variables) and the durations of power and water outages (in hours) associated with the storm, the latter two of which we analyzed as dependent variables. Descriptive statistics for all variables are shown in Table 1. To analyze the data, we used multiple imputation to address missing values and then employed our multiply imputed data in multivariable generalized estimating equation models. **PURPOSE**

It is important to study events such as Uri because they cause power<sup>4,5</sup> and water<sup>6,7</sup> outages, which pose serious risks to public health. Disasters tend to disproportionately affect socially disadvantaged communities that lack resources to stay safe and recover quickly.<sup>8</sup> Because of the lack of outage data, few published studies have examined inequities in power and water outages. During Uri, an ecological analysis revealed that Texas counties with more severe power outages had greater concentrations of Hispanic residents.<sup>2</sup> A report on an Internet survey conducted after Uri showed minimal differences in reported outage durations between racial/ethnic groups<sup>3</sup> but lacked statistical testing and examination of other covariates. Another report showed that one tenth of the population in predominantly White areas suffered a nighttime blackout during Uri, as compared with one half in areas with large concentrations of racial/ ethnic minority residents.<sup>9</sup> Our survey data provide a unique basis for statistically examining household-level inequalities in the self-reported durations of both power and water outages during Uri. We addressed the following question: How were sociodemographic characteristics associated with the duration of basic service outages during Uri across the eight Texas metropolitan areas assessed?

#### **EVALUATION AND ADVERSE EFFECTS**

Observed means for power and water loss durations were 42 hours and 33 hours, respectively. In the multivariable generalized estimating equation models, being Black, having children, and renting one's residence were associated with longer power outages; being Black was associated with longer water outages (all  $P$ s  $< .05$ ; Table 2). To determine how much longer, we used the models in Table 2 to calculate estimated marginal means. In contrast to observed means (Table 1), estimated marginal means adjust for covariates (i.e., all other variables held at their observed means) and multivariable model specifications (Table 2). The model for power outage duration predicted 58.6 hours versus 34.8 hours for Black versus non-Hispanic White householders, 45.7 hours versus 34.3 hours for households with children versus those without, and 41.4 hours versus 32.1 hours for renters versus owners. For water outage duration, the model predicted 57.0 hours versus 31.6 hours for Black versus non-Hispanic White householders.

These significant findings were robust according to sensitivity analyses of multiply imputed data for all cases ( $n=5896$ ; Table A, available as a supplement to the online version of this article at <http://www.ajph.org>), cases with complete data only ( $n=5699$ ; Table B, available as a supplement to the online version of this article at <http://www.ajph.org>), and cases without outlier dependent variable values ( $n=5746$  and  $n=5743$ ; Table C, available as a supplement to the online version of this article at <http://www.ajph.org>). The only exceptions, when comparing the sensitivity analyses to the Table 2 findings, were the renter status-longer power outage finding becoming statistically nonsignificant (Tables B and C); Electric Reliability Council of Texas grid, public housing residence, and being US born becoming statistically significant for longer power outages (Table C); and renter status becoming statistically significant for longer water outages (Table C).

In terms of limitations, survey data were collected five months after the event, which could have led to recall bias. We do not know whether there was nonresponse bias in the sample. In addition, we did not model locations of critical facilities, the presence of which reduced the chance of blackouts by approximately 6% during Uri.<sup>9</sup>

#### **SUSTAINABILITY**

Research on social disparities associated with events such as Uri is important and should be prioritized. Because of climate change<sup>10</sup> and the public health effects of service outages,<sup>4-7</sup> Uri should serve as a bellwether nationwide. Black householders, householders with children, and renters experienced disproportionately longer outages and should be targeted with public health interventions, including provision of bottled water, small grants to purchase

food, and blankets and warm jackets (especially when cold weather occurs in warm climates<sup>11</sup>). At a societal level, improving infrastructure systems to withstand extreme weather and equitably protect residents is of utmost public health importance.

#### PUBLIC HEALTH SIGNIFICANCE

Whereas previous research has highlighted disparities in power outages in minority areas<sup>9</sup> and Hispanic areas<sup>2</sup> in Texas during Uri, we found power outages of significantly longer durations for Black households. Households with children and renters also reported longer power outages. During a winter storm, power outages lead to relatively cold indoor temperatures, and cold is a leading cause of mortality; the attributable mortality rate in the United States for cold temperatures is an order of magnitude larger than it is for high temperatures.<sup>12</sup> Long-duration power and water outages are stressful for households as toilets cannot be flushed and lights cannot be turned on; furthermore, there are substantial economic costs associated with replacing food and buying bottled water. These stressors disproportionately affected Black householders, householders with children, and renters after Uri.

Gastrointestinal issues are a health risk associated with basic service outages. Black households likely faced increased risks of gastrointestinal issues after Uri because of their longer power and water outage durations relative to White households. One study showed that adolescents and adults with diarrhea after a daylong power outage in New York City were more than 2.5 times as likely as those without diarrhea to have consumed seafood and meats.<sup>4</sup> Although the Centers for Disease Control and Prevention recommends avoiding refrigerated food once power outages exceed four hours, that time window stretches to 24 to 48 hours for half-full and full freezers. Black households' outages exceeded the 48-hour window during which food would still be edible, whereas White households' outages did not.

In addition, a systematic review revealed that gastrointestinal issues are associated with longer versus shorter water outages because pipes become increasingly vulnerable to backflow and intrusion.<sup>6</sup> This implies that Black households likely faced higher risks of gastrointestinal issues than White households after Uri because of the disproportionately longer outages they endured.

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#### PUBLICATION INFORMATION

Full Citation: Grineski SE, Collins TW, Chakraborty J, Goodwin E, Aun J, Ramos KD. Social disparities in the duration of power and piped water outages in Texas after Winter Storm Uri. *Am J Public Health*. 2023;113(1):30-34. Acceptance Date: August 29, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307110>

#### CONTRIBUTORS

S. E. Grineski conceptualized and conducted the statistical analysis and wrote the first draft of the article. T.W. Collins and J. Chakraborty advised on the study design and statistical analysis and contributed to the writing of the article. E. Goodwin, J. Aun, and K.D. Ramos prepared the non-survey-based data for the project and contributed to the writing of the article. S. E. Grineski, T.W. Collins, and J. Chakraborty obtained the funding for the project.

#### ACKNOWLEDGMENTS

This article is based on work supported by the National Science Foundation under grants CMMI-2127941 and CMMI-2127932, and the National Institute of Environmental Health Sciences under award R25 ES031497.

We gratefully acknowledge the survey participants for taking the time to be part of our study.

#### CONFLICTS OF INTEREST

The authors report no conflicts of interest.

#### HUMAN PARTICIPANT PROTECTION

This project was declared exempt by the institutional review boards of the University of Utah and the University of Texas at El Paso as per exemption category 2.

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#### DETAILS

**Subject:** Climate change; Extreme weather; Cold; Blackouts; Food; Health services; Intervention; Telephone surveys; Health risks; Racial differences; Hispanic Americans; Minority & ethnic groups; Winter; Outages; Sociodemographics; Variables; Public health; Winter storms; Sociology; Water supply; Households



<b>Location:</b>	Texas; United States--US
<b>Company / organization:</b>	Name: University of Utah; NAICS: 611310; Name: Electric Reliability Council of Texas; NAICS: 221122
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	30-34
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307110">https://doi.org/10.2105/AJPH.2022.307110</a>
<b>ProQuest document ID:</b>	2760580667
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/social-disparities-duration-power-piped-water/docview/2760580667/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/social-disparities-duration-power-piped-water/docview/2760580667/se-2?accountid=211160</a>
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<b>Last updated:</b>	2023-03-01
<b>Database:</b>	Public Health Database

# Effect of the COVID-19 Global Pandemic on Illinois Children Tested for Blood Lead Level and Exposure

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## ABSTRACT (ENGLISH)

**Objectives.** To determine whether the number of children tested for lead exposure and the number of case rates increased (rate ratio [RR] >1), decreased (RR < 1), or remained stable (RR = 1) during COVID-19 pandemic year 2020 compared with prepandemic year 2019. **Methods.** We analyzed more than 415 000 children's records reported to the Illinois Department of Public Health in 2019 and 2020 by demographic characteristics. The testing rate was the number of children tested yearly per population. The case rate was the proportion of children whose yearly tests showed a blood lead level of 5 or more micrograms per deciliter. RR was the 2020 case rate divided by the 2019 case rate. **Results.** In 2020, 19.6% of children were tested for lead compared with 25.5% in 2019. Testing decreased in 97% of counties. The 24% decreased testing in 2020 was notably in African Americans (36.4% decrease), high-risk zip codes (29.8% decrease), and rural counties (26.9% decrease). Case rates increased in rural counties, high-risk zip codes, Whites, and Hispanics. **Conclusions.** During pandemic year 2020, the number of children tested for lead decreased by 24%, and case rates increased in 51% of counties.

## FULL TEXT

### Headnote

**Objectives.** To determine whether the number of children tested for lead exposure and the number of case rates increased (rate ratio [RR] >1), decreased (RR < 1), or remained stable (RR = 1) during COVID-19 pandemic year 2020 compared with prepandemic year 2019.

**Methods.** We analyzed more than 415 000 children's records reported to the Illinois Department of Public Health in 2019 and 2020 by demographic characteristics. The testing rate was the number of children tested yearly per population. The case rate was the proportion of children whose yearly tests showed a blood lead level of 5 or more micrograms per deciliter. RR was the 2020 case rate divided by the 2019 case rate.

**Results.** In 2020, 19.6% of children were tested for lead compared with 25.5% in 2019. Testing decreased in 97% of counties. The 24% decreased testing in 2020 was notably in African Americans (36.4% decrease), high-risk zip codes (29.8% decrease), and rural counties (26.9% decrease). Case rates increased in rural counties, high-risk zip codes, Whites, and Hispanics.

**Conclusions.** During pandemic year 2020, the number of children tested for lead decreased by 24%, and case rates increased in 51% of counties.

**Public Health Implications.** Redesignation of high-risk zip codes is recommended to increase the testing of at-risk populations. (Am J Public Health. 2023;113(1):89-95. <https://doi.org/10.2105/AJPH.2022.307109>)

Lead is a neurotoxin,<sup>1</sup> and there is no safe level of lead in the body. Lead exposure is one of the most prevalent, yet preventable environmental health hazards and can affect any family regardless of socioeconomic status. The damaging health effects lead exposure causes are irreversible. Childhood lead exposure contributes to learning disabilities, developmental delays, and behavioral problems.<sup>2</sup> The percentage of Illinois children whose tests showed lead in their blood remains among the highest in the nation.<sup>3</sup> The mission of the Illinois Lead Program is to eliminate lead exposure. One goal of the Illinois Lead Program is to identify children exposed to lead and provide prompt interventions to improve health and developmental outcomes.<sup>4</sup> Only a blood test can ascertain exposure to lead. Illinois law requires that all blood lead tests be reported to the Illinois Department of Public Health (IDPH).<sup>5</sup> In

2019, Illinois adopted a blood lead level (BLL) of 5 or more micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) as the new public health intervention level. Intervention is initiated when a BLL of 5 or more  $\mu\text{g}/\text{dL}$  is confirmed via venipuncture.<sup>5</sup>

On March 11, 2020, the World Health Organization declared COVID-19—with its potential for causing severe respiratory distress, fever, and cough, which could be fatal—a global pandemic.<sup>6,7</sup> Stay-at-home orders and social distance mitigations were implemented statewide to reduce multiplication of the virus.<sup>8</sup> As COVID-19 spread, multiple levels and phases of public health interventions likely influenced lead testing across 2020.

The Centers for Disease Control and Prevention (CDC) reported that, throughout the United States, fewer children were tested for lead exposure in the months following the declaration of the COVID-19 pandemic than in 2019.<sup>9</sup> However, the CDC report did not include the effect of the pandemic on the proportion of children whose tests demonstrated BLLs high enough to qualify for public health intervention (i.e., case rates) or these children's demographic characteristics.

We sought to determine whether the number of children tested and the proportion of tested children with confirmed BLLs of 5 or more  $\mu\text{g}/\text{dL}$  (case rates) increased, decreased, or remained stable during the COVID-19 pandemic year of 2020 compared with the prepandemic year 2019 among children younger than 6 years at time of blood test, by selected demographic characteristics.

## METHODS

Illinois adapted the CDC-sponsored, Healthy Housing and Lead Poisoning Surveillance System as its blood lead-tracking application and management platform in 2017. This centralized Web-based system provides direct access to blood lead test results and collaboration between the IDPH and local health departments around the state. The structured query language system provides tools for the Illinois Lead Program to track and manage blood lead surveillance, testing location, environmental investigations, abatement, mitigation, and case management activities.<sup>10</sup>

### Blood Lead Tests

We analyzed more than 415 000 blood lead tests that had been reported to the IDPH of children younger than 6 years that were collected between January 2019 and December 2020 in Illinois. Blood lead is collected via venous (venipuncture) or capillary (fingerstick) methodology. Hospitals, local health departments, laboratories, and medical professionals perform blood lead analyses and evaluate, diagnose, and treat lead-exposed children. A capillary BLL of 5 or more  $\mu\text{g}/\text{dL}$  is required to be confirmed with a venipuncture draw sent to a certified reference laboratory. Public health intervention was initiated when a child tested positive with a BLL of 5 or more  $\mu\text{g}/\text{dL}$ .

Illinois law requires all licensed, registered, or approved health care facility serving children younger than 6 years to ensure that children are evaluated for risk, tested for lead exposure, or both.<sup>5</sup> Furthermore, health care providers, hospital administrators, public health officers, and directors of clinical laboratories who have verified information of the existence of a blood lead test result for any child must report the result to the IDPH.

Illinois law requires any BLL of 5 or more  $\mu\text{g}/\text{dL}$  to be reported to the IDPH within 48 hours after analysis. All other blood lead test results ( $< 5 \mu\text{g}/\text{dL}$ ) must be reported to the IDPH no later than 30 days following the last day of the month in which the test results were analyzed.<sup>5</sup>

All children younger than 6 years are required to be evaluated for lead exposure risks by their physician and tested if necessary. Illinois recommends that all children be evaluated or tested as indicated at ages 12 and 24 months and 3, 4, 5, and 6 years according to the Childhood Lead Risk Questionnaire.<sup>11</sup> The case manager assigned to the child's case, along with the medical provider, should discuss the importance of regular blood lead testing and continue to monitor the child's follow-up BLLs. The recommended follow-up schedule for repeat testing ranges from within 1 week for BLL of 45 or more  $\mu\text{g}/\text{dL}$  to 3 months for BLL of 5 to 14  $\mu\text{g}/\text{dL}$ .<sup>11</sup> State and federal mandates require all children enrolled in Medicaid programs to be tested for lead exposure regardless of where they live.<sup>12,13</sup>

**Rural and Urban Areas**  
Of the 102 Illinois counties, 83 are predominantly rural. Rural areas are not part of a metropolitan statistical area or are part of a metropolitan statistical area with a population of less than 60 000.<sup>14,15</sup> Urban areas include 18 counties and the city of Chicago, where 22% of Illinois children reside.

## High-Risk Zip Codes

Illinois law requires the IDPH to designate areas of the state where children are at highest risk for lead exposure.<sup>5</sup> Of Illinois' more than 1500 zip codes, 581 are designated as high risk so they have mandated lead testing requirements. High-risk zip codes are designated based on socioeconomic status and proportion of pre-1978 housing units with lead-based paint prevalence or hazards.<sup>16</sup> We obtained the number of pre-1978 housing units from US Census 2020 data.<sup>14</sup> We adapted the prevalence of lead in housing units from the American Healthy Homes Survey.<sup>17</sup>

## Data Analyses

We conducted a retrospective comparative analysis of children tested for blood lead during prepandemic year 2019 and pandemic year 2020, stratified by demographic characteristics. We determined that changes in the number of children tested, testing rates, case rates, and rate ratios (RRs) occurred from all childhood blood lead records reported to the IDPH. We calculated testing rate as the number of children tested for lead in blood yearly (numerator) divided by the population of children according to the US Census 2020 (denominator) expressed as percentages. Case rate refers to the proportion of children tested with a confirmed BLL of 5 or more  $\mu\text{g}/\text{dL}$  per year. RR expressed as 2020 case rate divided by 2019 case rate indicated an increased ( $\text{RR} > 1$ ), decreased ( $\text{RR} < 1$ ), or stable ( $\text{RR} \approx 1$ ) case rate in pandemic year 2020 compared with 2019. Illinois law requires that any IDPH release of data to the public be done in aggregate form to eliminate disclosure conflicts with state or federal laws regarding personal health information.<sup>5</sup>

We categorized results by county of residence, rural versus urban county designation, high-risk versus low-risk zip codes for lead exposure, age, sex, race, and ethnicity. Year was a key analytic variable. We counted a child only once in a year if the child had multiple tests. Any capillary BLL of 5 or more  $\mu\text{g}/\text{dL}$  had to be confirmed through a venous test. We considered only venous BLLs of 5 or more  $\mu\text{g}/\text{dL}$  as confirmed results for the detection of case rates. We selected the highest venous result per child per year as a confirmatory test. We used the  $\chi^2$  test to analyze differences in testing and case rates by categorical variables ( $\alpha = 0.05$ ). We considered  $P < .05$  as statistically significant. We conducted the statistical analyses using SAS version 9.4 (SAS Institute, Cary, NC).

## RESULTS

We found decreases in the testing rate and the case rate following the declaration of COVID-19 as a global pandemic in 2020.

### Number Tested in 2020

A total of 228 614 and 173 204 Illinois children were tested for blood lead in 2019 and 2020, respectively. Among approximately 900 000 children younger than 6 years residing in Illinois, 25.5% were tested for lead in 2019 compared with 19.6% in 2020. Approximately 55 000 fewer children were tested in 2020 than in 2019, indicating a 24% decrease. Testing rate by sex was similar for boys and girls in 2019 and 2020, although approximately 5% more boys are tested on a yearly basis. Based on age, a substantial decrease in testing ranged from 18.5% for children aged 1 year to 33.1% for children aged 4 years. The largest decline in testing rate was recorded for non-Hispanic Black and African American children (36.4%), a nearly 50% higher decrease compared with non-Hispanic White or Latino children (Figure 1a). Sixty-four of the 102 Illinois counties (12.5% of which were urban and 87.5% rural) reported a more than 24% decrease in children tested. The decrease in testing was substantial, particularly in the southern and western parts of Illinois. High-risk zip code areas saw significant declines in testing (29.8%) compared with a 22.9% decrease in the rest of the state. Three of the 102 counties showed increased testing during the pandemic year 2020 (Figure 2).

### Case Rates

The number of Illinois children tested with a confirmed BLL of 5 or more  $\mu\text{g}/\text{dL}$  was 27% less in 2020 than in 2019. The Illinois case rate decreased to 1.7% in pandemic year 2020 compared with 1.8% in 2019. However, case rates increased ( $\text{RR} > 1$ ) in 2020 for children residing in rural counties or high-risk zip codes and for non-Hispanic Whites and Hispanics and Latinos compared with prepandemic year 2019 (Figure 1b). Case rates remained stable ( $\text{RR} \approx 1$ ) for children residing outside Chicago, children younger than 3 years, and girls. Conversely, case rates decreased

(RR <1) for Illinois as a whole, Chicago, urban counties, low-risk zip codes, boys, children aged 3 or 4 years, Black and African American individuals, and Asians.

At the county level, case rates fluctuated between pandemic and prepandemic periods. In 2020, based on 102 counties of residence, case rates increased (51%), decreased (41%), or remained stable (8%) compared with prepandemic year 2019. Counties with these various shifts were dispersed across the state. Of the 51% counties with increased case rates, 81% were rural and 19% were urban. The 41% of counties with decreased case rates were 83% rural and 17% urban (Figure 2).

## DISCUSSION

The results of this work showed a 24% decrease in testing rate and a decrease in overall case rate in pandemic year 2020 compared with prepandemic year 2019.

As previously stated, Illinois law<sup>5</sup> requires physicians licensed to practice medicine in Illinois and health care providers who see or treat children to test those children for lead exposure when they reside in or frequently visit a high-risk area. Children residing in areas the IDPH defines as low risk are evaluated using the Childhood Lead Risk Questionnaire, <sup>11</sup> and if they are determined to be at potential risk for lead exposure, they must receive a blood lead test. This evaluation is to be performed annually during a well-child visit or physical checkup.

Recent trends indicate that blood lead testing has been steadily declining at a rate of 4% nationally.<sup>18</sup> The 24% decrease in the testing rate in 2020 compared with that of 2019 was significant compared with decreases in preceding years. The largest decrease in the number of children tested occurred during the 6 months following the declaration of the COVID-19 pandemic, when the strictest COVID-19 mitigations were in place.<sup>8</sup> Illinois recorded a 38% decrease in testing in those months compared with a 34% decrease nationally per the CDC.<sup>9</sup> In addition to the long-term trend, stay-at-home orders and travel restrictions hindered routine medical care, including testing for elevated BLLs. Also, during the COVID-19 surges in 2020, physicians performed remote medical visits, making lead testing during a well-child visit impossible.

In 1 case, a county with 74% pre- 1978 housing units experienced a 46% decrease in the number of children tested during the pandemic. Quarterly reports sent to the IDPH from that county's local health department stated that lead testing decreased during the pandemic because immunization and Special Supplemental Nutrition Program for Women, Infants, and Children clinics were closed. Moreover, collaborations with health care providers and school nurses were limited to telephone interactions.

In February 2019, Illinois adopted a BLL of 5 or more  $\mu\text{g}/\text{dL}$  as the minimum level requiring the initiation of public health intervention, limiting our study to 2019 and later. Based on environmental inspection findings, the most common cause of lead in blood in Illinois children is exposure to lead paint and dust found in older housing. Approximately 65% of the state's housing units were built before 1978, the year lead paint was banned. The New York Times described lead exposure as a COVID-19 side effect owing to the lockdown.<sup>19</sup> Children spent more time at home during the pandemic. Some families and homeowners performed home renovations with minimal safety precautions, increasing the risk of lead exposure. However, because of decreased testing, fewer children were identified with lead in blood.

High-risk zip codes are found throughout Illinois, especially in the western portion of the state and a cluster in Cook County. Our most concerning findings were decreased lead testing rates and increased case rates in 52 counties, especially among children residing in designated high-risk zip codes. The risk consideration is that Medicaid-supported children are more likely to live in poorly maintained homes in high-risk zip codes.<sup>12,13</sup>

Our study supports a CDC study that reported a decrease in the number of children tested for blood lead during the COVID-19 pandemic.<sup>9</sup> Additionally, our study expanded on the CDC analysis to include demographic stratifications and case rates. The reduced number of tests and increased case rates may be partially attributable to different populations, as children previously tested with BLLs of less than 5  $\mu\text{g}/\text{dL}$  were probably not tested the following year. Children spent more time at home, and most untested children resided in high-risk zip codes. Fewer children were tested for blood lead in pandemic year 2020, and case rates increased in children residing in rural counties or high-risk zip codes and among non- Hispanic White and Hispanic children.

## Limitations

We used only BLLs of 5 or more  $\mu\text{g}/\text{dL}$  obtained by venipuncture to compute case rates. Many providers use LeadCare II point-of-care analyzers to test using finger-stick blood draws. In July 2021, Magellan recalled LeadCare II analytical components manufactured between October 2020 and June 2021 because of the potential for falsenegative results.<sup>20</sup> Children whose blood was analyzed with LeadCare II units during the last 3 months of 2020 may have obtained a false-negative diagnosis, resulting in underestimated case rates for 2020.

## Public Health Implications

In addition to elimination strategies and regulations established by the IDPH, reevaluation of high-risk zip codes for lead exposure is recommended for increasing the testing of targeted at-risk populations. Strategies to increase testing could include additional health care providers, enhanced remote medical care, and fortified support of programs with reduced capacity. If there is a policy recommendation for universal testing by age, there needs to be a funding mechanism to ensure that all children receive tests at no charge.

## Conclusions

The number of Illinois children tested for blood lead decreased by 24% following the declaration of the COVID-19 global pandemic in 2020. The decreased testing was most marked for African Americans, for those in designated high-risk zip codes, and for those in rural counties. Case rates increased for children residing in rural counties or high-risk zip codes and for non-Hispanic Whites and Hispanics or Latinos compared with prepandemic year 2019.

## ABOUT THE AUTHORS

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## PUBLICATION INFORMATION

Full Citation: Fokum FD, Entezar T, McAfee K. Effect of the COVID-19 global pandemic on Illinois children tested for blood lead level and exposure. *Am J Public Health*. 2023;113(1):89-95.

Acceptance Date: August 29, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307109>

## CONTRIBUTORS

F. D. Fokum conceptualized and designed the study and the study methodology, analyzed and interpreted the data, wrote the first draft of the article, and revised the article after reviewer and editor comments. T. Entezar created the map using ArcGIS. T. Entezar and K. McAfee reviewed the first draft of the article. K. McAfee supervised the study and revised and approved the final version of the article.

## ACKNOWLEDGMENTS

Funding for the Illinois Lead Program was provided by the Centers for Disease Control and Prevention (grant FAIN-NUE2EH001412), the US Environmental Protection Agency (grant FAIN-00E31611 BG), the Illinois Lead Poisoning Screening, Prevention, and Abatement Fund, and the Illinois State General Revenue Funds.

This research is part of the Illinois Department of Public Health's surveillance project. We thank Gerrin CheekButler, deputy director, Office of Health Protection, and the Illinois Lead Program Team, Andrew Stewart, Darla Hamende, Helen Wright, Cari Roger, Aubrey Dove, Jenn Kennett, and Sai Prahitha Arra (intern), for general review of the report.

Note. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

## CONFLICTS OF INTEREST

We have no potential or actual conflicts of interest to disclose.

## HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because we have reported only aggregated data, per Illinois statute.

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## DETAILS

<b>Subject:</b>	Pandemics; Laboratories; Blood; Socioeconomic factors; Minority & ethnic groups; Public health; COVID-19; Public health departments; Counties; Blood levels; African Americans; Lead; Children; Latin American cultural groups; Lead poisoning
<b>Location:</b>	United States--US; Illinois
<b>Company / organization:</b>	Name: Department of Public Health-Illinois; NAICS: 923120
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	89-95
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307109">https://doi.org/10.2105/AJPH.2022.307109</a>



ProQuest document ID: 2760580658

Document URL: <https://www.proquest.com/scholarly-journals/effect-covid-19-global-pandemic-on-illinois/docview/2760580658/se-2?accountid=211160>

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Last updated: 2023-03-01

Database: Public Health Database

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# Rethinking "Herd" Mentalities and Rethinking the Value of the History of Public Health

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## ABSTRACT (ENGLISH)

While public health practitioners have decried the misplaced popular use of terms such as endemicity, historians, philosophers, and sociologists of science have not been entirely surprised, though they, too, sought flat-footed ways of theorizing the pandemic in early 2020.<sup>2</sup> Endemicity is only the latest wedge in the cultural milieu of epidemic negotiations between science and society and suggests that now, more than ever, we collectively need a more nuanced understanding of the history of disease concepts in epidemiology and public health. [...] Anderson's essay does much more, penetrating into the heart of the history of the modern discipline of epidemiology to show how the concept of herd immunity emerged in early 20th century Britain and was deeply imbued with ideas not just from ecology and veterinary medicine, the obvious link to the concept of "herd," but also from social psychology, particularly the notion of altruism. Devoid of incoherent neologism and denying a familiar approach to the history of epidemiology that ignores complexity and embraces heroic "founders" and "moments," Anderson's approach is a stark reminder that we need to dramatically rethink the value of the history of epidemiology in public discussion and in public health practice today.

## FULL TEXT

The COVID-19 pandemic continues to reveal the uneasy ways in which the public co-opts epidemiological terms about the incidence and spread of disease-sometimes unknowingly and unwittingly, sometimes nefariously. The latest social variant of this infectious cultural trait is the term "endemic," which started to appear in popular discourse in late 2021 and gained steam in the first half of 2022. To politicians, the mainstream media, and many everyday people, reframing COVID-19 as endemic was a linguistic and rhetorical magic bullet that might bring some relief. The pandemic could be relabeled, they believed, as something less virulent, less deadly. Or at least as something that was not talked about as much.

### THE "PUBLIC VIEW" OF PUBLIC HEALTH

In the past few months, the term endemic has come to equate to normalcy, but not without significant pushback. Professional epidemiologists, evolutionary biologists, and historians of epidemiology, myself included, have

cautioned against the endemic framing of COVID-19 on two fronts. On one hand, the global epidemiological data on the disease do not indicate a shift to widely regarded definitions of endemicity. The term endemicity also has colonial roots of being a tool to assign moral blame to the Global South and absolve governmental responsibility of pandemic preparedness and response.<sup>1</sup> Endemicity, in other words, is a shifty and shifting term, one with a powerful history. While public health practitioners have decried the misplaced popular use of terms such as endemicity, historians, philosophers, and sociologists of science have not been entirely surprised, though they, too, sought flat-footed ways of theorizing the pandemic in early 2020.<sup>2</sup> Endemicity is only the latest wedge in the cultural milieu of epidemic negotiations between science and society and suggests that now, more than ever, we collectively need a more nuanced understanding of the history of disease concepts in epidemiology and public health. Early in the COVID-19 pandemic, both the public and public health practitioners turned to the history of past pandemics, particularly the 1918-1919 influenza pandemic. Some hoped to find, in this shallow leveling of past and present, patterns and structures to use in real-time health policy, while others, I am convinced, turned to the past for pandemic therapy. Most quickly lost interest.

#### THE SOCIAL ORIGINS OF "HERD IMMUNITY"

Much more fruitful is the rich historical analysis provided by Warwick Anderson in a recently published essay for AJPH's "Then and Now" section, titled, "Immunities of the Herd in Peace, War, and COVID-19."<sup>3</sup> In this provocative piece, Anderson calls for a rethinking of a ubiquitous and contentious term used during the past two and a half years—"herd immunity." Wielded early in the COVID-19 pandemic by libertarian groups and some far-right politicians in the Global North, pursuing herd immunity meant minimal governmental containment strategies, which would elicit herd immunity in populations through natural infection. As Anderson shows, there was significant pushback to the notion of herd immunity in the first half of 2020, particularly from scientists and public health officials who called the strategy, as virologist William Haseltine implored, "another word for mass murder."<sup>4</sup>

Reading Anderson's essay reminds us that the collective trauma of the past two years means that most of us have forgotten the intensity of the debate around herd immunity in 2020. This alone makes the essay a significant contribution to AJPH. But Anderson's essay does much more, penetrating into the heart of the history of the modern discipline of epidemiology to show how the concept of herd immunity emerged in early 20th century Britain and was deeply imbued with ideas not just from ecology and veterinary medicine, the obvious link to the concept of "herd," but also from social psychology, particularly the notion of altruism.

The term herd immunity was coined in 1923 by British experimental epidemiologists W.W.C. Topley and G.S. Wilson and further developed by Sheldon F. Dudley's studies of communal immunity in schoolchildren, as Anderson traces in the essay. But the term did not just emerge out of changes in academic epidemiology in the 1920s and 1930s. Instead, it borrowed from the social sciences, particularly William Trotter's theories of altruism. Herd immunity, Anderson demonstrates, meant almost the opposite in the mid-20th century to how it was weaponized in early 2020.

#### WHAT CAN THE HISTORY OF EPIDEMIOLOGY OFFER?

Anderson's powerful essay is the kind of analysis and insight that will arm readers of AJPH with the tools for understanding and engaging with the history of epidemiology in public discourse. Devoid of incoherent neologism and denying a familiar approach to the history of epidemiology that ignores complexity and embraces heroic "founders" and "moments," Anderson's approach is a stark reminder that we need to dramatically rethink the value of the history of epidemiology in public discussion and in public health practice today. This is particularly true of the rich and complicated set of developments in professional Anglo-American epidemiology that occurred in the first half of the 20th century. The fairytale histories of epidemiology routinely taught in undergraduate textbooks and classrooms serve mostly to reify what Olga Amsterdamska called "demarcating" the professional boundaries of epidemiology.<sup>5</sup> As Anderson's essay suggests, we can, and we should, be doing a lot more than disciplinary policing.

The COVID-19 pandemic has thrown professional epidemiologists and the discipline of epidemiology into the public spotlight in ways few could have predicted before January 2020. In the process, it has also revealed the dangerous ways with which the public employs epidemiological terms and the uneasiness with which popular ideas persist in

the history of the field. Anderson's foray into the past and present—the "Then and Now" at the heart of AJPH—of herd immunity will hopefully inspire further rethinking of the history of epidemiology and, in the process, help us to more effectively communicate the key concepts of epidemiology to broad public audiences and policymakers.

#### CORRESPONDENCE

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#### PUBLICATION INFORMATION

Full Citation: Steere-Williams J. Rethinking "herd" mentalities and rethinking the value of the history of public health. *Am J Public Health*. 2023;113(1): 20-21.

Acceptance Date: October 4, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307148>

#### ACKNOWLEDGMENTS

I wish to thank the editors of AJPH for their encouragement and editorial suggestions, and Professor Warwick Anderson for his engagement with the history of epidemiology.

#### CONFLICTS OF INTEREST

There are no conflicts of interest to report.

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#### DETAILS

**Subject:** Epidemiology; COVID-19; Pandemics; Coronaviruses; Epidemics; Psychology; Social psychology; Public health; Philosophers; Veterinary medicine; Historians; Altruism; Mental health; Herd immunity; History; Ecology

**Business indexing term:** Industry: 92312 : Administration of Public Health Programs

**People:** Anderson, Warwick Hugh

**Classification:** 92312: Administration of Public Health Programs

<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	20-21
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>ProQuest document ID:</b>	2760580572
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/rethinking-herd-mentalities-value-history-public/docview/2760580572/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/rethinking-herd-mentalities-value-history-public/docview/2760580572/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-08-31
<b>Database:</b>	Public Health Database

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# Adaptive Interventions for a Dynamic and Responsive Public Health Approach

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## ABSTRACT (ENGLISH)

Wang and Chakraborty's article in this issue of AJPH (p. 49) provides a fantastic summary of developments in the design and analysis of sequential, multiple-assignment randomized trials (SMARTs), alongside examples in which these trials can be used to improve infectious disease control. Sequentially randomized trials are powerful tools for developing evidencebased interventions that can adapt to individuals' changing needs overtime. In this comment, I focus on adaptive interventions themselves, separated from a study design, to advocate for their increased development and dissemination not only in infectious disease research, but in public health more broadly. Fundamentally, SMARTs are tools that allow for the development of high-quality adaptive interventions (also commonly called dynamic treatment regimens or adaptive treatment strategies). Adaptive interventions are sequences of decision rules that map ongoing information about individuals, clinics, geographical areas, or other types of treated units onto recommendations for subsequent treatment.<sup>1</sup> In this way, adaptive interventions operationalize real-life clinical and public health practice. Highquality adaptive interventions provide principled guidance on how to modify an intervention when and for whom it is necessary. Critically, an adaptive intervention is a fixed sequence of recommendations that guide treatment decisions: it is an intervention design, whereas a SMART is a study design that can answer questions about the development of adaptive interventions. Questions about how to construct an effective adaptive intervention take many forms. They can be as simple as, "How should we initiate treatment to maximize effectiveness?", "How should we modify treatment for units for which the initial intervention does not work?", or "Should we provide a maintenance intervention for those units that responded well to the initial treatment, or just watch and wait?" Other questions might be about how to identify individuals or units whose first-stage treatment should be modified, or how long one should wait before treatment modification. Fundamentally, these are questions about bundling interventions in sequences that recognize and leverage treatment effect heterogeneity to achieve better public health outcomes.

## FULL TEXT

Wang and Chakraborty's article in this issue of AJPH (p. 49) provides a fantastic summary of developments in the design and analysis of sequential, multiple-assignment randomized trials (SMARTs), alongside examples in which these trials can be used to improve infectious disease control. Sequentially randomized trials are powerful tools for developing evidencebased interventions that can adapt to individuals' changing needs overtime. In this comment, I focus on adaptive interventions themselves, separated from a study design, to advocate for their increased development and dissemination not only in infectious disease research, but in public health more broadly. Fundamentally, SMARTs are tools that allow for the development of high-quality adaptive interventions (also commonly called dynamic treatment regimens or adaptive treatment strategies). Adaptive interventions are sequences of decision rules that map ongoing information about individuals, clinics, geographical areas, or other types of treated units onto recommendations for subsequent treatment.<sup>1</sup> In this way, adaptive interventions operationalize real-life clinical and public health practice. Highquality adaptive interventions provide principled guidance on how to modify an intervention when and for whom it is necessary. Critically, an adaptive intervention is a fixed sequence of recommendations that guide treatment decisions: it is an intervention design, whereas a SMART is a study design that can answer questions about the development of adaptive interventions. Questions about how to construct an effective adaptive intervention take many forms. They can be as simple as, "How should we initiate treatment to maximize effectiveness?", "How should we modify treatment for units for which the initial intervention does not work?", or "Should we provide a maintenance intervention for those units that responded well to the initial treatment, or just watch and wait?" Other questions might be about how to identify individuals or units whose first-stage treatment should be modified, or how long one should wait before treatment modification. Fundamentally, these are questions about bundling interventions in sequences that recognize and

leverage treatment effect heterogeneity to achieve better public health outcomes.<sup>2</sup>

In the malaria SMART discussed by Wang and Chakraborty, the investigators recognize that the dynamic nature of malaria risk, along with rising insecticide resistance, necessitates adaptation: single interventions or standard combinations thereof may not be enough to control malaria in Africa.<sup>3</sup> In this context and many others, treatments that work in one region or for one group of individuals may not work for another, and treatments that work now may not work in the future. This is widely acknowledged, but there is still a dearth of research examining the effects of interventions working in concert with one another- as they do in practice-rather than as stand-alone, one-size-fits-all approaches to treatment.<sup>2</sup> Additionally, the adaptive interventions embedded in this SMART consider cost-effectiveness by reserving expensive interventions like larval source management for those sites where low-cost interventions were insufficient for reducing malaria incidence.

The American Public Health Association believes that equity is at the core of public health.<sup>4</sup> Adaptive interventions are of interest not only because they mimic actual public health practice, but also because they can help improve outcomes for everyone. By explicitly recommending intervention strategies for both responders and nonresponders, adaptive interventions provide a principled "backup plan" for those for whom the initial intervention is insufficient. In the COVID-19 example SMART described by Wang and Chakraborty, the trial design explicitly studies ways to motivate those individuals still unvaccinated after initial outreach.<sup>5</sup> If the trial discovers an effective adaptive intervention, it will be one that has considered the needs of those nonresponding individuals. Single-stage interventions cannot do this.

SMARTs are a powerful tool for addressing open questions about multiple stages of an adaptive intervention. But, as Wang and Chakraborty point out, they are not the only randomized trial design that facilitates research on adaptive interventions.<sup>6</sup> SMARTs are a means to an end: they exist to enable research into questions about adaptive interventions. As with any study design, those scientific questions must come first, and a SMART should only be designed if justified by the science. In some cases, the scientific questions may require a different, possibly simpler, trial design.<sup>7</sup> Additionally, randomization is not always feasible or ethical, in which case a randomized trial cannot be used at all.

In a rapidly evolving infectious disease context, such as the early COVID-19 pandemic, nonexperimental methods for identifying effective treatments and prevention strategies can be crucial. Just as there is a growing literature on methods for constructing adaptive interventions from SMARTs, similar innovation is happening in nonexperimental settings. Through the use of hospital records or data from an epidemiological surveillance system, for example, statistical reinforcement learning methods can be used to discover effective adaptive interventions.<sup>8</sup> These methods rely on natural variation in treatment provision over time to identify adaptive interventions that optimize the outcome of interest, and use causal inference techniques to avoid bias due to confounding.<sup>9</sup> Although SMARTs and other randomized trials remain the gold standard, other approaches to research on adaptive interventions do exist and can be used when randomization is difficult or impossible.

Wang and Chakraborty rightly point out the need for methodological innovations that improve the speed and efficiency of SMARTs. These methods will be critical for the design's adoption in time-sensitive scenarios like evolving epidemics or pandemics. Clusterrandomized SMARTs are likely to be an important tool in developing adaptive interventions for infectious disease control and prevention, just as clusterrandomized single-stage trials are. Adaptive randomization and interim monitoring techniques can help as well by allowing principled on-the-fly changes to the design that increase the number of participants receiving treatment recommendations from an effective adaptive intervention. Bringing in other methods from the singly randomized trial literature, such as covariate adjustment and early stopping procedures, may also help improve the efficiency of SMARTs.

Although development of adaptive interventions has been of growing interest, there remains a sizeable gap between research and practice. SMARTs are frequently described as optimization trials, not confirmatory ones. Indeed, Murphy's seminal 2005 article on SMARTs explicitly says that these trials should be viewed as part of a series of developmental studies leading to a confirmatory trial.<sup>10</sup> To the best of my knowledge, adaptive interventions informed by SMARTs are rarely if ever tested against standard of care in a confirmatory trial, even nearly 20 years

after the design's introduction. Suitable control groups can and have been built into SMARTs by embedding one adaptive intervention that recommends standard of care throughout, but rarely are these trials powered for comparisons of other embedded adaptive interventions against that control. Methods for powering trials for identifying an optimal adaptive intervention exist, but translational work is required to make them accessible to nonstatisticians.<sup>11</sup> Additionally, more attention should be paid to rolling out and scaling up high-quality, evidence-based adaptive interventions; advances in implementation science to support putting these multistage, tailored interventions into practice are needed.

Wang and Chakraborty provide a thorough introduction to SMARTs and their possible use in infectious disease research. Adaptive interventions have the potential to improve outcomes across fields by emphasizing combinations of effective treatments delivered sequentially when and to whom they are needed. Although methodological and implementation challenges remain, adaptive interventions can be powerful, cost-effective tools to promote public health. Wang and Chakraborty have developed an excellent resource for scholars looking to develop adaptive interventions to bring us toward a more dynamic, responsive vision for public health. „4JPU

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#### PUBLICATION INFORMATION

Full Citation: Seewald NJ. Adaptive interventions for a dynamic and responsive public health approach. *Am J Public Health*. 2023;113(1):37-39.

Acceptance Date: October 17, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307157>

#### ACKNOWLEDGMENTS

Research reported in this publication was supported by the National Institute of Mental Health of the National Institutes of Health (award no. P50MH115842).

Note. The contents are solely the responsibility of the author and do not necessarily represent the official views of the National Institutes of Health.

#### CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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## DETAILS

<b>Subject:</b>	Infectious diseases; Malaria; Public health; Intervention; Insecticide resistance; Disease prevention; Health services; Heterogeneity; COVID-19; Pandemics; Randomization; Coronaviruses; Surveillance systems; Disease control; Clinical trials; Design; Rules; Clinics
<b>Business indexing term:</b>	Industry: 92312 : Administration of Public Health Programs
<b>Company / organization:</b>	Name: American Public Health Association; NAICS: 813910
<b>Classification:</b>	92312: Administration of Public Health Programs
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	37-39
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	OPINIONS, IDEAS, & PRACTICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal



Language of publication: English

Document type: Commentary

ProQuest document ID: 2760580561

Document URL: <https://www.proquest.com/scholarly-journals/adaptive-interventions-dynamic-responsive-public/docview/2760580561/se-2?accountid=211160>

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Last updated: 2023-02-10

Database: Public Health Database

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Document 35 of 39

# Trends in Degree Conferrals, Degree-Associated Debt, and Employment Outcomes Among Undergraduate Public Health Degree Graduates, 2001–2020

Leider, Jonathon P; Burke, Emily; Nguyen, Ruby H N; Plepys, Christine; Kirkland, Chelsey; Resnick, Beth; Magaña, Laura

[ProQuest document link](#)

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## ABSTRACT (ENGLISH)

**Objectives.** To characterize the trends in degree conferrals, degree-associated debt, and employment outcomes among undergraduate public health degree (UGPHD) graduates. **Methods.** We reported administrative data on degree conferrals from 2001 to 2020 from the National Center for Education Statistics (NCES). For alumni graduating from 2015 to 2019, we also reported degree-associated debt and earnings 1 year after graduation compiled by NCES. Finally, we utilized a data set on 1-year postgraduation employment outcomes for graduates from 2015 to 2020 from the Association of Schools and Programs of Public Health. **Results.** As of 2020, more than 18 000 UGPHDs were awarded each year, more than 140 000 in total over the past 20 years. UGPHD graduates are highly diverse, with more than 80% being women and 55% being individuals from communities of color. We find alumni worked mostly in for-profit organizations (34%), health care (28%), nonprofits (11%), academic organizations (10%), government (10%), and other (6%). Degree-associated debt was \$24000, and the median first-year earnings were \$34000. **Conclusions.** While growth in UGPHD conferrals has slowed, it remains among the fastest-growing degree in the nation. However, the limited pathways into government remains a significant challenge. (AmJ Public Health. 2023;113(1):115-123. <https://doi.org/10.2105/AJPH.2022.307113>)

## FULL TEXT

## Headnote

**Objectives.** To characterize the trends in degree conferrals, degree-associated debt, and employment outcomes among undergraduate public health degree (UGPHD) graduates. **Methods.** We reported administrative data on degree conferrals from 2001 to 2020 from the National Center for Education Statistics (NCES). For alumni graduating from 2015 to 2019, we also reported degree-associated debt and earnings 1 year after graduation compiled by NCES. Finally, we utilized a data set on 1-year postgraduation employment outcomes for graduates from 2015 to 2020 from the Association of Schools and Programs of Public Health. **Results.** As of 2020, more than 18 000 UGPHDs were awarded each year, more than 140 000 in total over the past 20 years. UGPHD graduates are highly diverse, with more than 80% being women and 55% being individuals from communities of color. We find alumni worked mostly in for-profit organizations (34%), health care (28%), nonprofits (11%), academic organizations (10%), government (10%), and other (6%). Degree-associated debt was \$24000, and the median first-year earnings were \$34000. **Conclusions.** While growth in UGPHD conferrals has slowed, it remains among the fastest-growing degree in the nation. However, the limited pathways into government remains a significant challenge. (AmJ Public Health. 2023;113(1):115-123. <https://doi.org/10.2105/AJPH.2022.307113>)

The undergraduate public health degree (UGPHD) surpassed the master's degree in 2020 as the most conferred public health degree in the United States.<sup>1</sup> This rapid growth began in 2004, fueled in part by the rise in bioterrorism concerns and interest in strengthening the nation's public health system in the aftermath of 9/11 and the 2001 anthrax attacks.<sup>2</sup> The growth was also fueled by the seminal work published in the 2003 Institute of Medicine report recommending that all undergraduates have access to education in public health and the proliferation of accredited graduate schools and programs of public health.<sup>3</sup> More than twice the number of undergraduate students graduated with public health degrees from 2008 to 2012 than from 1992 to 2008, and the majority of students graduated with UGPHDs in general public health and health education or behavioral sciences.<sup>4,5</sup> It is also a degree whose recipients are far more racially and ethnically diverse than recipients of graduate degrees in general.<sup>5</sup> Yet, despite this marked growth, the UGPHD is once again in transition.

Degree conferrals have been driven both by growth within existing programs and by new entrants to the marketplace.<sup>4,5</sup> About 271 institutions offered UGPHDs in 2016 compared with 179 in 2012, with about 50% coming from institutions with public health degree programs that were accredited by the Council on Education for Public Health (CEPH).<sup>5,6</sup> CEPH was established in 1974 to serve as the independent accreditation body for graduate schools and programs of public health.<sup>7</sup> CEPH's standalone baccalaureate accreditation was introduced in 2016; there are currently 25 standalone CEPH-accredited baccalaureate programs.<sup>8</sup> The expansion of standalone programs is indicative of an expanded breadth of programs without other master's-level public health training.<sup>6</sup> Furthermore, this new accreditation offers the opportunity to greatly expand the reach of public health education to other institutions across the country and to increase diversity both in student populations and geographic regions.<sup>6</sup> Before this effort, UGPHD programs were only accredited if they were conferred by a CEPH-accredited graduate school of public health. However, now, with the drastic increase in undergraduate public health program offerings and with the number of UGPHDs conferred, several key questions have arisen regarding the UGPHD. Questions include the potential role of the UGPHD on the field's ability to diversify the public health workforce, establish pathways for training, reduce overlap with the graduate-level curriculum, and ultimately rebuild the governmental public health workforce with new UGPHD graduates.<sup>1</sup>

Especially of note are the employment outcomes for bachelor's students, including both what types of jobs they would get in general and, specifically, whether those jobs would substitute for master's-trained alumni, as had happened in other fields in previous decades.<sup>1,3,9,10</sup> For example, there is a current debate about whether hospitals should hire a certified registered nurse anesthetist or an anesthesiologist, with the former being less expensive, yet debate on cost-effectiveness and ultimate practice models remains.<sup>11,12</sup>

Given these questions, as well as the recent increased limelight on public health as a result of the COVID-19 pandemic, in this study, we explored recent trends in public health undergraduate education with a focus on first-destination outcomes, including employment or further higher education, of UGPHD recipients.

## METHODS

We used 3 data sets to characterize the UGPHD trends in the United States: the Integrated Postsecondary Education Data System (IPEDS),<sup>13</sup> the College Scorecard from the National Center for Education Statistics (NCES), and firstdestination outcomes from the Association of Schools and Programs of Public Health (ASPPH).<sup>14</sup> Our research utilized IPEDS data that catalogued degree conferrals for UGPHD programs in the United States that were reported from 2001 through 2020. IPEDS data are reported annually by all public and private postsecondary institutions that receive federal support, including federally backed financial aid. Degree conferral data are one of several required reporting areas, which also include enrollments, admissions, academic offerings, salary spending on faculty and staff, and staff composition, among other organizational characteristics.

IPEDS maintains data on institutional characteristics for each college or university in its data set; of primary interest are institutional (Carnegie) classification, control institution (public, private not-for-profit, private for-profit), and geographic region. UGPHD programs were identified with Classification of Instructional Program (CIP) codes (National Center for Education Statistics, <https://bit.ly/3gCEbHC>), including for public health (CIP 51.22XX), as well as for health policy analysis (44.0503), epidemiology (26.1309), and biostatistics (26.1102), which IPEDS classifies outside of public health (Table A, available as a supplement to the online version of this article at <https://ajph.org>). While NCES does not include biostatistics, epidemiology, or health policy, they have long been included as core degrees or program offers in public health institutions. IPEDS data before 2010 are crosswalked to the 2020 CIP code standards.

NCES constructs estimates of earnings and degree-associated debt using federal administrative data and publishes these data annually via the College Scorecard. These estimates are reported by institution, degree, degree level, and 4-digit CIP code family. NCES constructs these estimates by 2-year cohorts, with earnings information drawn from Internal Revenue Service filings of graduates 1 year after graduation and degree-associated debt from Free Application for Federal Student Aid filings. Data were available on students graduating in 2015 through 2019 at the time of this analysis, in spring 2022. NCES notes that institution-level data may be censored if there are insufficient student record matches or number of graduates. NCES data are thought to constitute the universe of public health degree conferrals in the United States but do not include firstdestination outcomes.

The third data set was provided by ASPPH. Since 2016, ASPPH has collected first-destination outcomes data through its membership, CEPH-accredited schools and programs of public health in the United States and abroad (only domestic data were used in this analysis). Students who are graduating, and up to 1 year after graduation, report first-destination outcomes to their schools and programs of public health. These data are de-identified and reported to ASPPH. Among those reporting employment outcomes, both broad employment sector and detailed sector are reported. The most recent available data are from graduating years 2015 through 2020 (collected up to 1 year later) and are included in this assessment.

ASPPH data include graduates of UGPHD programs at accredited schools and programs of public health, which represent approximately 48% of graduates from UGPHD programs in the United States captured in IPEDS data. Please see Figure A (available as a supplement to the online version of this article at <https://ajph.org>) for the number of applicants to MPH programs in Schools of Public Health Application Service, the centralized application service, by major or concentration in undergraduate degrees.

We calculated descriptive statistics to report findings from the administrative data sources. We used Stata version 17.1 (StataCorp LLC, College Station, TX) and Tableau Desktop (Tableau Software, Mountain View, CA) for analysis.

## RESULTS

In 2001, colleges and universities across the United States reported awarding 1480 UGPHDs, compared with 5576 graduate public health degrees. By 2020, 18 289 UGPHDs and 19 641 graduate public health degrees (18 044 and 1597 master's and doctorate degrees, respectively) had been awarded (Figure 1). The UGPHD grew an average 13.4% each year over the past 2 decades, eventually eclipsing the master's degree as the most conferred public health degree type in the United States in 2020.

## Demographics of Degree Grantors and Recipients

The number of institutions awarding solely UGPHDs with no graduate public health degrees has also grown substantially, from 44 in 2001 to 183 in 2020. As of 2020, more than 550 institutions awarded either a UGPHD or graduate public health degrees, with 392 awarding at least 1 UGPHD and 265 institutions awarding at least 10 UGPHDs. In terms of the size of graduating classes by institution, the median was 20 degrees conferred in 2020, with the 25th percentile at 7 degrees and the 75th percentile at 55 degrees. Between 2001 and 2020, 143,000 UGPHD conferrals were captured by NCES, of which about 24,000 were conferred between 2001 and 2010, 35,000 between 2011 and 2015, and 79,000 between 2016 and 2020.

Data from NCES show wide racial and ethnic diversity of UGPHD graduates. In 2020, 45% were White. Hispanic/Latino students constituted the second largest group of graduates (17%), followed by Black/African American (15%), Asian (13%), 2 or more race (4%), and American Indian/Alaska Native (1%) students. International students represented 2.5% of UGPHD conferrals, and another 2.5% of graduates had unknown race/ethnicity status. Women constituted 80% of conferrals in 2020, an increase from 69% in 2001.

Compared with graduate public health degree conferrals, during the past 2 decades, a smaller percentage of undergraduates received their UGPHD from a CEPH-accredited school or program of public health (Figure 2). Coincident with CEPH instituting a standalone undergraduate accreditation standard in 2016 (and therefore affording accreditation to students graduating up to 3 years before 15), the majority of UGPHDs were conferred by a CEPH-accredited school or program of public health or a standalone baccalaureate program. In 2020, 57% of UGPHDs came from CEPH-accredited institutions and programs, compared with 82% of master's degrees and 89% of doctoral degrees. We observed differences by race/ethnicity; 74% of Asian students received a UGPHD in 2020 from a CEPH-accredited institution and programs, compared with 56% of Black students, 53% of Hispanic/Latino students, and 55% of White students. We similarly observed differences in graduation by control of institution (public, private not-for-profit, or private for-profit) by race/ethnicity.

Conferrals by type of institution changed substantially since 2001, when 88% of UGPHDs came from public institutions, 11% from private not-for-profit, and less than 1% from private for-profit. In 2020, 75% of UGPHD conferrals came from public institutions, 22% from private not-for-profit, and 3% from for-profit institutions. In 2020, among Asian students, less than 1% of UGPHDs came from for-profit institutions, as did 9% of UGPHDs earned by Black students, 4% earned by Hispanic/Latino students, and 2% earned by White students.

## First-Destination Outcomes

Among 23,810 UGPHD graduates between 2015 and 2020 with first destination outcomes reported to ASPPH, 7% reported seeking employment, 31% reported enrollment in further study, and 62% reported having employment, a fellowship, or a volunteer position. Among the 8,724 UGPHD graduates with full-time employment outcomes reported, 34% reported working within for-profit organizations, 28% in health care organizations, 11% in nonprofit organizations, 10% in academic institutions, 10% in government, and 6% in "other" (Figure 3).

Detailed employment-sector information was provided by 10,939 UGPHD graduates. Of those working in academic institutions, two thirds worked in postsecondary education and one quarter in K-12 education. Among those working in for-profit organizations, 13% worked in consulting; 16% in marketing, public relations, communications, and pharmaceuticals; and 8% in health insurance and information technology. Among those in government positions, 24% worked in federal, 26% in state, 38% in local, 9% in military, and 3% in "other types." Of those working in the health care sector, 36% reported being within hospital and health systems and 6% in managed care.

Lastly, for UGPHD graduates who reported pursuing further study, 36% were pursuing a graduate public health degree, 27% were pursuing a medical or clinical degree, and 37% were pursuing another or unknown degree. NCES publishes degree-associated debt and postgraduation earnings through their College Scorecard (Figure 4). Median degree-associated debt for students graduating in 2014 to 2019 was highest among for-profit institutions awarding UGPHDs (median = \$39,800; interquartile range [IQR] = \$39,000-\$42,000), compared with not-for-profit institutions (median = \$26,000; IQR = \$23,000-\$27,000) and public institutions (median = \$22,000; IQR = \$19,000-\$25,000). One-year postgraduation earnings data were comparable across all institution types (median =

approximately \$34000). Median degree-associated debt and earnings varied widely for UGPHDs by geographic region, with degree-associated debt being highest in the mid-east and New England regions, and lowest in Rocky Mountain and far-west regions. Median 1-year postgraduation earnings ranged from \$31 000 to \$38 000 with the lowest being from the southeast region and highest from New England.

## DISCUSSION

In 2020, nearly 20 000 UGPHDs were conferred. While UGPHDs have overtaken master's degrees as the most awarded public health degrees in the United States, accredited master's degree conferrals still substantially outnumber accredited undergraduate degrees. This is not surprising given IPEDS reporting indicates that 89% of doctoral and 82% of master's degrees were conferred by universities with a CEPH-accredited schools and programs of public health while only 57% of UGPHDs were conferred by a university with a CEPH-accredited public health school, program, or standalone baccalaureate program.

UGPHD graduates secure employment in multiple industries upon graduation, and many pursue further higher education, including graduate studies in public health. Of those graduates securing employment, relatively few have pursued a job in governmental public health (10%), while the majority (62%) enter the workforce in the for-profit sector or in the health care sector. This differs somewhat from graduate program alumni, where 17% have pursued jobs in governmental public health and 41% landed in the for-profit or health care sector. Further more, the percentage of graduate program alumni working in governmental public health has increased each year since ASPPH began collecting first destinations outcomes data, with 21% of master's and doctoral graduates entering the governmental public health workforce in 2020.<sup>16</sup> This might suggest that UGPHD and graduate alumni are not competing for the same jobs as has been previously hypothesized.

However, it is reasonable, if not prudent, for public health practitioners to concretely distinguish job tasks and desired skills of undergraduates from graduates in the workplace while academic public health better communicates the continuum and progressive nature of the competencies that graduates demonstrate at the undergraduate, master's, and doctoral level.<sup>9,17</sup> These distinctions would ensure undergraduates and graduates do not compete for the same position and limit the ongoing concern about the threat of a "substitution effect," in which baccalaureate degree holders are preferentially hired at lower wages for the same jobs that graduate degree-holders had been previously recruited, in the government sector (or elsewhere). The concern arises from a history in other fields.<sup>4,5,9,17</sup> The best way to ensure a substitution effect does not occur is through task and skill differentiation for different levels of academic achievement.

We show that undergraduate public health is continuing to grow, that several hundred institutions are now offering these degrees, that graduates are pursuing a variety of jobs and sectors as employment outcomes, and that there is a wide range of earnings and debt loads associated with UGPHDs across the United States. Heterogeneity in UGPHDs, and education more broadly, is to be expected, even in an accredited field. In some respects, education is a marketplace, not just of ideas, but also one based on consumer and employer interests and needs, as well as one in which competition rewards positive program outcomes. A breadth of public health offerings should be encouraged, if they are indeed identifiable as public health programs.<sup>17</sup>

Institutions of higher education, in our view, should hold to core tenets of academic rigor and integrity and the pursuit of knowledge. At the same time, public health degrees are traditionally viewed in the vein of a professional degree, even at the undergraduate level, even where it is offered in the context of more general humanities or liberal arts programs. Fundamentally, after all, UGPHDs must be competency and skill-based to be creditable. There remains an open question about market saturation, especially considering continued and sustained growth, as well as broader opportunities for undergraduate public health-trained professionals to work in nontraditional areas, such as in public education, urban development, and political science. These remain substantive points for future discussion and research.

### Reflections in Light of the Great Resignation

As we reflect on the future of undergraduate public health and its relationship to governmental public health, data presented in this article suggest that the United States may be approaching a point of opportunity. The governmental

public health workforce is substantially depleted, generally since the Great Recession and specifically because of COVID-19 response (and the consequent Great Resignation/Reshuffling/ Renegotiation).<sup>18,19</sup> Data recently released from the 2021 Public Health Workforce Interests and Needs Survey show 44% of staff are considering leaving their job or planning to retire within the next 5 years<sup>20</sup>; this represents more than 80 000 staff nationwide. Are public health graduates filling this gap? If not, who will?

Governmental public health has traditionally hired baccalaureate degree holders from other fields and some master's degree holders, the latter of whom sometimes have a UGPHD. Might this change with concerted efforts to create practice-based training programs and improve pathway development from the schools and programs of public health into government? Federal public health agencies have recognized the potential future gaps in the public health workforce and have established mechanisms to increase pipelines into governmental public health careers.<sup>1,21-23</sup>

These data suggest that now is a critical time for the initiation of partnerships between educational institutions and governmental public health agencies to better examine undergraduate public health education and to determine whether specific pathways to government are a priority and, if so, how then to implement them in ways that accomplish the desired aims. UGPHD recipients may serve health departments in key entry-level public health science and data-oriented positions. Yet, to attract these students away from health care, pharma, and for-profit firms, health departments must offer more efficient hiring processes, competitive wages and benefits, and clear opportunities for advancement, and seek to maximize engagement and perceptions of employee support within one's organization, as these factors are all key to recruitment and retention.<sup>24,25</sup>

#### A Matter of Demographics

A particular challenge undergraduate education faces broadly in the United States is the upcoming demographic cliff and the "Great Interruption" associated with COVID-19. As a result, in 2025 and beyond, fewer students are expected to graduate high school and enter college than in years past, though this has already begun in some regions.<sup>26</sup> There are simply fewer younger people seeking traditional bachelor's degrees (and, in turn, traditional master's), although there may be more midcareer professionals seeking further education. Further exacerbating this issue is the Great Interruption of COVID-19 whereby 21 % fewer direct high school to college students enrolled in fall of 2020 when compared with 2019, and 1 in 4 college students failed to re-enroll in the fall of 2020.<sup>27,28</sup> In addition, uncertain macro-economic conditions along with low unemployment rates may make college or graduate school less appealing.<sup>29</sup> These uncertain conditions will likely continue to be a concern for some time among institutions of higher education.

It is not clear to us what a broad decline in undergraduate enrollment might mean for a specific field such as public health. It may well be that in a postpandemic environment, public memory and interest in public health fade, and fewer undergraduates are aware of the public health degree. Conversely, because the next several years have dedicated federal public health infrastructure funding to grow pathways into governmental practice, schools and programs of public health may outcompete other resource-poor or otherwise flagging program areas for paid internships and better placement prospects out of school.

Even if undergraduate overall enrollment is down, public health enrollment could grow with appropriate strategy and investment such as using online education<sup>30</sup> and building and implementing an enrollment management plan.<sup>31</sup> This could be critical to rebuilding the governmental public health workforce and is especially relevant as enrollment in master's education in public health similarly in 2022 has begun again to slow down, likely attributable to degree-offering institution saturation, as had been projected for some time before the COVID-19-associated bump in admission.<sup>32</sup>

#### Limitations

When interpreting these trends, the following limitations should be considered. First, while the NCES is widely regarded as a reliable source of degree conferral data,<sup>32</sup> misclassification may occur. Sensitivity analyses show that if institutions are excluded that conferred fewer than 10 undergraduate public health degrees in 2020, 265 of 392 institutions remain (data not shown). It is not clear whether the differences represent true, small programs or

reporting errors; these affect institution totals but do not materially affect conferral totals (these institutions represented 3.1% of conferrals in 2020).

Second, UGPHD majors are reported; public health minors are not included, thus excluding from our analysis a potentially important indicator of interest in and exposure to public health at the undergraduate level. Third, ASPPH member programs that report graduate outcomes use myriad approaches in data collection. Some augment with administrative data or publicly available data (e.g., Linked In scraping). As such, especially in early years of reporting, there are relatively high proportions of unknown employment sectors for employed graduates.

Lastly, a final set of limitations relate to College Scorecard debt data. NCES censors institutions when there are too few records either on salaries or on debt to ensure confidentiality of responses. As such, some institutions are not represented in this data set. Debt data include Parent Plus loans and federal direct subsidized and unsubsidized loans (Stafford loans), but do not include Perkins loans.<sup>33</sup> As such, data may be limited with respect to parental loan reporting around privatebacked loans, which are again becoming more common in recent years.

#### Conclusions

Throughout the past 2 decades, there have been calls for undergraduate public health education to create a greater population-based understanding for, and higher value of, the field of public health.<sup>6,17,34</sup> Thoughtfully developed undergraduate programs have provided, and will continue to provide, a public health foundation to all professions, regardless of the graduate's immediate employment sector. Our data show undergraduate public health graduates have most often entered either the health care or for-profit sectors, and relatively less into governmental public health. The nation relies on the vital roles that governmental public health agencies provide, but a postCOVID-19 world, one with a depleted governmental public health workforce,<sup>18,35</sup> presents grand challenges to protecting the public's health. However, our data show that the nation also has more than 18000 undergraduate public health graduates each year, which highlights the potential role of undergraduate education in addressing the near-future governmental public health gaps as well as an opportunity to recruit a more diverse and representative workforce.

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#### PUBLICATION INFORMATION

Full Citation: Leider JP, Burke E, Nguyen RHN, et al. Trends in degree conferrals, degree-associated debt, and employment outcomes among under-graduate public health degree graduates, 2001-2020. *Am J Public Health*. 2023;113(1): 115-123.

Acceptance Date: August 29, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307113>

#### CONTRIBUTORS

J.P. Leider, E. Burke, and C. Kirkland conducted initial analyses. All authors drafted the initial document and provided edits and critical review.

#### CONFLICTS OF INTEREST

The authors have no items to disclose.

#### HUMAN PARTICIPANT PROTECTION

The project involved secondary data analysis of publicly available data and employment outcomes data for Association of Schools and Programs of Public Health alumni institutions.

### Sidebar

See also Riegelman, p. 9.

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## DETAILS

<b>Subject:</b>	Earnings; Public health; Students; Trends; Employment; Graduate studies; Accreditation; Organizations; Nonprofit organizations; Profits; Debt; Public schools; Schools; Statistics
<b>Business indexing term:</b>	Subject: Employment
<b>Location:</b>	United States--US
<b>Company / organization:</b>	Name: National Center for Education Statistics; NAICS: 923110
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	115-123
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Journal Article
<b>ProQuest document ID:</b>	2760580526
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/trends-degree-conferrals-associated-debt/docview/2760580526/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/trends-degree-conferrals-associated-debt/docview/2760580526/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-03-01
<b>Database:</b>	Public Health Database

# Timing and Trends for Municipal Wastewater, Lab-Confirmed Case, and Syndromic Case Surveillance of COVID-19 in Raleigh, North Carolina

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[ProQuest document link](#)

## ABSTRACT (ENGLISH)

**Objectives.** To compare 4 COVID-19 surveillance metrics in a major metropolitan area. **Methods.** We analyzed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA in wastewater influent and primary solids in Raleigh, North Carolina, from April 10 through December 13, 2020. We compared wastewater results with lab-confirmed COVID-19 cases and syndromic COVID-like illness (CLI) cases to answer 3 questions: (1) Did they correlate? (2) What was the temporal alignment of the different surveillance systems? (3) Did periods of significant change (i.e., trends) align? **Results.** In the Raleigh sewershed, wastewater influent, wastewater primary solids, lab-confirmed cases, and CLI were strongly or moderately correlated. Trends in lab-confirmed cases and wastewater influent were observed earlier, followed by CLI and, lastly, wastewater primary solids. All 4 metrics showed sustained increases in COVID-19 in June, July, and November 2020 and sustained decreases in August and September 2020. **Conclusions.** In a major metropolitan area in 2020, the timing of and trends in municipal wastewater, lab-confirmed case, and syndromic case surveillance of COVID-19 were in general agreement. **Public Health Implications.** Our results provide evidence for investment in SARS-CoV-2 wastewater and CLI surveillance to complement information provided through lab-confirmed cases. (AmJ Public Health. 2023;113(1):79-88. <https://doi.org/10.2105/AJPH.2022.307108>)

## FULL TEXT

### Headnote

**Objectives.** To compare 4 COVID-19 surveillance metrics in a major metropolitan area. **Methods.** We analyzed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA in wastewater influent and primary solids in Raleigh, North Carolina, from April 10 through December 13, 2020. We compared wastewater results with lab-confirmed COVID-19 cases and syndromic COVID-like illness (CLI) cases to answer 3 questions: (1) Did they correlate? (2) What was the temporal alignment of the different surveillance systems? (3) Did periods of significant change (i.e., trends) align? **Results.** In the Raleigh sewershed, wastewater influent, wastewater primary solids, lab-confirmed cases, and CLI were strongly or moderately correlated. Trends in lab-confirmed cases and wastewater influent were observed earlier, followed by CLI and, lastly, wastewater primary solids. All 4 metrics showed sustained increases in COVID-19 in June, July, and November 2020 and sustained decreases in August and September 2020. **Conclusions.** In a major metropolitan area in 2020, the timing of and trends in municipal wastewater, lab-confirmed case, and syndromic case surveillance of COVID-19 were in general agreement. **Public Health Implications.** Our results provide evidence for investment in SARS-CoV-2 wastewater and CLI surveillance to complement information provided through lab-confirmed cases. (AmJ Public Health. 2023;113(1):79-

88. <https://doi.org/10.2105/AJPH.2022.307108>)

COVID-19 public health surveillance relies on multiple data sources to estimate disease burden. The number of positive clinical tests overtime has served as a primary metric for tracking COVID-19 infections in North Carolina because clinical testing of individuals accurately identifies cases and is legally required for surveillance of reportable diseases, including COVID-19.<sup>1</sup> Clinical testing is, however, costly and inefficient as a means of population-level surveillance of COVID-19.<sup>2</sup> In addition, this metric can be limited by sensitivity,<sup>3</sup> clinical test availability,<sup>4</sup> and changes in testing behavior such as the rise in use of nonreportable, at-home rapid test kits.<sup>5</sup>

Surveillance of severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) RNA in wastewater influent or settled wastewater solids has gained traction in public health practice.<sup>6</sup> In addition to capturing data on symptomatic individuals who are likely to be tested, wastewater surveillance captures information on infections among asymptomatic carriers who shed the virus in feces but are less likely to be tested (Figure 1). In retrospective studies, SARS-CoV-2 RNA concentrations in wastewater have been shown to correlate positively with reported clinical COVID-19 cases.<sup>7,8</sup> Public health officials have used wastewater surveillance trends to target public health mitigation efforts.<sup>9</sup> Most wastewater surveillance is conducted using centralized wastewater treatment systems; wastewater surveillance is not as efficient in communities with a high proportion of people dependent on individual septic systems.

Another form of surveillance used for COVID-19 response is syndromic surveillance for COVID-like illness (CLI) based on prediagnostic emergency department (ED) data not confirmed through laboratory testing. CLI captures data on individuals with serious illness and those seeking care at EDs, representing a smaller segment of the infected population. Syndromic surveillance is mandated in North Carolina<sup>10</sup> and is routinely used for other respiratory conditions, including influenza.

Given the different segments of the population captured via wastewater, lab-confirmed case, and CLI surveillance (Figure 1), it is important to evaluate how these surveillance systems compare in a given population. Wastewater may provide more sensitive surveillance of changing infection rates in areas where there is incomplete ascertainment of cases through clinical testing.<sup>11</sup> Increases in wastewater concentrations have sometimes preceded increases in clinical cases.<sup>12</sup> CLI surveillance based on ED data is unlikely to be more timely than lab-confirmed case surveillance, but it may be nearly as timely. With electronic health information systems, data on CLI ascertained at EDs can be available in near real time,<sup>13</sup> whereas laboratory testing can entail delays from sample collection to results reporting.

We compared COVID-19 surveillance data sets from a major metropolitan area and included 2 wastewater metrics. We analyzed SARS-CoV-2 RNA concentrations in wastewater influent and primary solids from a municipal wastewater treatment plant in Raleigh, NC. Subsequently, we compared wastewater levels with lab-confirmed COVID-19 and CLI counts for the sewershed to answer 3 questions: (1) Did they correlate? (2) What was the temporal alignment of the different surveillance systems? (3) Did trends (i.e., periods of significant increases or decreases) align across surveillance systems? This research can inform how public health officials look across surveillance systems to estimate COVID-19 burdens.

## METHODS

Raw wastewater influent and primary clarifier solids (i.e., primary solids) were sampled from the Neuse River Resource Recovery Facility in Raleigh between April 10 and December 13, 2020. We collected 24-hour composite influent wastewater samples (100 or 500 mL) and grab samples of solids (40 mL) 2 or 3 times weekly, with some periods of daily sampling (102 dates in total; Figure A, available as a supplement to the online version of this article at <https://ajph.org>). This facility serves approximately 580 000 people and had average treated flows of 48 million gallons per day in 2020. Solids collected from primary clarifiers were predominantly influent solids, but waste-activated solids were also present because the facility co-settles waste-activated solids in its primary clarifiers. Although co-settling waste-activated solids in primary clarifiers is not a common wastewater treatment practice, it is a recognized practice for improved sludge thickening.<sup>14,15</sup> The residence time of solids in the clarifiers was, on average, 2.8 days (range = 1.8-4.3 days), which is longer than typical primary clarifier residence times (on the order

of hours).

Concentrations of SARS-CoV-2 N1 and N2 genes in wastewater samples were determined via reverse-transcription droplet digital polymerase chain reaction (see Supporting Information, available as a supplement to the online version of this article at <https://ajph.org>). Wastewater sample processing protocols, depicted in Figure B (influent; available as a supplement to the online version of this article at <https://ajph.org>) and Figure C (primary solids; available as a supplement to the online version of this article at <https://ajph.org>), incorporated several of the current best practices.<sup>16</sup> Normalized N1 results (Supporting Information) were used in subsequent analyses with lab-confirmed cases and CLI.

#### Lab-Confirmed COVID-19 Case Data

Individual-level lab-confirmed COVID-19 cases with residential addresses from the North Carolina Electronic Disease Surveillance System were provided by the North Carolina Department of Health and Human Services. Positive case counts included polymerase chain reaction-positive tests, antigen-positive tests, and a few polymerase chain reaction-negative tests determined to be positive cases based on physician case notes. Cleaned residential addresses were geocoded in ArcGIS Pro version 2.7.0 (ESRI, Redlands, CA) via the 2018 ESRI Business Analyst USA\_LocalComposite locator (Supporting Information). As a means of producing daily case counts, we summed cases in the sewershed using specimen collection dates or test result report dates.

#### COVID-Like Illness Data

Data on individual-level CLI cases geocoded at the residential zip code level were acquired from the North Carolina Disease Event Tracking and Epidemiologic Collection Tool, a public health syndromic surveillance system capturing all civilian ED visits in North Carolina (as reporting is mandatory).<sup>13</sup> CLI ascertained at urgent care centers was not included because NC does not share these data with external researchers.

CLI was defined according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10; Geneva, Switzerland: World Health Organization; 1992) diagnostic codes (B97.2 or B34.2, J12.81 or J12.82, or U07.1 or U07.217) or 1 of the following conditions: a chief complaint related to coronavirus, triage notes indicating a loss of sense of taste or smell, or triage notes indicating shortness of breath with fever. CLI cases that also had diagnostic codes for influenza (J09-J11.89) were excluded unless they had 1 of the ICD-10 inclusion codes. The date for each CLI record was the ED visit date. We estimated daily CLI counts in the sewershed by summing counts in each of the 27 zip codes located entirely or partially in the sewershed, weighted by population density according to 2010 census block data.

#### Correlation Analysis

We used Spearman's rank correlation to determine the relationship between wastewater SARS-CoV-2 N1 concentrations (in influent or primary solids) and lab-confirmed COVID-19 cases or CLI. To investigate temporal alignment, we compared correlation coefficients and identified the maximum coefficient as 1 data set was offset forward or backward in time relative to another data set.<sup>18-22</sup> To reduce variation in the measurements for this analysis, we used the rolling 3-sampling-event averages of normalized SARS-CoV-2 quantities in wastewater influent and primary solids and the rolling 7-day averages for lab-confirmed cases and CLI. We used 2000 resamples with replacement to calculate bootstrap 95% confidence intervals for the correlation coefficient at each lead or lag and for all pairwise differences between correlations.<sup>23</sup> Correlation pairs were considered significantly different if the Bonferroni-adjusted 95% confidence interval for their difference excluded 0.<sup>24</sup>

#### Distributed Lag Model

The distributed lag measurement error time series model is an accepted epidemiological model for time series data.<sup>25</sup> We adapted a Bayesian distributed lag model developed previously<sup>8</sup> as a secondary approach to investigate temporal alignment between SARS-CoV-2 RNA levels in wastewater influent or primary solids and changes in clinical case rates. The 3-day rolling average of clinical cases was predicted via wastewater measurements from 3 sampling events before the report date until 3 sampling events after. A random effect was included in the model to account for overdispersion.

#### Trends

Trends were classified as increasing, decreasing, or plateau through a linear regression with observations from each surveillance system as the dependent variable and date as the independent variable; trend classification was based on slope (positive, negative, or 0) and statistical significance ( $P < .05$ ).<sup>6</sup> We classified short-term and sustained trends using regressions of 3 data points (approximately 1 week in duration) and 7 data points (approximately 2 weeks), respectively.<sup>26</sup>

## RESULTS

SARS-CoV-2 RNA was frequently detected in wastewater influent and solids during the 247-day study period (April 10 to Dec 13, 2020); influent samples had detectable levels of the SARS-CoV-2 N1 gene on 96 of 102 wastewater sampling dates (94%); solids samples had detectable N1 on all 102 days (Figure B). The SARS-CoV-2 N2 gene was detectable in influent on 94 of 102 days (92%) and solids on 100 of 102 days (98%). Because N1 and N2 gene concentrations were highly correlated in influent (Spearman  $\rho = 0.83$ ;  $P < .001$ ) and solids ( $\rho = 0.93$ ,  $P < .001$ ) and N1 had a slightly higher detection rate, we focused our subsequent analyses on N1.

### Surveillance Data Set Correlations

SARS-CoV-2 RNA daily loads in influent and SARS-CoV-2 RNA concentrations in primary solids (Figure 2) were moderately correlated over the study period ( $\rho = 0.65$ ;  $P < .001$ ; C). Wastewater influent was strongly correlated with lab-confirmed cases ( $\rho = 0.74$ ;  $P < .001$ ; Figure 2; Figure D, available as a supplement to the online version of this article at <https://ajph.org>), as were wastewater primary solids ( $\rho = 0.71$ ;  $P < .001$ ; Figure E and Table A, available as supplements to the online version of this article at <https://ajph.org>). Furthermore, wastewater influent was moderately correlated with CLI ( $\rho = 0.61$ ;  $P < .001$ ; Figure 2; Figure F, available as a supplement to the online version of this article at <https://ajph.org>), whereas solids were strongly correlated with CLI ( $\rho = 0.71$ ;  $P < .001$ ; Figure G, available as a supplement to the online version of this article at <https://ajph.org>).

The strongest correlation observed was between lab-confirmed cases and CLI ( $\rho = 0.84$ ;  $P < .001$ ; Figure H, available as a supplement to the online version of this article at <https://ajph.org>); during the study period, there were 20 858 lab-confirmed COVID-19 cases and 7441 cases of CLI in the sewershed. Lab-confirmed cases and CLI were highly correlated in earlier and later portions of the study period (Table B, available as a supplement to the online version of this article at <https://ajph.org>). The earlier portion (April 10 through August 13, 2020) captured the first rise and fall of infections and was characterized by lower testing penetration<sup>4</sup> and fewer ED visits (Figure I, available as a supplement to the online version of this article at <https://ajph.org>). The correlations between cases of CLI and wastewater (influent and primary solids) were substantially higher earlier in the study period (Table B).

### Temporal Comparisons

The strongest correlation between SARS-CoV-2 N1 daily load in wastewater influent and N1 concentrations in wastewater primary solids was found for solids samples collected 2 sampling events after influent (given our sampling frequency, 2 sampling events represented  $5.9 \pm 1.2$  days;  $\rho = 0.65$ ; Figure J, available as a supplement to the online version of this article at <https://ajph.org>).

Correlations between lab-confirmed cases and wastewater influent daily load increased slightly as cases were offset from 0 to 3 days ahead of the influent sample collection date, with the strongest correlation observed for case specimens collected 3 days before an influent sample ( $\rho = 0.75$ ; Figure 3). The median duration between specimen collection date and results report date was 1 day (5th-95th percentiles: 0-4 days). When report date for case results was used instead of specimen collection date, the strongest correlation between cases and wastewater influent was observed for cases reported on the same day that influent was sampled (i.e., day 0;  $\rho = 0.75$ ). For wastewater primary solids, correlations between solids concentrations and lab-confirmed cases increased gradually as cases were offset 0 days to 7 days ahead of solids, with the strongest correlation found for case specimens collected 7 days before a solids sample ( $\rho = 0.80$ ). This correlation was significantly higher than correlations for case specimens collected 1 to 7 days after a solids sample.

The strongest correlation between CLI and wastewater influent was found for CLI reported 3 days after an influent sample was collected ( $\rho = 0.64$ ; Figure 3). The strongest correlation between lab-confirmed cases and CLI was found for clinical case specimens collected 1 day before the ED visit date ( $\rho = 0.84$ ). This correlation was

significantly higher than correlations for case specimens collected on the same day or up to 7 days after the ED visit date. Correlations were generally similar but slightly weaker for the surrounding days. Distributed lag modeling results were consistent with the correlation analysis with date offsets: wastewater influent and primary solids lagged clinical cases based on case specimen collection date (Table C, available as a supplement to the online version of this article at <https://ajph.org>).

#### Numbers of Significant Trends

Public health officials monitor for significant changes in levels of COVID-19 surveillance metrics to inform public health action.<sup>27</sup> Short-term or weekly trend monitoring is valuable because a short-term trend can be an early indicator of a sustained trend and because, particularly at the start of the pandemic, public health officials acted as quickly as possible. Across the different surveillance data sets, we might expect the numbers of trends to be similar but the temporal alignment to be shifted. However, lab-confirmed cases exhibited substantially more short-term increases (n = 17) than CLI (n = 10), wastewater primary solids (n = 7), and wastewater influent (n = 4) over the study period. Lab-confirmed cases had a number of periods of sustained increases (n = 51) similar to that of CLI (n = 45; within 20% of each other), but wastewater primary solids (n = 21) and wastewater influent had substantially fewer (n = 20).

In terms of periods of decreasing levels of COVID-19 metrics, the numbers of short-term decreases were greatest for lab-confirmed cases (n = 8) and wastewater solids (n = 7), followed by CLI (n = 5) and wastewater influent (n = 1). Furthermore, the numbers of sustained decreases in CLI (n = 23) and cases (n = 21) were similar, whereas there were fewer decreases among wastewater solids (n = 15) and wastewater influent (n = 9).

#### Trend Agreement Across Surveillance Data Sets

There were 9 periods for which all data sets agreed with respect to classification of sustained trends: the periods ending June 11, July 2, July 7, July 9, July 11, and November 14 exhibited increasing trends, and the periods ending August 1, September 12, and September 15 exhibited decreasing trends (Figure 4). Not surprisingly, there were no short-term trends that agreed across the 4 surveillance data sets given the temporal shifting of the different surveillance metrics. The wastewater influent and primary solids data sets were in similar agreement with respect to sustained increases when each were compared with lab-confirmed cases.

Specifically, 14 of 51 (27%) increases in cases were also increases in influent data; 16 of the 51 (31%) were increases in solids data. Five of 17 (29%) decreasing trends in case data were decreasing trends according to influent data, whereas 3 (18%) were decreases according to solids data. There was better agreement between lab-confirmed case and CLI data in sustained increases and decreases. Thirty-six of 51 (71%) sustained increases in case data were also sustained increases in CLI data, and 18 of 21 (86%) decreases in case data were also decreases in CLI data.

## DISCUSSION

On the day wastewater sample collection began (April 10, 2020), there had been 206 cumulative cases and 41 new cases reported in the sewershed, although the true number of infections is unknown (Figure 1). The Raleigh sewershed had detectable levels of SARS-CoV-2 RNA in primary solids in early April, 1 month after the first lab-confirmed COVID-19 case was reported in the sewershed (March 9, 2020). Detection frequency across solids samples was high, as others have reported,<sup>28</sup> despite the fact that primary solids in the Raleigh system also contained waste-activated solids. Monitoring wastewater primary solids was marginally more sensitive than monitoring influent.

SARS-CoV-2 RNA levels in wastewater influent were highly correlated with lab-confirmed cases, as has been reported for other wastewater-case comparisons.<sup>7,20</sup> Despite the longer solids residence time in primary clarifiers, RNA concentrations in primary solids were also correlated highly with lab-confirmed cases, as others have reported.<sup>7,28,29</sup>

CLI being correlated with both measures of wastewater surveillance is notable given that CLI-wastewater agreement has not been widely investigated. Case or CLI correlations with wastewater becoming substantially lower later in the study period (Table B) may have been related to increasing noise in the wastewater signal. As the pandemic

progressed, increases in wastewater RNA concentrations from new COVID-19 infections would have occurred in the presence of RNA contributed by individuals who were no longer test positive but continued to shed RNA in feces<sup>30</sup> and residual RNA in the wastewater system.<sup>31,32</sup> In addition, more individuals may have traveled in and out of the sewershed after reopening of public facilities, contributing to greater measurement error in COVID-19 burden based on wastewater.

The strongest correlations observed were between lab-confirmed cases and CLI, even early in the pandemic when there was limited test access and fewer ED visits. Although fewer ED visits would have limited the sensitivity of CLI surveillance for ascertaining infections, CLI may still have strongly correlated with lab-confirmed cases because of a larger overlap in the populations captured by diagnostic testing and CLI surveillance systems. Early in the pandemic, more testing may have been done on individuals who had severe COVID-19 and went to the ED. Noteworthy differences in case and CLI time series occurred later in the study period. A prominent peak in lab-confirmed cases in late August 2020 was not as pronounced in CLI data.

Furthermore, the extent to which cases in December 2020 exceeded previous case peaks in July and August 2020 was not represented in the other surveillance data sets and may reflect increased test access or increased testing around the winter holidays.<sup>4</sup> Widespread COVID-19 vaccinations or a change in the predominant SARS-CoV-2 variant may affect correlations between different surveillance systems if, for example, the asymptomatic rate increases<sup>33</sup> or the fecal shedding profile is altered.<sup>18</sup> With COVID-19 vaccines now being widely available, wastewater surveillance can be used to identify locations where viral fecal shedding into wastewater is not declining, indicating specific locations of infection.<sup>34</sup>

Multiple surveillance metrics are used in real time by public health officials to provide a fuller COVID-19 public health picture. As such, a temporal comparison is important for the interpretation of agreement or disagreement across surveillance data sets. The reported lead time for wastewater has ranged from 0 to 2 days<sup>8,29</sup> to as high as 235 and 336,<sup>37</sup> weeks. In the Raleigh sewershed, trends in wastewater influent were observed earlier than labconfirmed case trends when case results report date was used but not when specimen collection date was used, underlining that the potential for wastewater surveillance to provide an earlier warning than clinical testing depends on when test results are reported.<sup>38</sup> The current increased availability of testing and faster turnaround times for case reporting and wastewater surveillance<sup>38</sup> relative to the study period in 2020 may further impact temporal alignment.

Wastewater solids lagged wastewater influent likely because of long solids storage times in Neuse River Resource Recovery Facility primary clarifiers. Wastewater treatment plant design and operation is aimed at wastewater conveyance and treatment and, as such, may not provide ideal conditions for COVID-19 public health surveillance.<sup>39</sup> Therefore, in interpreting wastewater surveillance results, the operation of the facility (with increased communication between plant operators and public health agencies) must be considered.<sup>40</sup> Although the maximum correlation coefficient indicated that rises in CLI were a day behind rises in lab-confirmed cases, syndromic surveillance can be more timely than clinical case surveillance depending on how syndromic data are captured.<sup>41</sup> The greater numbers of significant trends in lab-confirmed case and CLI metrics than with wastewater metrics indicated a need for public health action at times when wastewater surveillance data did not exhibit a significant change. A limiting factor for numbers of significant trends in wastewater data sets was the 95% statistical confidence requirement for trend classification, which the Centers for Disease Control and Prevention originally recommended but no longer strictly recommends for wastewater surveillance trend reporting.<sup>42</sup> SARS-CoV-2 RNA levels in wastewater primary solids may have had less variability than influent levels as evidenced by the minimal increase in correlation between solids and rolling 7-day average of cases when crude solids data were smoothed (Table A). Therefore, solids surveillance was able to meet the statistical confidence requirement more often than influent surveillance.

## PUBLIC HEALTH IMPLICATIONS

We captured COVID-19 dynamics in a major metropolitan area during the first and second waves of infections in 2020. To our knowledge, our study is the first to report agreement between CLI and wastewater surveillance and to demonstrate relationships between key COVID-19 metrics in NC.<sup>43</sup> This study from early in the COVID-19



pandemic, when reportable testing data were better correlated with true disease incidence, supports the use of wastewater and CLI surveillance to complement lab-confirmed case surveillance, especially at times when clinical test penetration is low. >4JPH

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#### PUBLICATION INFORMATION

Full Citation: Kotlarz N, Holcomb DA, Pasha ABMT, et al. Timing and trends for municipal wastewater, lab-confirmed case, and syndromic case surveillance of COVID-19 in Raleigh, North Carolina. *Am J Public Health*. 2023;113(1):79-88.

Acceptance Date: August 26, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307108>

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#### ACKNOWLEDGMENTS

This work was supported by National Science Foundation Rapid Response Research grant CBET- 2029025, the North Carolina Policy Collaborator, and North Carolina State Center for Human Health and the Environment grant P30ES025128. David A. Holcomb was funded in part by the National Institute of Environmental Health Sciences (grant T32ES007018).

We thank Nathan Howell, Jeremy Lowe, Daniel Cockson, Emma Bolden, Victoria Ponthier, Zach Bennett, Laura Gomez, Ramya Balasubramanian, Marc Serre, Kelly Hoffman, Jeseth Delgado Vela, Adam Smith, Lauren Stadler, Krista Wigginton, Eric Johnson, and Aaron Fleischauer for their contributions to this work.

#### CONFLICTS OF INTEREST

There are no known potential or actual conflicts of interest.

#### HUMAN PARTICIPANT PROTECTION

The use of North Carolina Department of Health and Human Services health tracking data was approved by the University of North Carolina institutional review board. Because this was a secondary analysis of de-identified data collected for administrative purposes, it was not necessary or possible to obtain informed consent.

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## DETAILS

<b>Subject:</b>	Health surveillance; Public health; COVID-19; Surveillance; Trends; Severe acute respiratory syndrome coronavirus 2; Water treatment; Disease; Solids; Influenza; Metropolitan areas; Municipal wastewater; Codes; Polymerase chain reaction; Viral diseases; Wastewater; Time series; Coronaviruses; Illnesses; Surveillance systems
<b>Business indexing term:</b>	Subject: Metropolitan areas; Industry: 22131 : Water Supply and Irrigation Systems
<b>Location:</b>	United States--US; North Carolina
<b>Classification:</b>	22131: Water Supply and Irrigation Systems
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	79-88
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association

Place of publication:	Washington
Country of publication:	United States, Washington
Publication subject:	Public Health And Safety, Medical Sciences
ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
ProQuest document ID:	2760580447
Document URL:	<a href="https://www.proquest.com/scholarly-journals/timing-trends-municipal-wastewater-lab-confirmed/docview/2760580447/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/timing-trends-municipal-wastewater-lab-confirmed/docview/2760580447/se-2?accountid=211160</a>
Copyright:	Copyright American Public Health Association Jan 2023
Last updated:	2023-08-25
Database:	Public Health Database

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# Microrandomized Trials: Developing Just-in-Time Adaptive Interventions for Better Public Health

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## ABSTRACT (ENGLISH)

Just-in-time adaptive interventions (JITAs) represent an intervention design that adapts the provision and type of support overtime to an individual's changing status and contexts, intending to deliver the right support on the right occasion. As a novel strategy for delivering mobile health interventions, JITAs have the potential to improve access to quality care in underserved communities and, thus, alleviate health disparities, a significant public health concern. Valid experimental designs and analysis methods are required to inform the development of JITAs. Here, we briefly review the cutting-edge design of microrandomized trials (MRTs), covering both the classical MRT design and its outcome-adaptive counterpart. Associated statistical challenges related to the design and analysis of MRTs are also discussed. Two case studies are provided to illustrate the aforementioned concepts and designs throughout the article. We hope our work leads to better design and application of JITAs, advancing public health research and practice. (AmJ Public Health. 2023;113(1):60-69. <https://doi.org/10.2105/AJPH.2022.307150>)

# FULL TEXT

## Headnote

Just-in-time adaptive interventions (JITAs) represent an intervention design that adapts the provision and type of support overtime to an individual's changing status and contexts, intending to deliver the right support on the right occasion. As a novel strategy for delivering mobile health interventions, JITAs have the potential to improve access to quality care in underserved communities and, thus, alleviate health disparities, a significant public health concern. Valid experimental designs and analysis methods are required to inform the development of JITAs. Here, we briefly review the cutting-edge design of microrandomized trials (MRTs), covering both the classical MRT design and its outcome-adaptive counterpart.

Associated statistical challenges related to the design and analysis of MRTs are also discussed. Two case studies are provided to illustrate the aforementioned concepts and designs throughout the article. We hope our work leads to better design and application of JITAs, advancing public health research and practice. (AmJ Public Health. 2023;113(1):60-69. <https://doi.org/10.2105/AJPH.2022.307150>)

Just-in-time adaptive interventions (JITAs), also known as dynamic tailoring,<sup>1</sup> ecological momentary interventions,<sup>2</sup> and intelligent real-time therapy,<sup>3</sup> represent an intervention design that adjusts the provision and type of support overtime to deal with an individual's changing status and contexts, which intend to deliver the most appropriate support on the right occasion.<sup>4,5</sup> The microrandomized trial (MRT) design has been proposed in recent years as a novel experimental design to construct evidence-based JITAs. According to this design, participants are sequentially randomized to different intervention options (e.g., whether to send a text message).<sup>6,7</sup> Briefly speaking, JITAs involve strategies that determine when to intervene and which intervention to provide, while MRTs focus on the optimization of such strategies by selecting and optimizing intervention components for use in a JITAI.

There are 2 key concepts that distinguish JITAs from standard interventions: just-in-time and adaptive.<sup>5</sup> By just-in-time, JITAs intend to intervene only when needed to alleviate the intervention fatigue and low engagement problems. On the other hand, adaptive refers to the strategy employed by the intervention design to determine which intervention to provide and when to intervene according to the user's ongoing information. To capture the right timings, JITAs require continuous monitoring of the user's internal state and contexts, typically via sensors in mobile phones or wearable devices. As a result, delivering just-in-time interventions face to face is not feasible in practice; JITAs heavily rely on the use of mobile health (mHealth) technologies.<sup>5</sup>

The JITAI in mHealth has the potential to enhance health care and reduce health disparities,<sup>8,9</sup> benefiting various domains of public health research and practice. The MRT has been deliberately introduced to assist with developing these interventions, which can provide information about the dynamics of the best intervention beyond theories and directly inform the construction of JITAs.<sup>6</sup> Nevertheless, JITAs and MRTs have not yet been widely adopted in public health, partly because of the unfamiliarity with the concepts, designs, and analysis methods.

With this article, we aim to introduce key ideas in JITAs, especially focusing on the novel experimental design of MRTs, covering both classical MRT design and its outcome-adaptive counterpart. We discuss the main characteristics of JITAs along with their potential in public health by relating to 2 mHealth studies with embedded MRT design. We also highlight statistical considerations when designing and analyzing MRTs.

## OVERVIEW OF INTERVENTION AND TRIAL DESIGN

The JITAI is an intervention design aiming to deliver adaptive and personalized support only at the time when needed.<sup>4,5</sup> A JITAI consists of 6 key components: decision points, tailoring variables, intervention options, decision rules, proximal outcomes, and distal outcomes.<sup>5</sup> The specific definitions are summarized in Box 1. An intervention option is selected at each decision point based on the values of tailoring variables via a predefined decision rule. The intervention is expected to achieve the distal outcomes by directly impacting the proximal outcomes.

On the other hand, the MRT is an experimental design that provides evidence for building JITAs. It involves the serial randomization of individuals to different intervention options at each decision point.<sup>5</sup> In general, they can answer several essential research questions arising from the construction of JITAs:<sup>6,7</sup>

1. Which intervention will have an impact on the proximal outcomes (proximal effects)?

2. What baseline or time-varying covariates will moderate the proximal effects (moderating effects)?
3. How will the proximal effects change over time?
4. When and how frequently should the intervention be delivered?

In what follows, we will illustrate the MRT design and how it connects to the construction of JITAIs by describing 2 mHealth studies: StayWell at Home and Diabetes and Mental Health Adaptive Notification Tracking and Evaluation (DIAMANTE).

#### Case Studies

**StayWell at Home.** The StayWell at Home trial examined the effect of a 60-day text messaging intervention that intended to help individuals manage their depression and anxiety during the COVID-19 pandemic.<sup>10</sup> This MRT consisted of adults aged 18 years or older who had a functioning mobile phone and spoke English or Spanish. Figure 1 shows the study design of StayWell at Home.

The distal outcome was the management of depression and anxiety during COVID-19 social distancing. The proximal outcome was a daily mood rating in the following 3 hours after receiving the message, an intermediate measure of the distal outcome that captures short-term progress toward better management of depression and anxiety. The intervention was supportive text messages, half related to behavioral activation and half about coping skills. Many contextual variables were also collected, including time-independent variables such as demographics and questionnaire data and time-varying variables such as study day and yesterday's mood rating. The decision point was chosen among 3 timeframes, including 9 am to 12 pm, 12 pm to 3 pm, and 3 pm to 6 pm.

In this design, all participants received uniform random messages. The randomization probability for each message category (behavioral activation vs coping skill) was 0.5, and the probability for each of the 3 timeframes was 0.33. The collected data allowed for pre-post analysis (i.e., the difference in depression and anxiety levels before and after receiving StayWell messages and the differential effects on mood ratings for the 2 categories of messages and different timings). The pre-post analysis has already been published,<sup>11</sup> while the analysis of MRT data is still underway.

**Diabetes and Mental Health Adaptive Notification Tracking and Evaluation.**

The DIAMANTE trial aimed to evaluate the effect of a text-messaging smartphone application targeting diabetes and depression management through an intermediate outcome representing physical activity.<sup>12</sup> This 6-month MRT study consisted of patients aged 18 to 75 years being treated at the Zuckerberg San Francisco General Hospital who had been diagnosed with diabetes and documented depressive symptoms. Figure 2 presents an overview of the design of this study.

The distal outcome was the improvement of clinical outcomes for comorbid diabetes and depression among low-income, low-health literacy, and ethnic minority individuals. Because lack of physical activity is an overlapping risk factor for these diseases, the embedded intervention was focused on improving an easy-to-measure proximal outcome (i.e., changes in daily step count). A multicomponent intervention consisting of motivational messages (4 categories) and feedback messages (5 categories) were adopted in DIAMANTE. Many contextual variables were collected during the study, including time-independent variables such as demographics, mobile technology familiarity, and other engagement measures, and time-varying variables such as study day and day of the week. The decision point was determined either by uniform randomization or some algorithm among 4 time-frames—that is, 9 am to 11:30 am, 11:30 am to 2 pm, 2 pm to 4:30 pm, and 4:30 pm to 7 pm.

At the macro level, this study is a randomized controlled trial with 3 groups, including a uniform random messaging group, an outcome-adaptive messaging group operationalized through reinforcement learning (RL), and a control group. Participants in the control group received no intervention during the study. With 3 groups, it enables the comparison of adaptive messaging to uniform messaging and no intervention. In the initial 2 weeks, uniform randomization was employed in both the uniform random messaging group and the adaptive messaging group to speed up algorithm learning. After that, the uniform random messaging group used a classical MRT design. Patients received up to 2 randomly selected messages per day within 4 randomly selected timeframes. For the adaptive messaging group, the message categories and timing were chosen by a reinforcement learning algorithm (i.e., linear

Thompson sampling).<sup>13</sup> During the conduct of the trial, a JITAI is constructed concurrently, and its characteristics are summarized in Box 1. Data collection for this MRT is currently under way.

### Key Design Elements

As an experimental design for empirically informing the construction of JITAIs, the design elements of an MRT study should be tightly connected with JITAI components. The intervention and tailoring variables included in a JITAI are usually supported by theoretical and empirical evidence. An intervention may consist of several components, and each of them may have multiple options. MRTs can be used to assess the proximal effects of 1 or more components simultaneously (e.g., motivational and feedback messages in DIAMANTE). During an MRT, it is essential to collect potential tailoring variables, including individual information and external contexts. These variables can serve as an indicator of individual availability.<sup>14</sup> In the HeartSteps I study, if a participant was driving or already walking, it was considered inappropriate to deliver an activity suggestion, and, thus, the participant was considered unavailable.<sup>15</sup> Potential moderation effects can also be investigated by collecting these variables.

The decision points are determined by the frequency of meaningful changes in the tailoring variables (suggested by empirical evidence and theories), as well as the associated assessment burden.<sup>5</sup> They might occur (1) at a prespecified time interval, (2) at specific times of day or days of week, or (3) following random prompts.<sup>5</sup> MRTs can also provide useful information regarding the selection of decision points. In both DIAMANTE and StayWell at Home, meaningful changes in an individual's context were expected to occur daily. As a result, there was 1 decision point per day. Furthermore, timeframes were treated as an experimental factor to examine the differential intervention effects, which can address the question of when to intervene each day.

At each decision point, participants are randomized to various options of an intervention component—for example, different categories of text messages in DIAMANTE and StayWell at Home, based on predetermined probabilities. These interventions are intended to have an impact on a distal outcome (e.g., diabetes or depression) by affecting an easy-to-measure proximal outcome (e.g., daily step count). Proximal outcomes are often specified as mediators of the distal outcome.<sup>5</sup> For example, ample evidence suggests that lack of physical activity is a risk factor for diabetes and depression. If the target distal outcome is comorbid diabetes and depression, physical activity would be a natural choice for the proximal outcome.<sup>12</sup>

In some cases, the distal outcomes are sustainable behavior change with limited knowledge of corresponding mediators; hence, proximal outcomes can also be short-term measures of the distal outcome.<sup>5</sup> For example, daily mood rating is an intermediate measure of depression and anxiety and can be an appropriate proximal outcome.<sup>10</sup> Note that the distal outcome can be affected by the intervention through multiple causal pathways, leading to a multivariate proximal outcome at each decision time in practice.<sup>5</sup> For example, the proximal outcomes in DIAMANTE and StayWell at Home concern the mechanism lying behind the clinical condition. However, the engagement with intervention may also affect the distal outcome and can be targeted by a JITAI.<sup>5</sup>

During an MRT, each participant may be randomized hundreds or even thousands of times (e.g., 180 times in DIAMANTE and 60 times in StayWell at Home). Randomization permits valid estimation of the intervention's time-varying proximal effects, as it balances unobserved covariates between the intervention options. An important design element of an MRT is randomization probability—that is, the probability of assigning participants to each option of the intervention component. They are motivated by both scientific and practical considerations. For example, assigning higher probabilities to less-demanding options may reduce participant burden. According to whether the randomization probabilities are updated to prioritize the intervention appearing to be optimal, MRTs can be further categorized as classical (e.g., in StayWell at Home) or outcome-adaptive (e.g., in DIAMANTE).<sup>16</sup> We will illustrate these 2 versions of MRTs in the next section.

### Classical Vs Outcome-Adaptive Trial Design

Within the classical MRTs, participants are repeatedly randomized to different intervention options according to a fixed time-invariant scheme (i.e., a scheme wherein the probabilities of being allocated to each intervention option remain uniform over time) or a time-varying allocation strategy, (i.e., a strategy wherein the randomization probabilities depend on the individual's previous observations).<sup>17,18</sup> Specifically, the latter seeks to avoid excess



burden by constraining the number of interventions per day and to spread the interventions uniformly across different strata of decision points (e.g., stressed minutes or nonstressed minutes).<sup>19</sup>

However, classical MRTs focus on post-data-collection JITAI optimization (i.e., data analysis is conducted at the end of the trial [known as "offline" learning in the computer science literature]). Such classical MRTs share similarities with the traditional fixed design (with fixed randomization probabilities) or the biased coin design (with time-varying randomization probabilities) of randomized clinical trials,<sup>20</sup> where interventions appearing to be desirable for users (i.e., showing better effectiveness) cannot be prioritized during the trial. The goal is to collect high-quality data that may inform practices for future patients, while participants of the current trial cannot benefit from the new findings.<sup>16</sup> For outcome-adaptive MRTs, the randomization probabilities are adaptively changed in favor of intervention options with superior performance or the highest expected proximal outcome.<sup>16</sup> An essential feature of outcome-adaptive MRTs is that the randomization probabilities are continually adjusted so that the user is assigned to an intervention appearing to be optimal with a higher chance. The outcome-adaptive MRT involves a number of interim analyses during the trial: at every decision point, the design algorithm, usually a reinforcement learning algorithm, selects an intervention option based on historical proximal outcomes and current context, enabling the timely delivery of proper support when needed (known as online learning in the computer science literature). This process leads to an online version of JITAI, which is certainly not the case with classical MRTs.

The outcome-adaptive MRT design is more ethical and efficient when compared with its classical counterpart. First, it can benefit current participants as the intervention delivery is continually optimized to their current context,<sup>16</sup> intending to maximize the cumulative proximal outcomes. The design algorithm can also uncover effective predictors of the right timings when users are more likely to benefit from support and can monitor changes in these predictors, triggering appropriate interventions when needed.<sup>16</sup> Furthermore, the outcome-adaptive MRT may save money by avoiding the collection of useless covariates (i.e., covariates not moderating the intervention effects). More importantly, data collected from outcome-adaptive MRTs can also be used for deriving causal effects and informing offline JITAI construction. Both mHealth and reinforcement learning literatures have provided ways for the analysis of MRTs with time-varying randomization probabilities.<sup>21,22</sup>

Despite that, some drawbacks, such as the increase in trial complexity and the statistical inefficiency caused by unequal allocation,<sup>23</sup> raise questions regarding the use of outcome-adaptive MRTs. As a result, careful considerations should be given to the adoption of outcome-adaptive MRTs, especially to ethical issues (e.g., whether the current participants are in urgent need of interventions) and budget constraints (e.g., balancing between the increased human resources because of trial complexity and the cost reduction during the data collection procedure).

## POTENTIALS IN PUBLIC HEALTH

As a plausible substitute for face-to-face interactions, JITAIs in mHealth might assist with enhancing health care and reducing health disparities caused by inequities in health care systems, especially in underserved communities.<sup>8,9</sup> First, the relative cost and scalability of these interventions allow for faster delivery of quality care, particularly critical in emergencies. During the COVID-19 pandemic, there has been a surge in interest and use of mHealth to meet the increasing demands of health care. With physical distancing restrictions and a lack of in-person care, mHealth has the potential to improve access to mental health care<sup>24,25</sup> and enable self-management.<sup>26</sup> For example, participants who received the StayWell text messaging intervention showed improved depression and anxiety symptoms after the study,<sup>11</sup> indicating that such mHealth interventions are beneficial.

Second, the high uptake of mobile technologies among minority and low-income patients has the potential to improve the health care of populations with limited access to traditional health care resources.<sup>27</sup> For example, the DIAMANTE study focused on low-income, low-health literacy, and ethnic minority individuals. These populations may experience higher prevalence and worse outcomes for both diabetes and depression, and, at the same time, they may lack access to health care. Because of the demonstrated effectiveness of DIAMANTE messages,<sup>28</sup> deploying these mHealth interventions can potentially decrease disparities in health care by reaching vulnerable populations.

More importantly, JITAs have a distinct advantage in capturing the exact moment of users' needs and providing just-in-time support only when it is more likely to benefit the user. As a result, JITAs may alleviate the practical issues of low engagement and declining effectiveness over time faced by many conventional mHealth interventions, which are delivered uniformly to users without taking into account the contexts and individual information. For these reasons, JITAs are increasingly being used in various public health domains, including physical activity maintenance,<sup>29</sup> mental health management,<sup>30</sup> weight loss,<sup>31</sup> and smoking cessation.<sup>32</sup> The effectiveness of JITAs on various health outcomes has been demonstrated in empirical studies.<sup>33</sup> In general, JITAs hold enormous potential in public health research and practice.

## STATISTICAL CHALLENGES FOR MICRORANDOMIZED TRIALS

In this section, we will describe several vital statistical considerations in the design and analysis of MRTs. When designing an MRT, sample size calculation is crucial, while for an outcomeadaptive MRT, the online "adaptive algorithm" for updating the randomization probabilities adds an additional layer of complexity. In what follows, we will briefly review existing methods related to the preceding issues. Other significant challenges are also summarized.

### Sample Size Calculations

When calculating the sample size, it is necessary to specify a primary research question out of all questions of interest. In an MRT study, the primary research question is typically the time-varying effects of an intervention component on the proximal outcome, and sample size calculations are performed to ensure an adequate power to detect statistically significant effects. For example, in StayWell at Home, the primary aim was to investigate whether the type of text messages would affect participants' moods. To facilitate MRT design, Liao et al.<sup>34</sup> proposed an approach to determine the sample size for continuous outcomes by modifying sample size formulas originally developed in the context of generalized estimating equations. Seewald et al.<sup>35</sup> developed an online sample size calculator to help domain scientists implement this method. The calculator for binary outcomes can be accessed via [https://tqian.shinyapps.io/mrt\\_ss\\_binary](https://tqian.shinyapps.io/mrt_ss_binary), while the methodology article has not yet been published online. In addition, Dempsey et al.<sup>17</sup> developed a stratified MRT and provided a sample size formula, and Xu et al.<sup>36</sup> proposed a flexible MRT design allowing for the addition of intervention options during the study and derived corresponding sample size estimators. Box 2 presents information on the sample size calculation methods and software. Nonetheless, other open questions still warrant further research in the design of MRTs, such as the sample size formula for MRTs with count (e.g., number of cigarettes, number of active minutes) or ordinal (e.g., mood rating on a scale of 1-9) proximal outcomes, which are commonly seen in practice.

### Randomization Probability Updates

In outcome-adaptive MRTs, the randomization probabilities are continuously changed in favor of better-performing interventions (i.e., the intervention option that can lead to a higher proximal outcome), allowing the optimization of online JITAs. Reinforcement learning provides an ideal framework for solving such sequential decision-making problems:<sup>40</sup> an agent continuously interacts with a stochastic environment, or the context, and learns how to make better actions or interventions to maximize the cumulative feedback or proximal outcome over time.

Currently, most methods for constructing JITAs online within the outcomeadaptive MRT fall in a subcategory of RL (i.e., contextual multiarmed bandits).<sup>41</sup> Various algorithms have been proposed for contextual multiarmed bandits, making different assumptions about the data-generating process.<sup>41,42</sup> In particular, Thompson sampling has demonstrated not only valid theoretical performance guarantees but also strong empirical performance.<sup>43,44</sup> Because of these advantages, as well as its randomized exploration nature, Thompson sampling has been adopted in the DIAMANTE<sup>12</sup> study and the HeartSteps II study.<sup>45</sup> In addition, other reinforcement learning methods have been employed in mHealth studies. We refer readers to Deliu et al.<sup>42</sup> and Tewari and Murphy<sup>41</sup> for comprehensive reviews of existing RL approaches for developing JITAs, and to Trelia et al.<sup>46</sup> and Figueroa et al.<sup>47</sup> for guidelines regarding the design of online RL algorithms for mHealth interventions.

### Data Analysis

Analyzing MRT data and deriving causal effects are critical steps for constructing efficacious JITAs. Because MRT data include time-varying interventions and endogenous covariates (i.e., depends on previous interventions or

outcomes), standard methods for longitudinal data, including generalized estimating equations and mixed effect approaches, can lead to inconsistent estimates of causal effects.<sup>48</sup>

A weighted and centered least squares (WCLS) estimation procedure has been proposed to obtain unbiased estimates of the causal excursion effects of time-varying components on a time-varying continuous outcome.<sup>21</sup> With some modifications, the WCLS estimator and its standard error can be derived using standard software for generalized estimating equations,<sup>6,21</sup> such as `geepack`<sup>49</sup> in R (R Foundation for Statistical Computing, Vienna, Austria) and PROC GEE in SAS (SAS Institute, Cary, NC). This approach can also be generalized to the setting where the randomization probabilities may change overtime.<sup>21</sup>

Because the WCLS approach is limited to continuous proximal outcomes, Qian et al.<sup>37</sup> proposed a semiparametric estimator of the causal excursion effect in MRTs with binary proximal outcomes. Furthermore, Shi et al.<sup>38</sup> developed a general inferential approach for the causal excursion effect with continuous outcome under potential clusterlevel treatment effect and interference. Li and Wager<sup>39</sup> provided estimation strategies for various causal estimands (i.e., the short-term and long-term direct effect) and the long-term total effect, with a binary outcome under cross-unit interference. See Box 2 for a summary of these methods, as well as the available software. Despite that, specific methods for other data types, such as ordinal or count outcomes, are still not well-developed, as is the case with sample size calculation.

#### Variable Selection

Within JITAs, the content and delivery of interventions are tailored to an individual's ongoing information and external context. Hence, it is necessary to collect all relevant contextual variables and assess the moderation effects of each variable. If there is a large number of potential moderators, we need to conduct moderation analyses using the WCLS approach many times, which can be inconvenient and burdensome. For example, the DIAMANTE study has a high number of baseline and time-varying covariates, which may also interact with the interventions. Although Seewald et al.<sup>50</sup> recommended prespecifying the relative "priority" of each variable, in practice, scientists may not have a priori knowledge about these variables. Therefore, how best to select a subset of variables for subsequent moderation analyses remains unresolved.

#### Missing Data

In the pilot study of DIAMANTE,<sup>28</sup> there were 670 days with missing steps and 3 participants with 2 or fewer days of step data. A critical issue with analyzing MRT data is how to handle these missing data, as missingness may lead to selection bias in subsequent causal inference.<sup>51</sup> However, there is no comprehensive discussion of missing data issues in MRT. In general, 3 methods to handle missing data have been used in MRT studies: complete-case data analysis,<sup>28,52</sup> single imputation,<sup>15</sup> and multiple imputation.<sup>53</sup> In practice, the choice of method should depend on the missingness mechanisms, which can be identified by collecting reasons for missing data during the study.<sup>50</sup> Nevertheless, no matter which method is adopted in the main analysis, sensitivity analysis is recommended to assess the robustness of the findings, especially when data are not missing at random.<sup>54</sup>

#### CONCLUSION

In this review, we have summarized the general framework of the JITAI emerging in mHealth, as well as the key concepts, design considerations, and statistical challenges of a novel experimental design, MRT, that can empirically inform JITAs by assessing the proximal effects and moderation effects. In particular, MRTs can be categorized as classical or outcome-adaptive according to whether the randomization probabilities are adaptively updated in favor of the optimal intervention. When designing outcome-adaptive MRTs, researchers need to choose an appropriate reinforcement learning algorithm for updating these probabilities in addition to the sample size considerations. Nonetheless, there are still some challenges concerning designing and analyzing MRT studies—for example, analysis methods for other types of proximal outcomes, variable selection, and missing data.

With this review, we have sought to introduce the intervention design (JITAI), as well as the cutting-edge experimental design (MRT) of mHealth interventions, to a broad range of readers in the field of public health. We hope our work will lead to greater interest among the public health research community in the uptake of JITAs and MRT methodologies, ultimately leading to the improvement of human lives. ,4JPH

## Sidebar

¾See also Vaughan, p. 35, Seewald, p. 37, Bauer et al., p. 40, and Wang and Chakraborty, p. 49.

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### PUBLICATION INFORMATION

Full Citation: Liu X, Deliu N, Chakraborty B. Microrandomized trials: developing just-in-time adaptive interventions for better public health. *Am J Public Health*. 2023;113(1):60-69.

Acceptance Date: October 5, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307150>

### CONTRIBUTORS

X. Liu wrote the first draft of the article. B. Chakraborty conceptualized the project and developed the outline and topics to be covered.

N. Deliu contributed sections of the article. All authors reviewed and approved the final version of the article.

### ACKNOWLEDGMENTS

B. Chakraborty would like to acknowledge research support from the Khoo Bridge Funding Award (Duke-NUS-KBrFA/2021/0040) and the start-up grant from the Duke-NUS Medical School, National University of Singapore. We wish to acknowledge helpful comments from Roger Vaughan, DrPH, MS.

### CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

### HUMAN PARTICIPANT PROTECTION

No protocol approval was needed for this project because no human participants were involved.

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## DETAILS

<b>Subject:</b>	Public health; Diabetes; Just in time; Overtime; Anxiety; Quality of care; Telemedicine; Health research; Intervention; Medical research; Health disparities; Mental depression; Algorithms; Mental health; Coronaviruses; Text messaging; COVID-19
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	60-69
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association

Place of publication:	Washington
Country of publication:	United States, Washington
Publication subject:	Public Health And Safety, Medical Sciences
ISSN:	00900036
Source type:	Scholarly Journal
Language of publication:	English
Document type:	Journal Article
DOI:	<a href="https://doi.org/10.2105/AJPH.2022.307150">https://doi.org/10.2105/AJPH.2022.307150</a>
ProQuest document ID:	2760580355
Document URL:	<a href="https://www.proquest.com/scholarly-journals/microrandomized-trials-developing-just-time/docview/2760580355/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/microrandomized-trials-developing-just-time/docview/2760580355/se-2?accountid=211160</a>
Copyright:	Copyright American Public Health Association Jan 2023
Last updated:	2023-06-12
Database:	Public Health Database

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# The Sequential Multiple Assignment Randomized Trial for Controlling Infectious Diseases: A Review of Recent Developments

Wang, Xinru, MS; Chakraborty, Bibhas, PhD

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## ABSTRACT (ENGLISH)

Infectious diseases have posed severe threats to public health across the world. Effective prevention and control of infectious diseases in the long term requires adapting interventions based on epidemiological evidence. The sequential multiple assignment randomized trial (SMART) is a multistage randomized trial that can provide valid evidence of when and how to adapt interventions for controlling infectious diseases based on evolving epidemiological evidence. We review recent developments in SMARTs to bring wider attention to the potential benefits of employing SMARTs in constructing effective adaptive interventions for controlling infectious diseases and other threats to public health. We discuss 2 example SMARTs for infectious diseases and summarize recent developments in SMARTs from the varied aspects of design, analysis, cost, and ethics. Public health investigators



are encouraged to familiarize themselves with the related materials we discuss and collaborate with experts in SMARTs to translate the methodological developments into preeminent public health research. (Am J Public Health. 2023;113(1 ):49-59. <https://doi.org/10.2105/AJPH.2022.307135>)

## FULL TEXT

### Headnote

Infectious diseases have posed severe threats to public health across the world. Effective prevention and control of infectious diseases in the long term requires adapting interventions based on epidemiological evidence. The sequential multiple assignment randomized trial (SMART) is a multistage randomized trial that can provide valid evidence of when and how to adapt interventions for controlling infectious diseases based on evolving epidemiological evidence.

We review recent developments in SMARTs to bring wider attention to the potential benefits of employing SMARTs in constructing effective adaptive interventions for controlling infectious diseases and other threats to public health. We discuss 2 example SMARTs for infectious diseases and summarize recent developments in SMARTs from the varied aspects of design, analysis, cost, and ethics.

Public health investigators are encouraged to familiarize themselves with the related materials we discuss and collaborate with experts in SMARTs to translate the methodological developments into preeminent public health research. (Am J Public Health. 2023;113(1 ):49-59. <https://doi.org/10.2105/AJPH.2022.307135>)

Infectious diseases have posed severe threats to public health throughout human history. In recent years, the COVID-19 pandemic has inflicted enormous human suffering and in tandem has attracted considerable research attention. To slow the spread of COVID-19 and to reduce the morbidity and mortality rates, numerous interventions have been imposed to control the spread of the disease (e.g., limiting group size of social gatherings, promoting vaccine uptake, and issuing stay-at-home orders).<sup>1</sup> However, to minimize the negative impact on people's livelihood while also effectively controlling the diseases, decisionmakers are required to find the precise ways to adapt health promotion and disease prevention programs based on evolving epidemiological evidence, instead of sticking to "one-size-fits-all" interventions.

Such sequences of decision-making about when and how to adapt interventions based on evolving epidemiological evidence have been widely applied to the prevention of infectious diseases and can be referred to as "adaptive interventions," also known as "dynamic treatment regimens" or "adaptive treatment strategies" in the field of biostatistics.<sup>2</sup> The main components of an adaptive intervention are (1) intervention options, such as different types of interventions, delivery approaches, and dosage levels; (2) decision points, that is, the prespecified time points to recommend interventions based on baseline characteristics or intermediate tailoring variables; (3) tailoring variables, that is, variables that can be used to identify which intervention should be recommended and for whom (e.g., mediators, moderators, or early surrogates for longer-term outcomes of interest); and (4) decision rules, that is, prespecified rules that can recommend interventions based on previous historical data.

One example of an adaptive intervention for treating COVID-19-positive patients with mild symptoms is the following: First, treat the patients at community care facilities with general medical care. Then, assign patients who respond adequately, according to prespecified criteria, to the community recovery facilities before discharging them, and hospitalize nonresponders and provide intensified medical care.<sup>3</sup>

With the increasing popularity of adaptive interventions, there appears to be a wave of interest in developing a promising evidence-based adaptive intervention to maximize patient gains.<sup>4</sup> When faced with life-threatening infectious diseases, researchers rely primarily on historical experiences and observational data to inform decision-making procedures, given that explanatory randomized controlled trials (RCTs) are time consuming and may fail to generate up-to-date conclusions to guide the implementation of public health interventions. However, the validity of such an analysis based on observational data depends on the untestable ignorable intervention assignment assumption, that is, the assumption that receiving the intervention or not is independent of the potential outcomes.<sup>5</sup> At the outset of the COVID-19 pandemic, observational studies were essential to provide evidence for prompt public

policies. However, as the increasing level of COVID-19 vaccine coverage has significantly decreased the morbidity and mortality rates, proactive research (e.g., pragmatic study designs) is needed to move to the next-generation epidemiological prevention measures and further identify evidence-based interventions for future public health practice for infectious diseases.

The sequential multiple assignment randomized trial (SMART) is an experimental design consisting of multiple randomization stages.<sup>2</sup> This type of design serves as a promising tool to address scientific questions about constructing effective adaptive interventions for controlling infectious diseases. SMARTs have been implemented in various health domains, including diet and weight control,<sup>6</sup> HIV infection,<sup>7</sup> mental health,<sup>8</sup> and behavioral sciences.<sup>9</sup> This recent surge in the prevalence of SMARTs can be attributed to the increasingly ripened methodology in the design and analysis aspects and the availability of some good tutorial articles providing blow-by-blow guidance to help practitioners gain a better understanding of SMARTs.<sup>10-16</sup> However, to the best of our knowledge, except for the setting of HIV infection, there are far fewer SMARTs in the field of infectious diseases, likely on the grounds that contagious diseases require a rapid real-time response at the early stage of the outbreak. Furthermore, SMARTs may be relatively uncommon to many public health researchers; thus, researchers may hesitate to choose a SMART design when constructing evidence-based adaptive interventions for controlling infectious diseases.

We aim to facilitate the implementation of SMARTs for infectious diseases by summarizing the recent developments in SMARTs with a special focus on infectious diseases. We first review 2 SMARTs for infectious diseases to help readers gain a better grasp of employing SMARTs to improve public health. We then provide details about associated data analysis and cost and ethical considerations in SMARTs. We also summarize the existing software for designing and analyzing SMARTs to build a bridge between methodological developments and practical implementation. Although we focus on infectious diseases, our discussion is sufficiently general to apply SMARTs to a wide range of other fields.

#### EXAMPLE SMARTS FOR INFECTIOUS DISEASES

In this section, we provide 2 example SMARTs for controlling infectious diseases.

##### Example 1

Despite the high global capacity to produce COVID-19 vaccines and the increasing clinical trial data demonstrating their effectiveness, some people still hesitate to get vaccinated because they fear potentially severe side effects or simply lack the conviction that the vaccines are useful. Governments have taken public measures (e.g., mounting public media programs) to dispel the rumors about COVID-19 vaccines. However, such measures can reach only a limited audience. More efforts are needed to further promote vaccine uptake and speed up the process of herd immunity.

There is a large-scale SMART, each stage of which was planned as a separate RCT for investigating the effect of digital interventions on the uptake of COVID-19 vaccines.<sup>17</sup> The investigators in this SMART considered several first-line interventions to motivate people to get vaccinated and second-line interventions to further remind those who have not received the first vaccine dose in a prespecified period because of having received the first-line intervention. A simplified version of the design is presented in Figure 1. Participants who had not already taken the first dose at the starting point of the trial were equally randomized to either the message group or the message plus video group. After 8 days, those who still had not received the first dose were randomized to either the no further message group or the reminder group, with a reminder message that could help clear potential barriers to vaccination, such as forgetfulness, hassle, costs, and procrastination. The primary outcome of interest was whether a participant has made the appointment for the first vaccine dose. There were 4 adaptive interventions embedded in this SMART: (1) first send a motivating message, then send a basic reminder message if not vaccinated; (2) send a motivating message only at the starting point; (3) first send a motivating message plus explanatory video, then send a reminder message if not vaccinated; and (4) send a motivating message plus explanatory video only at the starting point.

##### Example 2

Malaria, a potentially serious infectious disease transmitted by a specific type of mosquito, can be effectively controlled by the use of long-lasting insecticide-treated nets (LLIN), indoor residual spraying (IRS), and larval source management (LSM).<sup>18</sup> The high cost of implementing IRS and LSM is a major concern that needs to be considered when constructing an effective adaptive intervention for malaria control, and more scientific evidence is required to guide the prevention interventions, such as when and how to employ IRS and LSM while ensuring efficient harnessing of the resources for malaria control.

An ongoing cluster-randomized SMART (Figure 2) was designed to collect evidence for constructing an effective adaptive intervention for malaria control in western Kenya.<sup>18</sup> By "cluster randomized," we mean that the interventions are randomly administered at the cluster level (e.g., a village or several neighboring villages), whereas the outcomes are collected at the individual level (i.e., residents in the randomly selected households). The enrolled clusters are randomized to receive LLIN, piperonyl butoxide (PBO) LLIN (the next-generation LLIN combining the synergist piperonyl butoxide with pyrethroids), or the combination of LLIN and IRS. After 15 months, clusters will be evaluated for the response status based on the change in clinical malaria incidence when using PBO LLIN or LLIN + IRS compared with LLIN alone. Responders will continue with their initial intervention, whereas nonresponders to PBO LLIN are randomized to the combination of PBO LLIN + LSM or the intervention determined by a reinforcement learning algorithm developed to generate unbalanced randomization probabilities in favor of the estimated superior intervention for each cluster, and nonresponders to LLIN + IRS are randomized to LLIN + IRS + LSM or PBO LLIN + IRS. The primary outcome of interest is the clinical malaria incidence. The primary aim of this trial is to compare first-line interventions PBO LLIN and LLIN + IRS in terms of the effectiveness of reducing malaria incidence after 36 months, and the secondary aim is to identify the most effective intervention to reduce malaria incidence.

In addition to these 2 examples, there is another ongoing SMART for developing an optimal adaptive intervention to facilitate COVID-19 testing and adherence to the Centers for Disease Control and Prevention recommendations among high-risk people in an urban community.<sup>19</sup> We have not presented details here because of space limitations.

#### WHEN TO USE SMARTS

There have been tremendous improvements in the experimental designs for constructing interventions with multiple components, such as factorial designs,<sup>20</sup> SMARTs, and microrandomized trials.<sup>21</sup> Given that the concepts of these designs are somewhat entangled, researchers may be confused about when to use SMARTs at the beginning of the design stage, which limits the broader use of SMARTs. With this backdrop, Nahum Shani et al.<sup>22</sup> proposed a practical framework to provide valuable insights into choosing the most appropriate design among all these candidate designs. To briefly summarize, a SMART design is a proper choice when (1) the interventions of interest are multicomponent interventions, (2) the researchers aim to select multiple effective components out of all candidates to be included in the final intervention, (3) there are research interests in the timing of intervention components, and (4) the conditions are changing slowly.

It is important to note that, in cases in which all 4 conditions for choosing SMARTs are met, multiple single-stage RCTs may serve as an alternative way to examine the effect of the initial and subsequent interventions.<sup>23</sup> Single-stage RCTs, however, have some inevitable disadvantages compared with SMARTs.<sup>11</sup> First, single-stage RCTs do not allow researchers to investigate either the synergistic effect between the initial and subsequent interventions in the long term or the potential tailoring variables for more tailored adaptive interventions.

In addition, it can be argued that participants in SMARTs may be less likely to drop out because alternative interventions are provided in cases of insufficient early response. In other words, SMARTs provide participants with a "safety net" (i.e., a second chance to get a different, potentially beneficial intervention when the current intervention is not working). By contrast, with single-stage RCTs, participants with apparently ineffective interventions have no choice but to discontinue the intervention or drop out. SMARTs can also be replaced by an up-front randomized trial,<sup>24</sup> which randomizes patients to candidate adaptive interventions at the beginning of the study. Compared with SMARTs, the rationale and statistical methods in upfront randomized trials are easier to understand. However, several studies have demonstrated that the estimators from SMARTs are more efficient (with smaller variance) than are those from upfront randomized trials.<sup>24,25</sup> Moreover, rerandomizations in SMARTs allow

restratification, which may be useful in achieving balanced distributions of covariates in rerandomizations, whereas up-front randomized trials do not allow this.

## SAMPLE SIZE

### CALCULATIONS IN SMARTS

The required sample size in a SMART is dictated by its primary research questions.

Table 1 summarizes the most common primary goals of SMARTs, and some illustrative applications and software are provided for each case when applicable. Briefly, there are mainly 4 primary research goals in SMARTs: (1) performing the pilot evaluation, (2) estimating the main effects of first-line and second-line interventions, (3) comparing embedded adaptive interventions, and (4) developing the optimization goal (i.e., more deeply tailored adaptive interventions).

The evaluation of feasibility is often the intended goal in a pilot SMART, in which researchers assess the acceptability and the rationale of the embedded adaptive interventions as well as the fidelity of the study staff to implement the specified adaptive interventions in preparation for a future full-scale SMART. Almirall et al.<sup>12</sup> described in detail how to design a pilot SMART and proposed a feasibility-based method to determine the required sample size that ensures sufficient participants in each intervention sequence, allowing researchers to gather comprehensive information about the feasibility of a planned SMART. Building on this, Yan et al.<sup>26</sup> presented a precision-based method to size a pilot SMART with various types of outcomes, by which the SEs of estimates of interest are confined in a prespecified range.

For a full-fledged SMART, one of the most common primary research goals that drive sample size calculation is to investigate the effect of individual components. Oetting et al.<sup>29</sup> gave a detailed illustration of deriving the required sample size for comparing stage-specific intervention effects with continuous primary outcomes. Briefly, the calculation procedure is similar to that used in RCTs, except that the response rate of initial interventions should be incorporated when investigating the intervention effect of subsequent interventions for responders and nonresponders. Practitioners can follow the same principles for other types of primary outcomes.

A sizable literature focuses on comparing embedded adaptive interventions as a whole, comparing 2 or more embedded adaptive interventions,<sup>29-31</sup> or screening out the inferior set of adaptive interventions.<sup>43</sup> Ghosh et al.<sup>42</sup> further extended the framework by emphasizing the importance of noninferiority testing between 2 embedded adaptive interventions to construct an almost equally effective adaptive intervention with lower cost, less burden, or fewer side effects and developed the analysis and sample size calculation formulas for the noninferiority testing. All the aforementioned sample size calculation methods are suitable for individual-level SMARTs with continuous primary outcomes. Recently there has been tremendous progress in deriving the sample size calculation formulas for comparing embedded adaptive interventions in individual-level SMARTs with binary,<sup>34</sup> survival,<sup>35</sup> 48-50 ordinal,<sup>37</sup> and continuous longitudinal<sup>36</sup> outcomes; for cluster-level SMARTs with binary and continuous outcomes<sup>33</sup> 39; and for cluster-level SMARTs with various features of outcomes, including spatial clustering, non-Gaussianity, and missing not at random.<sup>40</sup>

Investigators may also be interested in constructing more tailored adaptive interventions (i.e., sequences of decision rules that recommend intervention options based on additional observed information; e.g., baseline characteristics or intermediate potential tailoring variables). The research question is thus to explore an optimal tailored adaptive intervention that is expected to maximize the overall effectiveness of interventions if applied to the entire study population. Although optimization is a possible primary goal, it often serves as a bonus on top of investigating main effects and comparing embedded adaptive interventions when conducting a SMART.

When a SMART is designed with the optimization objective, the sample size calculation involves technical issues posed by estimating and evaluating an optimal adaptive intervention using the same data. Rose et al.<sup>47</sup> proposed normality-based and projection-based sample size calculation methods to ensure enough power for comparing the estimated optimal deeply tailored adaptive intervention with the fixed standard intervention. Note that the required sample size for comparing embedded adaptive interventions or optimization is often higher than that for comparing stage-specific interventions. Researchers are advised to define the primary goals of SMARTs based on the research

budget for recruiting participants and the major research questions of interest.

Although significant strides have been made in statistical methodology, to the best of our knowledge, these sample size calculation methods for comparing adaptive interventions or optimizations are scarcely used in real practice. The reason for this may be that both the scientific investigators and the statisticians are more familiar with the statistical methods in standard trials, so they are inclined to sizing SMARTs based on the main effect, with the additional goal of comparing embedded adaptive interventions or optimization to provide complementary information for future confirmatory trials. More efforts are needed to translate the developed methodologies to real clinical and public health practice by lucidly explaining the concepts of SMARTs and the statistical tools to a broader audience.

#### DATA ANALYSIS IN SMARTS

When the research question concerns examining the main effects in a SMART, standard statistical methods in RCTs can be used to analyze the SMART data. However, when the goal is to discern the effectiveness of 2 or more embedded adaptive interventions, adjustments to the standard methods are required to account for the sequential randomizations in SMARTs. The weighted and replicated regression<sup>51</sup> can provide valid inferences of the mean outcomes of all the embedded adaptive interventions simultaneously, by weighting and replicating observations to account for the underrepresentation of certain subgroups because of the design of the trial. Nahum-Shani et al.<sup>52</sup> presented a thorough guideline on how to use this method to analyze data from SMARTs with end-of-study continuous outcomes. This method holds the promise of being straightforward and accessible to practitioners as it is akin to standard regression methods and can be executed using standard software. The method has been extended to analyze data from SMARTs with continuous longitudinal outcomes,<sup>53</sup> binary outcomes,<sup>34</sup> and continuous outcomes in cluster-level SMARTs,<sup>39</sup> and it has been employed in real practice for primary, secondary, and exploratory analyses<sup>6,54,55</sup> Q-learning, a stage-by-stage regression type procedure,<sup>56</sup> can be used to identify an optimal deeply tailored adaptive intervention (as opposed to the embedded adaptive interventions) based on SMART data. The letter Q stands for the quality of an intervention (e.g., a desired clinical outcome), conditional on the observed information and subsequent interventions. Intuitively, Q-learning begins by estimating the optimal decision rule at the last stage and moves backward successively to construct an optimal decision rule at each stage, assuming the use of optimal decision rules at the subsequent stages. Nahum-Shani et al.<sup>56</sup> provide a detailed illustration of implementing Q-learning to construct more tailored adaptive interventions in SMARTs. Other notable statistical learning-based and tree-based methods<sup>57-59</sup> can also be applied to develop optimal adaptive interventions. Table 2 lists several user-friendly R packages to compare embedded adaptive interventions or develop more tailored adaptive interventions.

Missing data problems pose a significant challenge to data analysis in SMARTs. Standard imputation methods cannot be directly applied to deal with missing data in SMARTs because of the nonstandard multistage randomization procedure. However, researchers can alleviate the impact of missing data on the validity of analysis from both design and analysis perspectives. First, as stated by Almirall et al.,<sup>12</sup> pilot SMARTs can provide valuable insights for future fullscale SMARTs in terms of strategies to reduce the dropout rate and to treat early dropout patients. Liu et al.<sup>64</sup> presented a SMART with enrichment to improve design efficiency when the dropout rate is high by augmenting the trial sample with new patients who have received previous stages' interventions. In terms of analysis, Shortreed et al.<sup>65</sup> proposed a multiple imputation strategy to tackle the unique missing data problems arising in SMARTs. Researchers are encouraged to employ these tactics to achieve more reliable inferences from SMARTs and perform sensitivity analysis to check the validity of the missing at random assumption.

#### COST-EFFECTIVE ADAPTIVE INTERVENTIONS

Effective control of infectious diseases requires the involvement of a variety of communities and stakeholders. Efficient use of scarce medical and financial resources is one of the major challenges when implementing large-scale prevention and intervention programs.<sup>66</sup> When intervention resources are limited for conducting a SMART, the optimal allocation of interventions with a fixed budget constraint is desired. Morciano and Moerbeek<sup>67</sup> proposed an optimal allocation strategy for simultaneously comparing embedded adaptive interventions in SMARTs with a fixed sample size or a fixed budget and provided an easy to use Web app to facilitate the use of this optimal

allocation strategy.

Although the efficacy of improving outcomes is often the main focus when developing optimal adaptive interventions, the cost of an intervention is another important factor to consider in health economics. When an intervention is more effective and less costly than another, it is deemed to be the strictly superior intervention. However, if the more effective intervention costs more, to select the adaptive interventions that can be both effective and sustainable in practice, policymakers are expected to weigh their options between health efficacy and the additional cost per unit outcome improvement. Xu et al.<sup>68</sup> proposed a decision tree-based algorithm to develop a cost-effective adaptive intervention with the net monetary benefit as the primary outcome. This cost-effectiveness analysis method is recognized as a promising way to analyze SMART data and develop more tailored cost-effective adaptive interventions. As it has been widely acknowledged that cost effectiveness is a major concern during clinical practice, researchers are encouraged to collect cost-related data for a future cost-effectiveness analysis.

#### ETHICAL CONSIDERATIONS IN SMARTS

Even though SMARTs can potentially unpack the black box of sequenced multicomponent interventions, they may require more time to implement than do standard RCTs. For infectious diseases, however, the earlier the intervention is delivered, the more benefits it will provide for public health. With the aim of reducing the time for conducting SMARTs, Wu et al.<sup>69</sup> proposed a SMART with interim monitoring, in which the global hypothesis testing of all embedded adaptive interventions is conducted at each interim monitoring time, and early stopping of the trial is permitted if the evidence of efficacy is sufficient.

When faced with emerging infectious diseases that threaten millions of human lives, it is imperative to conduct trials to select effective interventions for future patients while minimizing the infection and mortality rate of enrolled participants. Several extensions of SMARTs can be potentially applied to increase the number of participants receiving the optimal intervention in SMARTs for controlling infectious diseases. Cheung et al.<sup>70</sup> provided a SMART with adaptive randomization based on Q-learning. Roughly speaking, it estimates the parameters of the stage-specific conditional mean outcomes based on the data from previous patients and updates the assignment probabilities in favor of the interventions with higher values of the predicted stage-specific conditional mean outcomes. Wang et al.<sup>71</sup> presented a response-adaptive SMART to incorporate the short-term intervention efficacy shown from previous patients when randomizing the stage 2 interventions. So far, very few adaptive SMARTs have been implemented in practice; for example, Ruppert et al.<sup>72</sup> presented a trial protocol for a SMART with an interim analysis targeting older patients with chronic lymphocytic leukemia, in which rerandomization will be discontinued if the adaptive intervention to be randomized has proven to be inferior to the others.

At the early stage of an infectious disease outbreak, the information regarding potentially effective interventions accumulates continuously, and as a result, a more flexible trial design that allows adding new interventions and removing inferior interventions may be a better choice to save on costs and time. One of the most notable examples is the RECOVERY (Randomized Evaluation of COVid-19 ThERapY) trial,<sup>73</sup> a platform trial to discover effective interventions to reduce the mortality rate in hospitalized COVID-19 patients. Future work could extend SMARTs to have such flexibility and compare its statistical properties with other types of SMARTs, which may be useful in planning for future pandemic control.

#### CONCLUSIONS

We sought to facilitate the application of SMARTs in the area of infectious diseases by familiarizing interested investigators with the general framework of SMARTs and the recent developments in SMARTs in terms of methodology and practical guidelines. Despite our best efforts to find related literature for a thorough review, there may be some publications that we have missed. Although we do not provide an exhaustive list of related articles, we cover the most important aspects of conducting a SMART, from identifying scenarios in which SMARTs are applicable and summarizing design and analysis methods for SMARTs to addressing the costs and ethical issues in such trials. Note that we did not intend to provide step-by-step guidance on implementing a SMART; instead, we attempted to provide comprehensive resources for potential designers of SMARTs for infectious diseases, including example SMART designs for controlling infectious diseases and easy-to-use software for sample size calculation.

and data analysis in SMARTs.

Although SMARTs may seem conceptually complex to some readers, they can shift the fixed interventions to the more realistic interventions in which modifying interventions is allowed according to the early response status, which mimics what public health practitioners do in practice. We hope that investigators will draw inspiration from this review and translate it into practice to improve public health in the face of life-threatening infectious diseases as well as other potential health-related challenges. ÂfPU

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#### PUBLICATION INFORMATION

Full Citation: Wang X, Chakraborty B. The sequential multiple assignment randomized trial for controlling infectious diseases: a review of recent developments. *Am J Public Health*. 2023;113(1): 49-59.

Acceptance Date: September 19, 2022.

DOI: <https://doi.org/10.2105/AJPH.2022.307135>

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B. Chakraborty helped write and critically revise the article.

#### ACKNOWLEDGMENTS

B. Chakraborty would like to acknowledge research support from a Khoo Bridge Funding Award (Duke-NUS-KBrFA/2021/0040) and a startup grant from Duke-NUS Medical School, National University of Singapore.

We wish to acknowledge helpful comments from Roger Vaughan, DrPH, MS, and the anonymous reviewers.

#### CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

#### HUMAN PARTICIPANT PROTECTION

No protocol approval was needed for this study because no human participants were involved.

#### Sidebar

See also Vaughan, p. 35, Seewald, p. 37, Bauer et al., p. 40, and Liu et al., p. 60.

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## DETAILS

<b>Subject:</b>	Infectious diseases; Public health; COVID-19 vaccines; Cost analysis; Epidemiology; Mortality; Health research; Decision making; Threats; Disease control; Prevention; Health care expenditures
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1

<b>Pages:</b>	49-59
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2023
<b>Section:</b>	RESEARCH & ANALYSIS
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Evidence Based Healthcare, Journal Article
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307135">https://doi.org/10.2105/AJPH.2022.307135</a>
<b>ProQuest document ID:</b>	2760580333
<b>Document URL:</b>	<a href="https://www.proquest.com/scholarly-journals/sequential-multiple-assignment-randomized-trial/docview/2760580333/se-2?accountid=211160">https://www.proquest.com/scholarly-journals/sequential-multiple-assignment-randomized-trial/docview/2760580333/se-2?accountid=211160</a>
<b>Copyright:</b>	Copyright American Public Health Association Jan 2023
<b>Last updated:</b>	2023-03-01
<b>Database:</b>	Public Health Database

Document 39 of 39

## AJPH in 2023: Embracing Digital-First

Benjamin, Georges C, MD <sup>1 1</sup> Executive Director American Public Health Association

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**FULL TEXT**

Over the past few decades, a change has been brewing in how people want information and how associations and other publishers provide content. The Web and digital versions of newspapers, for example, have become increasingly important as readers have shifted away from having physical papers delivered to their homes. People want and expect instant access to information.

We've watched these changes for years and taken action to meet them and the changing desires of our members and AJPH subscribers. AJPH articles have been available online for years. We've released First Look articles as a way to share information more quickly. Fifteen years ago, we even moved the AJPH version of record from our print edition to the digital one.

Over the past three years, as the world dealt with COVID-19, the shift to digital really ramped up within the publishing and news industries, especially for associations.

Looking at trends within the industry and our membership, member comments, and what we offer, we've decided to embrace this shift and spend 2023 transitioning AJPH to a digital-first publication. I'll miss flipping through the glossy pages of AJPH, but it's time to readjust our thinking and continue the evolution of AJPH to ensure that it maintains its status as the leading resource for impactful public health research and information.

The positive impacts are many: AJPH will reduce its contribution to the climate crisis by reducing the number of copies of the journal being printed and mailed, our digital offerings will expand, and resources will be reallocated to more popular and effective mediums, including short videos, podcasts, and more.

We hope you're as excited about the coming changes as we are.

Of course, this was not an easy decision. Providing print copies of the journal to members who want them is an APHA member benefit, and we don't want to change the format of that benefit unless the positives vastly outweigh the negatives. In this instance, we believe that's the case.

To show our ongoing commitment to members and readers who desire it, we're developing a full-issue PDF to provide a cover-to-cover experience for those who wish to receive it as part of their APHA membership. People will be able to print the PDF and save it to up to six devices. We're making upgrades to the AJPH e-Reader edition as well, which will be available as an individual purchase with a discount for members or at a reduced monthly subscription rate.

For members accustomed to receiving AJPH in print, the shift will happen at your renewal date. As you renew, you'll have an opportunity to receive the new full-issue PDF. Of course, all members will continue to enjoy full access to all AJPH articles, including those dating back to 1911.

Print is not disappearing entirely, it's simply not at the forefront anymore. Organizations subscribing to AJPH outside of any APHA membership will be able to purchase AJPH in print to make it available as a resource in their libraries if they wish. In instances where someone wants to purchase a physical issue, we'll print the needed copies on-demand.

We hope you'll join us in embracing these changes in the same spirit that we made them, with an eye toward a more versatile, accessible, and climate-friendly AJPH. For more information on this transition, check out our FAQs at [www.apha.org/ajph](http://www.apha.org/ajph) and stay tuned to the journal's home page, [www.ajph.org](http://www.ajph.org), for updates.

19 Years Ago

Pitfalls of and Controversies in Cluster Randomization Trials

The issue of choosing the unit of inference is sometimes referred to as the "unit of analysis problem." We believe that this phrase can be misleading, since it confuses the choice of analytic unit with the need to account for clustering. Similarly, statements sometimes seen in the literature to the effect that "analysis by individual" is incorrect for cluster randomization trials or that the "allocation unit should be the unit of analysis" are also misleading. In general, an analysis at the individual level that properly accounts for the effect of clustering is equivalent to an appropriately weighted cluster-level analysis. Thus, the issue of fundamental importance in this context is best referred to as the unit of inference, rather than the unit of analysis.

From AJPH, March 2004, p. 418

47 Years Ago

## A Bayesian Approach To Health Project Estimation

[A]nyone trying to study anything in a poor country hears time and again that practically any statistic he finds is useless. Admitting this, he must decide what to do next. There are three possible approaches. The first rejects statistical analysis and depends on the opinion of individuals with long experience in the field. . . . The second approach ignores the problem and proceeds to apply the whole gamut of classical statistical methods to the existing data.... There is a third way... Bayesian statistical techniques can create a measure of output in a way that lays all the assumptions open to refutation, but also permits the use of expert opinion where recorded numbers are nonexistent or hopelessly inadequate.

From AJPH, August 1976, p. 748

## DETAILS

<b>Subject:</b>	Journals; Electronic publishing
<b>Company / organization:</b>	Name: American Public Health Association; NAICS: 813910
<b>Publication title:</b>	American Journal of Public Health; Washington
<b>Volume:</b>	113
<b>Issue:</b>	1
<b>Pages:</b>	5
<b>Publication year:</b>	2023
<b>Publication date:</b>	Jan 2 023
<b>Section:</b>	EDITOR'S CHOICE
<b>Publisher:</b>	American Public Health Association
<b>Place of publication:</b>	Washington
<b>Country of publication:</b>	United States, Washington
<b>Publication subject:</b>	Public Health And Safety, Medical Sciences
<b>ISSN:</b>	00900036
<b>Source type:</b>	Scholarly Journal
<b>Language of publication:</b>	English
<b>Document type:</b>	Editorial
<b>DOI:</b>	<a href="https://doi.org/10.2105/AJPH.2022.307161">https://doi.org/10.2105/AJPH.2022.307161</a>
<b>ProQuest document ID:</b>	2760580331

**Document URL:** <https://www.proquest.com/scholarly-journals/ajph-2023-embracing-digital-first/docview/2760580331/se-2?accountid=211160>

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**Last updated:** 2023-02-10

**Database:** Public Health Database

## Bibliography

Citation style: APA 6th - Annotated with Abstracts - American Psychological Association, 6th Edition

Testa, A., PhD. (2023). The contribution of criminal justice systems to reproductive health disparities. *American Journal of Public Health, Suppl. Supplement 1*, 113, S10-S12. Retrieved from <https://www.proquest.com/scholarly-journals/contribution-criminal-justice-systems/docview/2770264176/se-2?accountid=211160>

Racial inequities are deeply embedded in the fabric of the United States. Two areas where racial disparities are highly prevalent are in the criminal justice system and in reproductive health outcomes. The United States has the largest incarceration rate in the world and incarcerates Black persons at a rate of nearly five times that of White persons.<sup>1</sup> Millions of persons in the United States also experience contact with law enforcement each year, and Black individuals experience the bulk of unjust and aggressive police encounters. The National Academies of Science, Engineering, and Medicine recently concluded, "There are likely to be large racial disparities in the volume and nature of police-citizen encounters when police target high-risk people or high-risk places, as is common in many proactive policing programs."<sup>2</sup>(p301) Unfortunately, the racial disparities that disadvantage Black persons in the United States are also present in reproductive health, which is perhaps most clearly seen in the Black-White gap in preterm births.<sup>3</sup> Scholars note that these disparities are "likely largely due to social and physical exposures that vary by race due to enduring inequity in the] USA."<sup>4</sup>(p934) The role of racially patterned social stressors (e.g., proactive policing) as a contributor to the racial preterm birth gap has gone overlooked, necessitating research to better understand how criminal justice systems contribute to reproductive health disparities. The study by Jahn et al. (p. S21) in this issue of *AJPH* forwards research at the intersection of criminal justice and public health in a rigorous analysis that illuminates the unambiguous racial disparities in reproductive health and proactive policing; their study also details how the two intersect. Using data from the New Orleans Police Department and state vital statistics, the authors geocoded records from every birth occurring in New Orleans, Louisiana, from 2018 to 2019 (n = 9102) and linked these records with census tract data on proactive police stops. The findings show that Black birthing persons experience preterm birth at a rate that is nearly twice as high as that of White birthing persons (15.8% vs 8.0%).

Young, M. D. T., PhD.M.P.H., & Crookes, D. M., D.R.P.H.M.P.H. (2023). Dismantling structural racism by advancing immigrant health. *American Journal of Public Health, Suppl. Supplement 1*, 113, S16-S20. Retrieved from <https://www.proquest.com/scholarly-journals/dismantling-structural-racism-advancing-immigrant/docview/2770264168/se-2?accountid=211160>

In "Strategies for Naming and Addressing Structural Racism in Immigrant Mental Health," Cerda et al. (p. S72) make a critical call to bring a structural racism framework into efforts to promote immigrants' mental health. Mounting public health research shows that structures and systems of racism are associated with poor health, yet there have been limited applications of a structural racism framework to immigrant health research or practice.<sup>1</sup> As Cerda et al. highlight, structural racism can harm immigrants' health through processes such as policies, workplace conditions, and treatment in mental health service settings. Building on the work of Cerda et al., we discuss how the US immigration system shapes and is shaped by structural racism. We offer recommendations for dismantling structural racism by going to the sources of racial power in research and practice, addressing the intersecting systems that harm health, and advancing antiracist multisectoral partnerships.

Spolum, Maren M, M.P.H., M.P.P., Lopez, William D, PhD., M.P.H., Watkins, D. C., PhD., & Fleming, Paul J, PhD., M.P.H. (2023). Police violence: Reducing the harms of policing through public Health-Informed alternative response programs. *American Journal of Public Health, Suppl. Supplement 1*, 113, S37-S42. doi:<https://doi.org/10.2105/AJPH.2022.307107>

Police violence is a public health issue in need of public health solutions. Reducing police contact through public health-informed alternative response programs separate from law enforcement agencies is one strategy to reduce police perpetration of physical, emotional, and sexual violence. Such programs may improve health outcomes, especially for communities that are disproportionately harmed by the police, such as Black, Latino/a, Native American, and transgender communities; nonbinary residents; people who are drug users, sex workers, or houseless; and people who experience mental health challenges. The use of alternative response teams is



increasing across the United States. This article provides a public health rationale and framework for developing and implementing alternative response programs informed by public health principles of care, equity, and prevention. We conclude with recommendations for public health researchers and practitioners to guide inquiries into policing as a public health problem and expand the use of public health-informed alternative response programs. (Am J Public Health. 2023;113(S1):S37-S42. <https://doi.org/10.2105/AJPH.2022.307107>)

Pamplin, John R, II,PhD., M.P.H., Rouhani, Saba,PhD., M.Sc, Davis, Corey S,J.D., M.S.P.H., King, C., M.P.H., & Townsend, T., PhD. (2023). Persistent criminalization and structural racism in US drug policy: The case of overdose good samaritan laws. American Journal of Public Health, Suppl.Supplement 1, 113, S43-S48. doi:<https://doi.org/10.2105/AJPH.2022.307037>

The US overdose crisis continues to worsen and is disproportionately harming Black and Hispanic/Latino people. Although the "War on Drugs" continues to shape drug policy-at the disproportionate expense of Black and Hispanic/Latino people-states have taken some steps to reduce War on Drugs-related harms and adopt a public health-centered approach. However, the rhetoric regarding these changes has, in many cases, outstripped reality. Using overdose Good Samaritan Laws (GSLs) as a case study, we argue that public health-oriented policy changes made in some states are undercut by the broader enduring environment of a structurally racist drug criminalization agenda that continues to permeate and constrict most attempts at change. Drawing from our collective experiences in public health research and practice, we describe 3 key barriers to GSL effectiveness: the narrow parameters within which they apply, the fact that they are subject to police discretion, and the passage of competing laws that further criminalize people who use illicit drugs. All reveal a persisting climate of drug criminalization that may reduce policy effectiveness and explain why current reforms may be destined for failure and further disadvantage Black and Hispanic/Latino people who use drugs. (AmJ Public Health. 2023;113(S1):S43-S48. <https://doi.org/10.2105/AJPH.2022.307037>)

Cerda, I. H., M.S., Macaranas, A. R., Liu, C. H., PhD., & Chen, Justin A,M.D., M.P.H. (2023). Strategies for naming and addressing structural racism in immigrant mental health. American Journal of Public Health, Suppl.Supplement 1, 113, S72-S79. doi:<https://doi.org/10.2105/AJPH.2022.307165>

Immigrants account for 13.7% of the US population, and the great majority of these individuals originate from Latin America or Asia. Immigrant communities experience striking inequities in mental health care, particularly lower rates of mental health service use despite significant stressors. Structural barriers are a significant deterrent to obtaining needed care and are often rooted in racist policies and assumptions. Here we review and summarize key pathways by which underlying structural racism contributes to disparities in immigrant mental health, including anti-immigration policies, labor and financial exploitation, and culturally insensitive mental health services. Significant accumulated research evidence regarding these barriers has failed to translate into structural reform and financial investment required to address them, resulting in pronounced costs to both immigrant populations and society at large. We propose specific strategies for addressing relevant structural inequities, including reforming economic and financial policies, community education initiatives, and task-sharing and strengths-based interventions developed in partnership with immigrant communities to promote access to mental health care for populations in dire need of culturally appropriate services.

Table of contents. (2023). American Journal of Public Health, Suppl.Supplement 1, 113 Retrieved from <https://www.proquest.com/scholarly-journals/table-contents/docview/2770264080/se-2?accountid=211160>

Mehdipanah, R., PhD., McVay, K. R., B.S., & Schulz, A. J., PhD. (2023). Historic redlining practices and contemporary determinants of health in the detroit metropolitan area. American Journal of Public Health, Suppl.Supplement 1, 113, S49-S57. doi:<https://doi.org/10.2105/AJPH.2022.307162>

Objectives. To examine how redlining, a historical racially discriminatory housing policy implemented by the Home Owners' Loan Corporation (HOLC), is associated with current neighborhood determinants of health in the Detroit Metropolitan Area. Methods. We analyzed associations between census tract-level HOLC color grades (red = "hazardous"; yellow 5 "declining"; blue = "desirable"; and green = "best") and a developed neighborhood

determinants of health index (DOHI) consisting of 8 indicators of economic, social, governance, and physical environment characteristics using spatial regression analysis and controlling for change in the census tract's percentage of White residents. Results. A total of 484 Detroit Metropolitan Area census tracts had HOLC grades. The mean redlining score across all census tracts was 3.02 (min = 1.0; max = 4.0). The mean contemporary DOHI was 19.11 (min 5 8.0; max = 36.0). Regression models show significantly higher DOHI scores in yellowlined (b 5 2.71; 95% confidence interval CI] 5 1.52, 3.91), bluelined (b 5 5.33; 95% CI 5 3.65, 7.01), and greenlined (b 5 9.25; 95% CI 5 6.86,11.64) neighborhoods compared with redlined neighborhoods. Conclusions. Historical redlined neighborhoods experience contemporary determinants of health conditions that are less conducive to health compared with those in nonredlined neighborhoods. These differences also reflect the accumulation of resources essential for health in greenlined neighborhoods.

Kapadia, Farzana,PhD., M.P.H., & Borrell, Luisa N,D.D.S., PhD. (2023). Structural racism and health inequities: Moving from evidence to action. *American Journal of Public Health, Suppl.Supplement 1*, 113, S6-S9. Retrieved from <https://www.proquest.com/scholarly-journals/structural-racism-health-inequities-moving/docview/2770263933/se-2?accountid=211160>

Ignoring structural racism as a core determinant of social inequities, political inequities, and economic inequities ignores its roles as a fundamental driver of the ongoing and stark health inequities racialized and marginalized communities face. The laws, policies, and practices that are manifestations of structural racism in the United States include policing policies and police violence, the War on Drugs, housing discrimination, mass incarceration, occupational inequities, and xenophobic immigration policies, to name a few of the most insidious forms of structural racism. In this issue of AJPH, we present a collection of(1) empirical articles providing evidence on how specific laws, policies, and practices related to the aforementioned topics have upheld and reified structural racism and, specifically, how they have shaped the health inequities pervasive in the United States; and (2) articles providing clear evidence of why researchers must center structural racism as a core determinant of health and health inequities.

Alang, S., PhD., Haile, R., PhD., Hardeman, Rachel,PhD., M.P.H., & Judson, J., P. (2023). Mechanisms connecting police brutality, intersectionality, and women's health over the life course. *American Journal of Public Health, Suppl.Supplement 1*, 113, S29-S36. doi:<https://doi.org/10.2105/AJPH.2022.307064>

Police brutality harms women. Structural racism and structural sexism expose women of color to police brutality through 4 interrelated mechanisms: (1) desecration of Black womanhood, (2) criminalization of communities of color, (3) hypersexualization of Black and Brown women, and (4) vicarious marginalization. We analyze intersectionality as a framework for understanding racial and gender determinants of police brutality, arguing that public health research and policy must consider how complex intersections of these determinants and their contextual specificities shape the impact of police brutality on the health of racially minoritized women. We recommend that public health scholars (1) measure and analyze multiple sources of vulnerability to police brutality, (2) consider policies and interventions within the contexts of intersecting statuses, (3) center life course experiences of marginalized women, and (4) assess and make Whiteness visible. People who hold racial and gender power-who benefit from racist and sexist systems-must relinquish power and reject these benefits. Power and the benefits of power are what keep oppressive systems such as racism, sexism, and police brutality in place. (*AmJ Public Health. 2023;113(S1):S29-S36. <https://doi.org/10.2105/AJPH.2022.307064>*)

White, Kellee,PhD., M.P.H., Moody, D. L. B., PhD., & Lawrence, Jourdyn A,PhD., M.S.P.H. (2023). Integrating racism as a sentinel indicator in public health surveillance and monitoring systems. *American Journal of Public Health, Suppl.Supplement 1*, 113, S80-S84. doi:<https://doi.org/10.2105/AJPH.2022.307160>

Objectives. To evaluate public health surveillance and monitoring systems' (PHSMS) efforts to collect, monitor, track, and analyze racism. Methods. We employed an environmental scan approach. We defined key questions and data to be collected, conducted a literature review, and synthesized the results by using a qualitative description approach. Results. We identified 125 PHSMS; only 3-the Behavioral Risk Factor Surveillance System, Pregnancy

Risk Assessment and Monitoring System, and California Health Interview Survey-collected and reported data on individual-level racism. Structural racism was not collected in PHSMS; however, we observed evidence for linkages to census and administrative data sets or social media sources to assess structural racism. Conclusions. There is a paucity of PHSMS that measure individual-level racism, and few systems are linked to structural racism measures. Public Health Implications. Adopting a standard practice of racism surveillance can advance equity-centered public health praxis, inform policy, and foster greater accountability among public health practitioners, researchers, and decision-makers. Failure to explicitly address racism and the insufficient capacity to support a robust health equity data infrastructure severely impedes efforts to address and dismantle systemic racism. (AmJ Public Health. 2023;113(S1):S80-S84. [https://doi.org/ 10.2105/AJPH.2022.307160](https://doi.org/10.2105/AJPH.2022.307160))

Kapadia, Farzana, PhD., M.P.H., & Borrell, Luisa N, D.D.S., PhD. (2023). Structural racism and public health. American Journal of Public Health, Suppl. Supplement 1, 113 doi:<https://doi.org/10.2105/AJPH.2022.307175>

Jones, A. A., PhD., & Santos-Lozada, A. (2023). The impact of racism, class, and criminal justice on women's distress and health: A reinforcing cycle of social disadvantage. American Journal of Public Health, Suppl. Supplement 1, 113, S13-S15. Retrieved from <https://www.proquest.com/scholarly-journals/impact-racism-class-criminal-justice-on-womens/docview/2770263464/se-2?accountid=211160>

The intersection of racism, classism, gender discrimination, and criminal justice involvement in the United States continues to manifest syndemic inequalities. In their work, Alang et al. (p. S29) describe police brutality and the adverse outcomes produced in women's lives over time. Drawing on seminal work on intersectionality and public health,<sup>1,2</sup> Alang et al. argue for in-depth consideration of how gender and racism influence police brutality and the impact of interactions with the police on the health and well-being of racialized women. Personal and vicarious witnessing of police brutality and other adverse criminal justice contacts has been shown to affect women and Black individuals.<sup>3,4</sup> Moreover, Black and Latina women are significantly more likely to fear police brutality than White women, and this anticipatory fear is linked with depressed moods.<sup>5</sup> Furthermore, evidence suggests that even having a family member incarcerated during a woman's childhood is associated with a higher likelihood of depressed mood in adulthood.<sup>5</sup> The interaction between the criminal justice system and racial minority status is complex, as evidenced by results on the impact of a partner's incarceration on racially minoritized women and consequences for their own life. In the case of Black women, evidence suggests that partner incarceration is linked with substance use.<sup>6</sup> Although the mechanisms through which partner incarceration leads to drug use need further exploration, the knitted relationship between gender and race can lead to heightened vulnerability and inequality. <sup>6</sup> Moreover, fear of harassment from police reduces access to syringe service programs and other harm reduction programs among racialized people who use drugs and may contribute to rising overdoses and fear of overdoses among minoritized groups, contributing to health disparities.

Blankenship, K. M., PhD., Rosenberg, A., M.P.H., Schlesinger, P., B.A., Groves, Allison K, PhD., M.H.S., & Keene, D. E., PhD. (2023). Structural racism, the social determination of health, and health inequities: The intersecting impacts of housing and mass incarceration. American Journal of Public Health, Suppl. Supplement 1, 113, S58-S64. doi:<https://doi.org/10.2105/AJPH.2022.307116>

Public health researchers have directed increasing attention to structural racism and its implications for health equity. The conceptualization of racism as historically rooted in systems, structures, and institutions of US society has important implications for addressing social determinants of health (SDOH). It requires theorizing SDOH as embedded in and expressions of racially oppressive historical structures that are manifested in and maintained by policies, programs, and practices in multiple domains that dynamically intersect to reinforce and reproduce in new ways: race inequities in health. We develop this argument using housing, a SDOH recognized as reflecting longstanding racist practices and policies that, among other things, have restricted the affordable housing options of Black people to segregated neighborhoods with limited resources. We argue that understanding and addressing the health inequities resulting from structural racism associated with housing requires simultaneously understanding and addressing how housing intersects with mass incarceration, another SDOH and manifestation of structural racism. We suggest that unless these intersections are intentionally analyzed and confronted, efforts to address the impacts

of housing on racial health disparities may produce new forms of health inequities. (AmJ Public Health. 2023;113(S1):S58-S64. <https://doi.org/10.2105/AJPH.2022.307116>)

Jahn, Jaquelyn L,PhD., M.P.H., Wallace, Maeve,PhD., M.P.H., Theall, Katherine P,PhD., M.P.H., & Hardeman, Rachel R,PhD., M.P.H. (2023). Neighborhood proactive policing and racial inequities in preterm birth in new orleans, 2018–2019. American Journal of Public Health, Suppl.Supplement 1, 113, S21-S28. doi:<https://doi.org/10.2105/AJPH.2022.307079>

Objectives. To measure neighborhood exposure to proactive policing as a manifestation of structural racism and its association with preterm birth. Methods. We linked all birth records in New Orleans, Louisiana (n = 9102), with annual census tract rates of proactive police stops using data from the New Orleans Police Department (2018-2019). We fit multilevel Poisson models predicting preterm birth across quintiles of stop rates, controlling for several individual- and tract-level covariates. Results. Nearly 20% of Black versus 8% of White birthing people lived in neighborhoods with the highest rates of proactive police stops. Fully adjusted models among Black birthing people suggest the prevalence of preterm birth in the neighborhoods with the highest proactive policing rates was 1.41 times that of neighborhoods with the lowest rates (95% confidence interval = 1.04,1.93), but associations among White birthing people were not statistically significant. Conclusions. Taken together with previous research, high rates of proactive policing likely contribute to Black-White inequities in reproductive health. Public Health Implications. Proactive policing is widely implemented to deter violence, but alternative strategies without police should be considered to prevent potential adverse health consequences. (Am J Public Health. 2023;113(S1):S21-S28. <https://doi.org/10.2105/AJPH.2022.307079>)

Yearby, Ruqaiijah,J.D., M.P.H., Lewis, Crystal,J.D., M.P.H., & Gibson, Charysse,M.P.H., M.A. (2023). Incorporating structural racism, employment discrimination, and economic inequities in the social determinants of health framework to understand agricultural worker health inequities. American Journal of Public Health, Suppl.Supplement 1, 113, S65-S71. doi:<https://doi.org/10.2105/AJPH.2022.307166>

In 2010, the federal government and several state governments began using the social determinants of health (SDOH) framework to highlight contributing factors of health inequities and, in 2022, recognized that structural racism was associated with health inequities. Yet, efforts to eliminate health inequities have disproportionately focused on individualized solutions instead of addressing structural racism. Many racial/ethnic-minority workers have been segregated to low-wage occupations that lack access to paid sick leave, such as agricultural work, which has been associated with health inequities. Research shows these inequities are attributable to structural racism enforced through laws that structure the employment system to disadvantage agricultural workers, who are disproportionately racial/ethnic minority individuals, which will not be addressed with individualized solutions. In this article, we explain why the current SDOH framework and efforts to eliminate health inequities are inadequate, discuss Yearby's revised SDOH framework that includes structural racism as one of the root causes of health inequities, and illustrate how Yearby's revised SDOH framework better captures the impact of structural racism, which is associated with health inequities for agricultural workers. (Am J Public Health. 2023;113(S1):S65-S71. <https://doi.org/10.2105/AJPH.2022.307166>)

Credits. (2023). American Journal of Public Health, Suppl.Supplement 1, 113 Retrieved from <https://www.proquest.com/scholarly-journals/credits/docview/2770262914/se-2?accountid=211160>

Kleykamp, Bethea A,PhD., M.A., & Kulak, Jessica A, PhD,M.P.H., M.S. (2023). Cigarette use among older adults: A forgotten population. American Journal of Public Health, 113(1), 27-29. Retrieved from <https://www.proquest.com/scholarly-journals/cigarette-use-among-older-adults-forgotten/docview/2760582625/se-2?accountid=211160>

The number of adults aged 65 years and older is expected to more than double worldwide over the next several decades, and for the first time in recorded history, older adults will outnumber children (<https://bit.ly/3D4p0im>). Despite these unprecedented population shifts, older adults are significantly underrepresented in biomedical research, especially in the field of nicotine and tobacco science (<https://bit.ly/3shUSul>). This focus on younger

cohorts has obscured the reality that combustible tobacco use (i.e., smoking) has remained virtually unchanged for older adults for nearly two decades in the United States (Figure 1). Meanwhile, smoking prevalences among youths and young adults in the United States are at the lowest levels ever recorded. One explanation for these differences in prevalence trajectories could be that, since at least 2005, quit rates among older smokers have remained stagnant (<https://bit.ly/3NaxXeF>).<sup>1</sup> Aligning with this observation is evidence suggesting that traditional tobacco control policies (i.e., pricing, smoke-free policies, information campaigns, bans on advertising, health warning labels, cessation treatments) are not affecting older smokers the same as younger cohorts, as represented in an analysis of smoking behavior in Europe between 2004 and 2013 (<https://bit.ly/3VVvs2y2>). Additionally, older smokers may have less knowledge of quitlines or other local smoking cessation services<sup>2,3</sup> and more misconceptions about the relative harms of nicotine and combustible tobacco.<sup>2</sup> Older adults are also less likely to use noncombustible nicotine products (<https://bit.ly/3z3iZAY>). The lack of attention paid to older smokers does not match the incredible burden of disease and death that this population carries. Tobacco-related disease is age-related disease as evidenced by older smokers incurring 12 times greater health care expenses than middle-aged smokers (<https://bit.ly/3eXhLR8>).<sup>4</sup> As noted by the American Cancer Society, cancers associated with smoking are most often diagnosed after the age of 65 years and include lung, kidney, bladder, and stomach cancer (<https://bit.ly/3F7gtxB>). Although most people start smoking in the early part of their life, most suffering and deaths associated with tobacco use occur far later. Unfortunately, older adult smokers are not represented in the most basic methodological details of nicotine and tobacco research. For example, in other fields of study, "older adults" are often defined as those who are 65 years and older and may be further delineated as the young old (65-74 years), middle old (75-84 years), and old old (> 85 years).<sup>5</sup> However, research on tobacco use does not adhere to this definition, with studies defining "older adults" across a wide range of ages (e.g., 25 years or older; <https://bit.ly/3TljwAr>). Beyond this, many studies explicitly exclude anyone older than 65 years from participation (<https://bit.ly/3VP032T>). These inconsistencies in definitions and study inclusion criteria can confound what we know about tobacco use among older adults.

Grubbs, J. B., PhD., Floyd, C. G., M.S., & Kraus, S. W., PhD. (2023). Pornography use and public health: Examining the importance of online sexual behavior in the health sciences. *American Journal of Public Health*, 113(1), 22-26. Retrieved from <https://www.proquest.com/scholarly-journals/pornography-use-public-health-examining/docview/2760580879/se-2?accountid=211160>

In 2020, *AJPH* published "Should public health professionals consider pornography a public health crisis?" by Nelson and Rothman.<sup>1</sup> The impetus for this work was clear: in the relatively recent past, 17 states have drafted or passed resolutions calling widespread pornography use a public health crisis, with many US politicians taking the position that pornography use is a threat to public health. The reasons for this contention (i.e., that pornography use is a threat to public health) are varied, though proponents of such a position often contend that pornography is a threat to families, impedes brain development in adolescents, affects brain functioning in adults, is inherently addictive, and promotes a wide variety of illegal sexual activities.<sup>1</sup> Through their critical review, Nelson and Rothman's work clearly demonstrates that such a position is untenable. Most, if not all, of the contentions made by such legislation and resolutions are entirely unsupported by current research, and pornography use does not meet standard criteria associated with threats to public health (i.e., it is not an acute event requiring immediate response; it does not immediately or directly lead to death, morbidity, or adverse health consequences; it does not overwhelm the capacity of local health care systems).<sup>1</sup> In short, such resolutions are wholly unsupported in both their factual claims and general arguments. Moreover, since 2020, no new states have drafted or passed such resolutions, which may be attributable to the rise of a true public health crisis in 2020. The impact of Nelson and Rothman's work is both obvious and subtle. Among obvious impacts, their work has been cited widely in a short period of time, generated intense public attention, inspired several op-eds and opinion pieces, and served as a starting point for thousands of conversations via social media (see <https://apha.altmetric.com/details/73766659/citations> for a summary of the popular media impact of this work). Central to much of this attention has been their conclusion that pornography use is not a public health crisis. Yet, an equally important implication of the work is overlooked. Nelson and Rothman's work, while showing that pornography is not a public health crisis, demonstrates that pornography use is a topic to be studied by public health. Whereas some disciplines have largely refused to consider pornography use as a topic relevant for inquiry (e.g., *American Psychologist*, the flagship journal of the American Psychological Association, has

published nothing on the topic for more than 30 years), public health has engaged with this activity substantively. More directly, Nelson and Rothman demonstrate that seeking to understand pornography use and its effects is a valid domain of inquiry for public health and the health sciences more broadly.

Kapadia, Farzana, PhD., M.P.H. (2023). Environmental justice from pennsylvania to paris: A public health of consequence, january 2023. *American Journal of Public Health*, 113(1), 12-14. Retrieved from <https://www.proquest.com/scholarly-journals/environmental-justice-pennsylvania-paris-public/docview/2760580872/se-2?accountid=211160>

Mitigating the impact of environmental disasters and climate change on vulnerable groups of people calls for an environmental justicebased approach that makes "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income" a top priority.<sup>1</sup> In 2011, Gracia and Koh presciently wrote that promoting environmental justice "requires reaffirming, revitalizing, and reinvigorating past national commitments" to how we plan and sustain laws, policies, and practices.<sup>2</sup>(pS14) An environmental justicebased approach to ensuring "greater access to health care, clean air and water, healthy and affordable food, community capacity building through grants and technical assistance, and training to educate the health workforce about environmentally associated health conditions"<sup>2</sup>(pS15) for all is the path to bridging environmental justice and health equity.<sup>3</sup> In this editorial, I highlight the historical and current calls for an environmental justice approach to preparing for and responding to man-made as well as natural environmental disasters.

Table of contents. (2023). *American Journal of Public Health*, 113(1), 3. Retrieved from <https://www.proquest.com/scholarly-journals/table-contents/docview/2760580871/se-2?accountid=211160>

Keck, James W, M.D., M.P.H., & Berry, Scott M, PhD., M.B.A. (2023). Wastewater surveillance-"messy" science with public health potential. *American Journal of Public Health*, 113(1), 6-8. Retrieved from <https://www.proquest.com/scholarly-journals/wastewater-surveillance-messy-science-with-public/docview/2760580825/se-2?accountid=211160>

Wastewater testing for infectious diseases blossomed during the COVID-19 pandemic.<sup>1</sup> Public health agencies are using wastewater data to augment traditional case and syndromic disease surveillance systems.<sup>2</sup> In this issue of *AJPH*, Kotlarz et al. (p. 79) report on the correspondence between COVID-19 disease trends observed with wastewater analysis, clinical testing, and syndromic surveillance in Raleigh, North Carolina, in 2020. They found moderate to strong correlations in COVID-19 trends across these data sources with wastewater influent and clinical testing disease signals preceding disease signals from syndromic surveillance and wastewater solids. Wastewater analysis is an emerging surveillance tool that has potential benefits but also presents challenges compared with existing disease surveillance approaches. We find it useful to think about wastewater surveillance in the paradigm of a SWOT (strengths, weaknesses, opportunities, and threats) analysis (Figure 1). Kotlarz et al. identified some of these issues as pros and cons in the first figure in their article. Wastewater analysis as a disease surveillance tool has several potential advantages over traditional surveillance methods. Wastewater analysis theoretically provides information about all of the individuals contributing to the wastewater-in essence, pooled testing of a community. Kotlarz et al. measured disease biomarkers in wastewater samples that may have contained contributions from more than 500 000 individuals living in Raleigh. Compared with individual clinical testing, wastewater analysis is efficient and likely cost saving-one study estimated that it was 1.7% of the total cost of clinical testing.

Vaughan, Roger, D.R.P.H., M.S. (2023). Embracing advanced methodology to improve population health. *American Journal of Public Health*, 113(1), 35-36. Retrieved from <https://www.proquest.com/scholarly-journals/embracing-advanced-methodology-improve-population/docview/2760580818/se-2?accountid=211160>

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