Public Health 183 (2020) 122–125

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Short Communication

Assessing changes in US public trust in science amid the COVID-19 pandemic

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ARTICLE INFO

Article history:
Received 26 March 2020
Received in revised form
29 April 2020
Accepted 1 May 2020
Available online 13 May 2020

Keywords:
Trust
Coronavirus
Epidemiology
2019-nCoV
COVID-19

ABSTRACT

Objectives: The emergence of the coronavirus disease 2019 (COVID-19) and subsequent pandemic has led to the most substantive large-scale, open, and public social discussion of epidemiology and science in recent history. In the United States (US), extensive debate has ensued as to the risk posed by the disease, whether the health system is prepared to manage a high volume of critical cases, whether any number of public health responses are necessary and appropriate, and the appropriate ways to prevent, manage, and treat the pandemic. I hypothesized that the interplay between scientists, policymakers, and the public in an open forum was associated with increased overall public trust in science and scientists, but that this was moderated by political orientation and/or religious commitment. In the context of a public health emergency, it is important to understand the degree to which science and scientists are trusted to produce information that can provide reassurance and also can explain the details of a highly complex event such as a viral pandemic while providing actionable recommendations.

Study design: The study design was analytic cross-sectional.

Methods: Data were obtained on March 17–18, 2020, from a sample of 242 US-based Amazon Mechanical Turk users. Respondents completed a 49-question survey consisting of key sociodemographic variables, political affiliation, religious commitment, and two iterations of the *Trust in Science and Scientist Inventory* (one for March 2020, and one for December 2019 using retrospective recall). Changes in mean level of trust and interaction with political affiliation and/or religious commitment were assessed using mixed ANOVA via the general linear model.

Results: On a scale from 1 (low trust) to 5 (high trust), the mean level of trust in science and scientists was static; 3.82 in December 2019 and 3.81 in March 2020. Conservative political orientation and high religious commitment were associated with significantly less overall trust in science; the interaction effect suggested that liberal trust in science decreased slightly from December 2019 to March 2020, whereas conservative trust increased slightly.

Conclusions: Counter to my expectations, the overall level of trust in science remained static after the first several months of COVID-19 in the US, although there is some evidence that political orientation was associated with magnitude and directionality of change in trust. Continued examination of these trends is important for understanding public response to epidemiologic recommendations.

Introduction

Since the emergence of coronavirus disease 2019 (COVID-19), we have observed a rapid, public back-and-forth exchange between scientific research, policy, and social media that is largely unprecedented. On January 20, 2020, the first confirmed case of the novel COVID-19, was reported in the United States (US).[1] Much early communal discussion analyzed the epidemiologic risks posed by the disease within the US, although the preponderance of data remained sourced from international cases. A preprint scoping review/meta-analysis of 61 studies from January 1, 2019 to February 24, 2020 reported that 13.9% of COVID-19 cases were severe and 4.7% were critical, with an overall case fatality rate (CFR) of 1.1%.[2] The US CFR on the *COVID-19 Dashboard* at Johns Hopkins University as of April 24th indicated a 5.7% CFR, although only 4,692,797 total tests had been conducted.[3] Without access to true data (e.g. complete information or data via random sample), debate

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https://doi.org/10.1016/j.puhe.2020.05.004
0033-3506/

continued as to the actual severity and CFR.[4] Reasonable and serious concerns were raised that the US healthcare system is under-resourced and understaffed to manage a high volume of COVID-19 cases, which has led to efforts at and calls for self-monitoring, quarantine, capacity-building, and other methods to 'flatten the curve.'[5] Non-pharmaceutical, behavioral, and policy responses to COVID-19 were expected to be a primary mechanism by which the basic reproduction number, R_0, could be reduced below 1.0.[6] In the time between initial submission and revision of this study, additional public debate has also illustrated tension between differing perspectives and advice on perceptions, treatment, and management of the pandemic, such as continued comparisons between COVID-19 and influenza,[7] the proposed use of hydroxychloroquine to treat COVID-19,[8] and implementation of and compliance with social distancing measures.[9]

The COVID-19 pandemic has produced a large-scale, open, and public epidemiologic investigation and discussion, with contributions from scientists, journalists, clinicians, politicians, and laypeople often shared contemporaneously.[10,11] Because of the way in which the scientific process, such as making conclusions based on complex epidemiological modeling, has been conducted rapidly and discussed in open forums, public perception of the scientific enterprise may have been altered in some way in the past several months.

In observing this display of science in action, I hypothesized that the interplay between scientists, policymakers, and the public in an open forum increased overall public trust in science and scientists, but that this was moderated by political orientation and/or religious commitment. In referring to 'science and scientists' I did not mean the institutional or governmental implementation of policy based on scientific research, but rather trust in scientists *qua* scientists, and in the scientific methodology.[12] This was somewhat different from much (though not all) of the prior literature on trust as it relates to science, such as the fairly extensive body of work on vaccine hesitancy,[13] as the focus of this hypothesis was not on a specific set of evidence but rather on the people and processes involved in generating evidence. In this case, for example, I was not concerned with measuring whether individuals believed that COVID-19 was similar to influenza, but rather whether there was any preliminary evidence that the pandemic shifted how people thought about science itself. In doing so, I was guided by the work of Nadelson et al. (2014),[12] who conceptualized trust as a complex and multifaceted belief, weighted by epistemology (e.g. 'how our degrees of confidence are rationally constrained by our evidence').[14] Their instrument measured trust using Likert-type scales capturing a wide variety of components of trust, such as 'When scientists change their mind about a scientific idea it diminishes my trust in their work' and 'Scientists will protect each other even when they are wrong.'[12]

The way that individuals respond to recommendations or advice regarding public health appears to rely on a variety of factors, among which trust in multiple entities, including government, community, and scientists, appears to play a role.[9,12] Any such shift in trust is therefore important to understand. Jones (2020) describes prior work explaining epidemics as social dramas involving citizens that include 'desire for self-reassurance' followed by 'reluctant acknowledgement' and then a demand for explanations.[15] In this context, too, it is important to understand the degree to which science and scientists are trusted to produce information that can provide reassurance and also can explain the details of a highly complex event similar to a viral pandemic. We therefore conducted a pilot survey to investigate changes in trust of science and scientists among US adults aged 18+ two months after the first COVID-19 case was identified in the US.

Methods

Data were obtained on March 17–18, 2020, from a sample of 242 US-based Amazon Mechanical Turk (mTurk) users. Respondents completed a 49-question survey consisting of key sociodemographic variables (age, race, ethnicity, education level), political affiliation (1:Liberal to 10:Conservative), religious commitment (1:low to 10:high), and two iterations of the *Trust in Science and Scientist Inventory*,[12] a 21-question validated scale. One set of questions was worded for the present, and the other asked for recall of attitudes (retrospective pretest[16]) from December 2019. To avoid biasing responses, no content in the survey or invitation to participate specifically mentioned COVID-19.

'Trust' was used as the dependent variable and was computed for each time point (December 2019 and March 2020) by managing reverse coded items and then calculating the sum of all responses divided by 21 to form an average value between 1 (low trust) and 5 (high trust). Analyses were repeated measures 2 × 2 analyses of variance (ANOVAs) using GLM; because this was a hypothesis-generated study, it was powered to examine the interaction, separately, between religious commitment/political affiliation (each dummy coded) and mean trust in science/scientists, assuming a small within-between interaction effect ($f = .1$; $\alpha = .025$; $1\text{-}\beta = .8$), yielding the suggested sample of 242. The study alpha was set at .05 but was adjusted downward for the power analysis to control for noise because of the potential for some mTurk respondents to provide careless or random data.[17] Sociodemographic data were provided in descriptive format for a transparent view of the sample but were not hypothesized to influence levels of trust and therefore analyses were not conducted. However, a full, unaltered data set is available alongside this study should other researchers wish to explore the data. Data collection was Exempt (Indiana University IRB #2003822722).

Results

Characteristics of the sample are provided in Table 1. Mean trust was computed from low (1) to high (5); overall trust in science/scientists was 3.81 in mid-March 2020 and 3.82 for December 2019.

Religious commitment was dichotomized (low: 1–5, high: 6–10). A score >5 was associated with lower overall trust in science/scientists ($F = 51.47$, $P < .001$, $\eta^2_{part} = .177$), and the interaction effect religion*time was very small and non-significant ($F = 1.94$, $P = .165$, $\eta^2_{part} = .008$). Conservative political orientation was dichotomized (liberal: 1–5, conservative: 6–10). A score >5 was associated with lower trust in science/scientists ($F = 62.86$, $P < .001$, $\eta^2_{part} = .208$). The interaction effect politics*time was small ($F = 4.29$, $P = .039$, $\eta^2_{part} = .018$) (Table 2).

There was no overall change in trust from December 2019 to March 2020, but the interaction effects and marginal means suggest that conservative trust in science increased slightly, and liberal trust in science decreased slightly (Table 2).

Discussion

Counter to my hypothesis, the overall level of trust in science remained static between March 2020 and December 2019, although conservatives reported slight increases in trust, and liberals reported slight decreases in trust. This interaction effect was small and should be re-examined by future studies to verify whether similar effects continue to be observed, which would potentially indicate a differential response to COVID-19 in terms of trust. Although not the focus of this study, data also indicated substantive differences between liberal and conservative respondents, as well as respondents with low and high levels of

Table 1
Sociodemographic characteristics of respondents ($n = 242$).

Characteristics	Mean (SD)	Median
Age (years)	37.04 (10.54)	34.00
Religious commitment (0 = low, 10 = high)	3.55 (3.80)	2.00
Political orientation (0 = liberal, 10 = conservative)	4.25 (3.30)	4.00
Current trust in science/scientists (1 = low, 5 = high)[a]	3.81 (.70)	3.90
Retrospective (Dec. 2019) trust in science/scientists (1 = low, 5 = high)[b]	3.82 (.73)	3.90
Results	**N**	**%**
Gender		
Male	141	58.3
Female	101	41.7
Race		
Black or African American	18	7.4
American Indian or Alaska Native	2	.8
Asian	13	5.4
White	201	83.1
Other	8	3.3
Hispanic or Latino/a	23	9.5
Highest level of education		
Less than high School	2	.8
High school or GED	64	26.4
Associate's degree	28	11.6
Bachelor's degree	117	48.3
Master's degree	22	9.1
Doctoral or professional degree	9	3.7

GED = general educational development test.
[a] Cronbach's alpha = .937.
[b] Cronbach's alpha = .945.

Table 2
Analytic results ($n = 242$).[a]

	MS	F	*P*	η^2_{part}
Religious commitment				
Time (within)	1.04E-5	.000	.984	.000
Time*religious commitment	.048	1.94	.165	.008
Error (time)	.025			
Religious commitment (between)	42.55	51.47	<.001	.177
Political orientation				
Time (within)	.001	.023	.880	.000
Time*political orientation	.105	4.29	.039	.018
Error (time)	.024			
Political orientation (between)	50.01	62.86	<.001	.208
	EM Mean (SE)	95% CI		N
Time 1 (December 2019)				
Low religious commitment	4.03 (.05)	3.93–4.13		162
High religious commitment	3.38 (.08)	3.23–3.52		80
Time 2 (March 2020)				
Low religious commitment	4.01 (.05)	3.91–4.11		162
High religious commitment	3.40 (.07)	3.26–3.54		80
Time 1 (December 2019)				
Liberal political orientation	4.06 (.05)	3.96–4.16		159
Conservative political orientation	3.35 (.05)	3.21–3.49		83
Time 2 (March 2020)				
Liberal political orientation	4.03 (.07)	3.93–4.13		159
Conservative political orientation	3.38 (.07)	3.25–3.52		83

MS = mean square; EM = estimated marginal; CI = confidence interval.
[a] Levene's Test of Equality of Variances was violated for these analyses, but inspection of the variance for key variables indicates that interpretation of test results is still reasonable. For transparency, data are included as a supplement to this letter.

religious commitment, in terms of overall trust in science and scientists. These latter findings were consistent with correlations observed in the validation study for the instrument used to measure trust.[12]

Research conducted by Gadarian et al.[18] identified self-placed political ideology as the 'most consistent factor that differentiates' Americans health behaviors' in the context of COVID-19. Thus, in addition to continued research on changes, if any, brought about by the COVID-19 pandemic, it seems that additional investigation into the directionality of influence of political orientation on trust in science/scientists, and vice versa, might be also valuable, especially in cases where health-related advice from scientists and non-scientific entities differs, and individuals are determining whose advice to follow, and in what way.

These findings are not statistically representative of the US and are subject to standard self-report mTurk survey limitations, including limited generalizability and potentially random (e.g. rushed) responses. At the same time, the design also allowed for a

complete absence of missingness and for a rapid response to an ongoing public health event. The measure of trust has been validated and was reliable for this sample, but the extent to which change in trust could be observed over several months is unclear, though this was, to some degree, an impetus for the present study. Importantly, as with all preliminary findings, the results should be replicated, and the research concepts expanded, before conclusions are drawn.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2020.05.004.

Author statements

Ethical approval

Approved by Indiana University IRB #2003822722.

Funding

This study was unfunded.

Competing interest

None reported.

Author contributions

The author thanks Dr. Mikyoung Jun for her statistical review and advice.

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Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

COVID-19 and migrant workers: Lack of data and need for specific management

We found the publication entitled 'COVID-19: Immense necessity and challenges in meeting the needs of minorities, especially asylum seekers and undocumented migrants' to be very interesting.[1] The COVID-19 pandemic can affect any population, and minorities are the underprivileged group who are prone to many infections. In terms of COVID-19, there is currently no literature on disease among migrant minorities. Public health attention is required for disease control among minorities and migrants.[2] Here, the authors would like to share an observation from our own setting.

In Thailand, there are many migrant workers from nearby Indochina countries. Based on the local available data on the COVID-19 outbreak, there are no cases in migrant workers. Although there are some active screening programs for migrant workers, there have been no COVID-19 cases, to date. Migrant workers may be more tolerant to infection, or there could be an underdiagnosis of disease because of limited medical services available for the migrant workers. If prevention strategies are not implemented or adhered to in this population, then disease outbreak is possible. Finally, we should bear in mind that we are seeing large outbreaks of COVID-19 in migrant worker communities in many other countries, such as Singapore and the Gulf states. Therefore, disease prevention for migrant worker communities is an important global public health issue.

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24 April 2020
Available online 13 May 2020

https://doi.org/10.1016/j.puhe.2020.05.008

Public Health 183 (2020) 50–51

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

COVID-19 in Bangladesh: public awareness and insufficient health facilities remain key challenges

The coronavirus disease 2019 (COVID-19) pandemic has now spread through the entire world and emerged as a major public health threat. COVID-19 is a highly transmittable and pathogenic viral infection caused by severe acute respiratory syndrome coronavirus 2. This novel pathogenic virus emerged in Wuhan, China, and has rapidly spread around the world,[1] with 210 countries, including Bangladesh, reporting more than 2.4 million confirmed cases of COVID-19, leading to 169,006 deaths as of April 22, 2020.[2] Many developed countries in the world have imposed uniquely severe isolation measures in an attempt to attenuate the mortality and disease transmission of the virus, and the World Health Organization (WHO) declared the situation a public health emergency of international concern. The first COVID-19 case in Bangladesh was identified on March 8, 2020. Since then, 120 deaths of 3772 confirmed cases have been reported to date. The total number of cases is rising rapidly, with a high mortality rate (3.18%).[3] As the number of COVID-19 infections continues to rise in Bangladesh (Fig. 1), an emergency public health response is urgently required to mitigate the severity of the COVID-19 outbreak, which has the potential to result in devastating social, economic, and political crisis.

In response to COVID-19, the government of Bangladesh, including the Directorate General of Health Services (DGHS) and Institute of Epidemiology, Disease Control and Research (IEDCR), has raised a national-level alert and implemented wide-ranging, multiagency public health measures under WHO guidelines to fight against the pandemic. However, lack of public awareness and widespread panic and anxiety related to an unknown illness among the general population, as well as limited health facilities, pose unique challenges and an enormous threat to the population. Because COVID-19 appears to be transmitted from person to person through respiratory droplets, close contact, and fomites in the immediate

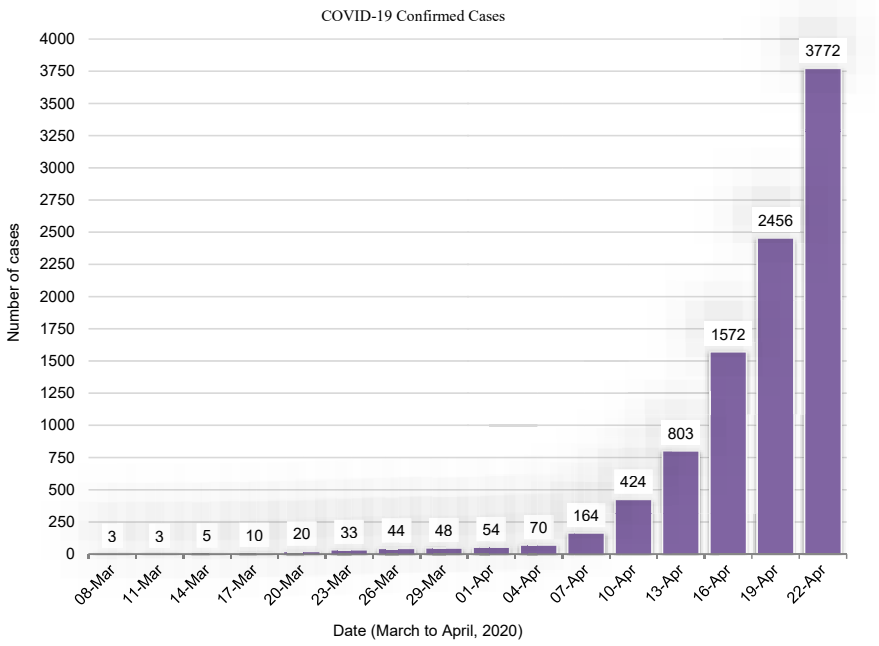

Fig. 1. Number of confirmed COVID-19 cases recorded in Bangladesh. COVID-19 = coronavirus disease 2019.

https://doi.org/10.1016/j.puhe.2020.04.037

environment around the infected person,[4] the Bangladeshi government initiated a public campaign highlighting the necessity of practicing respiratory hygiene and hand hygiene and using appropriate personal protective equipment (PPE) such as mask and gloves,[5] with evidence of minimal adoption by the public at large. Early detection and isolation of cases have been the bedrock for curbing the rapid spread of communicable diseases such as COVID-19, and extra precautions need to be taken to promptly identify asymptomatic viral carriers.[6] Currently, there are only 20 laboratories, which perform COVID-19 testing in Bangladesh, and most of them are in Dhaka.[7] By April 22, a total of 32,674 samples were tested, and in the last 24 h, a total of 3096 samples were tested all over the country.[3] The overall COVID-19 test rate in Bangladesh is 156 per 1,000,000 population,[7] obviously a markedly insufficient figure that attests to the severe insufficiency in testing facilities and the absence of sufficient testing centers with necessary equipment such as testing kits, surgical gloves, and PPE for healthcare staff to address the anticipated surge in COVID-19 cases.[8] Dhaka, the largest and most populated city, remains the epicenter of COVID-19 in Bangladesh; multiple clusters have been identified from which rapid community transmission has taken place, and measures such as lock-down and social distancing to disrupt transmission chains have already begun.[9] However, public awareness remains extremely low and often dismissive of the social isolation directives. Government interventions aimed at enforcing the preventive measures have been quite difficult to implement and rather unsuccessful despite the mobilization of the Bangladesh police.[10]

A comprehensive awareness-raising program through mass media as well as the Internet and social media is urgently required to fully engage the general people to learn and understand the seriousness of the outbreak and their role and responsibility in alleviating the severity of COVID-19. At the same time, however, government measures aimed at ensuring the adequacy of the food supply chain, making sure that the poor and disadvantaged are brought under adequate and effective relief programs, and that community leaders are identified and empowered to lead and preserve the social isolation measures while effectively constituting surveillance mechanisms that are all needed. In a time of crisis such as the one generated by the rapid transmission of COVID-19, Bangladesh stands, similar to many other emerging economies, in an extremely vulnerable position, whereby the absence of adequate testing and hospital resources along with public unawareness and lack of coordination among the various government or private agencies is likely to result in catastrophic loss of lives.

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24 April 2020
Available online 7 May 2020

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Public Health 183 (2020) 23–29

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Original Research

Exploring the non-technical competencies for on-scene public health responders in chemical, biological, radiological, and nuclear emergencies: a qualitative study

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ARTICLE INFO

Article history:
Received 20 December 2019
Received in revised form
4 April 2020
Accepted 7 April 2020
Available online 20 April 2020

Keywords:
Non-technical competencies
Chemical, Biological, Radiological, and Nuclear response
Disaster medicine
Health personnel education/training

ABSTRACT

Objectives: The purpose of this study was to define and delineate specific non-technical competencies for first-line public health responders in Chemical, Biological, Radiological, and Nuclear (CBRN) emergencies in China.

Study design: A qualitative study was conducted in China involving interviews with key informants in the field of health response to CBRN disasters.

Methods: One-on-one in-depth interviews were carried out with 20 participants, including expert members of National Medical Response Teams for CBRN disasters, officials at emergency management authorities, and scholars of academic institutions related to CBRN emergency. Interviews were recorded using audio equipment, transcribed, and coded into codable passages as per grounded theory using NVivo software. Themes were identified within the transcriptions by using thematic analysis.

Results: A total of 159 codable passages were produced. Eight domains of non-technical core competencies were identified: (1) situation awareness, (2) communication skills, (3) collaboration, (4) resource management, (5) task management, (6) cultural competency, (7) austere environment skills, and (8) physical stamina.

Conclusions: The study identified a variety of competencies for on-scene public health responders in CBRN emergencies. The findings of this study could specifically benefit development of strategy and improvement of content of education and training. Further research that involves input from the disaster response community at large is needed for the validation of these competencies.

Introduction

Increasing Chemical, Biological, Radiological, and Nuclear (CBRN) threats are a public health challenge in China. China has experienced 200–600 accidents every year in hazardous chemical industry,[1] frequent emerging epidemics[2] (e.g. coronavirus disease 2019, severe acute respiratory syndrome (SARS), H5N1, and African swine flu), more than 43 planned nuclear reactors,[3] and unpredictable terrorism attacks. China has invested heavily in the development of CBRN medical response capacity including the CBRN Medical Response Teams (CBRN-MRTs) designed to be deployed on the site.

Despite the fact that public health responders adequately respond to the clinical or public health aspects of disasters, they are not always prepared or trained to work in a real hazardous environment and complex temporary situation.[4] The unique nature of intense working relationships and particularly austere environment requires not only technical skills but also non-technical competencies. A body of previous studies has explored the components of non-technical competency for health workers in a critical environment.[5–10] It has been established that interpersonal, social, and cognitive skills play an important role in response performance.[11] Those non-technical competencies broadly involve a range of knowledge, attitude, and skills in communication,[12–14] collaboration,[15,16] leadership,[17–19] situation awareness,[12] and other individual personal attributes.[20] However, the literature

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https://doi.org/10.1016/j.puhe.2020.04.015
0033-3506/

search revealed relatively few studies specifically focusing on public health staff working at a CBRN incident site.

Complicating a straightforward emergency response is the addition of CBRN factors that add an extra layer of complexity to the emergency response.[21] CBRN emergencies cause trauma on a large scale and demand complex responses including triage, monitoring, diagnosis, decontamination, and self-protection for public health workers.[11,22] CBRN mass casualty situations are normally chaotic. Casualties may have single or multiple injuries or may have conventional injuries that are complicated by CBRN exposure (such as in a toxic spill or nuclear power plant accident). The treatment of CBRN casualties should reflect the conventional incident and casualty management paradigms with additional safety and treatment considerations.[23] CBRN incidents present different challenges for all responders, necessitating the rapid decontamination and treatment of a significant number of casualties while taking critical measures to ensure the well-being of the personnel managing the incident.[24] CBRN events have an additional 'fear factor' and expose responders to potential agents and possible hazards, and it has been reported that health professionals may not respond to CBRN events as willingly as they would to a conventional disaster event.[25–27]

There are differences in particular context and nature among various disasters, so it is difficult to define a consistent set of competencies across disciplines and jurisdictions. The present study aims to define and identify specifically non-technical competencies for on-scene public health workers in CBRN disasters.

Methods

Study participants

A qualitative study was performed in China involving interviews with key informants in the field of health response to CBRN disasters. Semistructured in-depth interviews were used to seek deep perspectives of the experts. A purposive sampling approach was conducted to ensure that included interviewees could reflect on their experiences training and working in a CBRN-MRT. Those public health responders who had significant on-scene experience and direct involvement in real CBRN disaster management or full-scale disaster drills were involved. To increase data quality, the sample was also interprofessional, representing diverse healthcare professions on the team. In addition, several academic experts were included based on their relevant study background.

Data collection

The interview took place by phone or face-to-face in the respective institutions with a single interviewer and lasted 30–60 min. Open-ended main questions were asked to gain insights into requirements of non-technical competencies for an on-scene medical responder in CBRN emergencies. To ensure that the interviewees elaborated on their experiences, the interviewer also explored with additional probing questions. Questioning was informed and evolved according to responses of the interviewees. The interview guide is presented in Appendix 1.

This study used a constructivist grounded theory approach encompassing the notion that interpretation of the data is co-constructed by interactions between participants and researchers. As per grounded theory, analysis occurred alongside data collection and was able to inform the next interview and develop an emergent understanding of the themes and findings. Substantive coding facilitated the process of theoretical sampling and directed the evolution of the interview guide. As interviews were conducted and coded, the competencies were revised iteratively. Theoretical sampling was carried out until the researchers reached theoretical saturation, that is to say, when conducting more interviews would add little value to the research and when data saturation was achieved and the interviewing ceased.

Data analysis

Each interview was recorded, transcribed, and imported into NVivo 10 software (released in 2012 by QSR International). The usual grounded theory approach to data analysis was undertaken. The initial coding stage was undertaken during data collection and theoretical coding stages. The lead author then reviewed each transcript again to yield final codable passages and undertook validity checks. Moving on to theoretical coding, codable passages similar in meaning content were merged into larger units as subcompetencies, which were further condensed into competency domains. The questions that were used during coding initially inquired about 'what specific competency or subcompetency is these data a study of?' followed with 'what competency category does these data indicate?' Domains and subcompetencies were refined through comparable responses. A second author conducted cross-verification of the whole data to minimize missing an important competency category and optimize the rigor of the study. Disagreements in coding were resolved by discussion between the two reviewers. Discussions among all researchers were also used to develop the relationships between analytic themes of the competency domain.

Results

Interview participants' characteristics

A total of 20 experts from across the nation participated in the interviews. The demographics of interviewees are summarized in Table 1. Most of them had a master's or doctoral degree (70%) and

Table 1
Demographic details of the interviewees.

Characteristic	No. (%)
Education	
Bachelor's degree	6 (30)
Master's degree	8 (40)
Doctoral degree	6 (30)
Specialization	
Preventive medicine	5 (25)
Public health administration	5 (25)
Chemical medicine and pharmacy	3 (15)
Medical imaging sciences and nuclear medicine	2 (10)
Medical laboratory science and biomedical technology	2 (10)
Others[a]	3 (15)
Agency	
Centers for Disease Control and Prevention	9 (45)
Hospital	5 (25)
Authority	3 (15)
College and academic institution	3 (15)
Job position	
Public health communicable disease staff	4 (20)
Public health laboratory staff	4 (20)
Public health officials	3 (15)
Environmental health staff	2 (10)
Public health clinical staff	2 (10)
Scholar	2 (10)
Others[b]	3 (15)
Age (years)**, median** (range)	46 (32–75)
Years of practice in CBRN emergency, median (range)	20 (4–40)

CBRN = Chemical, Biological, Radiological, and Nuclear.
[a] Epidemiology, logistics management, and veterinary medicine.
[b] Logistics officer.

worked in the Centers for Disease Control and Prevention or hospitals (70%), with a median age of 46 years (range from 32 to 75 years), and a median of 20 years of practice in the field of CBRN emergency (range from 4 to 40 years). Half of them were specialized in preventive medicine or public health administration, covering multiple professions.

Identified non-technical competencies

A total of 159 codable passages were produced from the interview transcript. Eight non-technical competency domains were identified: (1) situation awareness, (2) communication skills, (3) collaboration, (4) resource management, (5) task management, (6) cultural, ethnic, and legal competency, (7) austere environment skills, and (8) physical stamina. Table 2 contains detailed descriptions of these domains with definition of the competency domain, subcompetencies, and illustrative examples from the interview transcripts.

Discussion

Systematic development of a competent medicine workforce prepared for a CBRN crisis requires a targeted non-technical competency framework used to guide workforce planning, recruitment, placement, assessment, and demand-driven training.[8,28,29] The present study developed 8 non-technical core competencies specifically required for first-line public health responders in CBRN emergencies. As per the similarities and differences in response methods between CBRN emergencies and other general disasters, those identified competencies are discussed in three groups: common, enhanced, and specialized non-technical competencies.

Common non-technical competencies

The challenges posed and the response requirement for CBRN and accidental incidents differ but are similar or the same in many respects. For that reason, some of the competencies explored within this study are equally applicable to both situations and can be implemented for all levels of incidents. Some components of non-technical competencies identified through this study thus confirmed correlations with the common skills defined in prior research involving health professionals working in general critical situations, including communication,[12–14,17,30] collaboration,[15,16,31] and cultural competencies.[32] Owing to widespread public concern about mass casualties and diverse participation of multiple professions, public health responders in CBRN incidents are required to do well in communicating internally and externally, along with interprofessional and intra-agency collaboration within complex managerial structures.[11,13,16,26,33] Understanding of cultural backgrounds, ethical principles, and regulations is also necessary for CBRN public health responders to deal with common interest conflicts and dilemmas.[22] In addition, this study added specific understanding of those common competencies by description of the corresponding subcompetencies that are required in the CBRN context.

Enhanced non-technical competencies

Compared with other disasters, emphasis and enhancement should be placed on the competencies of situation awareness, resources management, and task management. CBRN missions in contrast have often involved unknown or unidentified substances, with a greater emphasis on the need to identify the substance through sampling and intelligence collection. Situation awareness of public health responders thus plays a more important role because responsive actions are based on timely recognition of the uncertain status and trends of CBRN harm closely correlated with dynamic weather conditions and the geographical environment.[33] CBRN events, usually leading to mass casualties, have the potential to rapidly overwhelm—or threaten to exceed—the local capacity available to respond, and therefore, public health responders during CBRN disasters should also do better in resource management of detection devices and special reagents needed in CBRN responses which are characterized with more diversity, precision, and vulnerability to environmental impact.[11] Task management not only directly affects response performances, which has been widely cited in the previous literature,[8,9] but also may have indirect influence by affecting other non-technical competencies. Most of the interviewees indicated that having a good knowledge of professional task procedures and standards is a type of fundamental non-technical competency that can make contributions to better communication, collaboration, and mental quality. This finding suggests that effective CBRN training should integrate and synchronize courses based on non-technical and technical competency.

Unique non-technical competencies

Because rescuers and victims are continually under life threats from CBRN contamination, responders must take measures to protect the airway, skin, and eyes before entering the contaminated area, which is a unique and indispensable component of emergency response.[22] Austere environment skills involving physical/psychological self-care are definitely perceived as a priority for the CBRN public health responders because limitations to the use of personal protective equipment (PPE) are restriction of physical activity, heat-related illness, dehydration, and psychological effect. Most study participants started their discussions with personal safety considerations and skills in a hot or warm zone, and psychological self-care was also highlighted as essential for medical workers at high risk of suffering severe stress or even anxiety disorders from the fear of CBRN hazards. In addition, overwhelming workloads are frequently encountered by medical staff dressed in heavy PPE in austere hazardous environments, where they encounter an influx of patients. In contrast to prior studies,[9,15,19] physical stamina was frequently discussed in this study as a non-technical competency that makes a substantial contribution to response performance.

Limitations

The present qualitative study is subject to several limitations. The raw data were the expressed opinions of a purposive sample of experts. Although inclusion criteria for subjects were based on their experience in the field of CBRN responses and their varying backgrounds, it is possible that a potential source of bias exists in respondents. Second, the interpretivist framework raises questions about the validity of the findings and empirical generalizability of the study, although validity checks on the coding and data analysis are allowed. Finally, this qualitative study was intended to identify categories, not to quantify their relative importance to the participants.

Further studies should continue to identify and validate potential non-technical competencies using multiple approaches based on a broader sample to explore the attributes of effective public health responders in new CBRN emergencies. With the changing characteristics of CBRN incidents, the competency framework should keep updating to match the emergent needs of response and to advance the evolvement of workforce development processes. More efforts are also needed to explore relative contribution of each non-technical competency to the comprehensive

Table 2
Non-technical competency domains, subcompetencies for on-scene public health responders in CBRN emergencies.

Competency domain (definition)	Subcompetency	Example quotes coded for each subcompetency
1. Situation awareness (ability to perceive environmental elements and events with respect to time or space, the comprehension of their meaning, and the projection of their future status)	1.1. Knowledge applied to detect, project, and identify CBR agents.	1. Knowledge of the CBR agent categories (ZJP). 2. Be familiar with population density, the location of the plant, and other critical infrastructures (FQS). 3. Describe incident types and corresponding causes (ZZJ).
	1.2. Understanding the impact of environmental factors on CBR hazard dispersion.	1. Have knowledge of transmission of infectious disease (FQS). 2. Investigate the local whether, wind, transportation around the incident site (ZZJ). 3. Understand local terrain (ZJP).
	1.3. Knowledge of potential health and environment effects of typical CBR agents.	1. Project number of the casualties (GHD). 2. Determine the extent of the damage (FZL). 3. Correctly anticipate likely consequences (ZJP).
	1.4. Identify limits to individual and team knowledge, skill, and authority.	1. Ability to identify and solve key problem (FZL). 2. Awareness of possible contaminants (FQS).
	1.5. Evaluate and project effectiveness of all actions taken.	1. Understand the critical steps necessary to respond to a range of CBR events (ZZJ). 2. Evaluate and project the needed rescue actions … evaluate the urgency of the actions (CWL).
2. Communication skills (ability to exchange information, ideas, thoughts, or recommendations between or among individuals or organizations through a common system of symbols, signs, or behavior)	2.1. Describe communication role(s), channels, and processes in response to a CBRN incident.	1. Communication is essential- with our own team members, relevant professionals in other organizations, and, with victims and the public (FZL) 2. Communication should be established with local, regional and national authorities, with private sectors, and with the media (FQS). 3. Know the audience and use discretion in sharing data (SXC).
	2.2. Demonstrate correct use of all communication equipment while wearing personal protection equipment in hazardous environments.	1. Use the communication tools in CBR environment (ZZJ). 2. Be flexible and adapt communication tools to the contaminated environment, such as megaphone (SXC). 3. Use the telephone and walkie-talkie (ZP).
	2.3. Outline principles of risk communication in response to CBR events.	1. Use plain language to explain technical issues (FZL). 2. Correctly interpret technical reports of the detection of CBRN agents (ZJP). 3. Recognize the urgency and timeliness of communication (FQS). 4. Be familiar with the techniques of risk communication … Release only confirmed facts … be aware of probable audience emotions and show concern (ZZJ).
3. Collaboration (ability to work together with two or more people or organizations to accomplish a task or achieve a goal)	3.1. Understand and identify agency and partner agency roles, responsibilities, and capacities in response to a CBRN incident.	1. Identify roles and responsibilities of each position within team … collaborate with chemical corps (CWL). 2. Identify and evaluate other response teams at the incident site and propose a plan for collaboration of efforts (ZJP). 3. Know the chain of command, the process and each team's responsibilities (ZZJ). 4. Integrate the volunteers (ZW).
	3.2. Identify and locate agency and relevant partner response plans for CBRN incidents.	1. Become familiar with institutional plans and with local and national response plans (ZJP). 2. Create a plan for organization and deployment (SXC).
	3.3. Understand the methods of identifying and requesting regional, national, and international support.	1. Collaborate on evacuation and patient transportation (CWL). 2. Knowledge of the chain of command and the process (ZZJ). 3. Effective inter-agency coordination on scene (GDH).
4. Resource management (ability to use limited resources effectively and efficiently)	4.1. Ability to identify and predict specific crucial resources needed for response to CBR incidents.	1. Knowledge of the function and limitations of special equipment for CBRN response (FZL). 2. Knowledge of the proper drug treatments for the CBR contamination (FZL). 3. Estimate the pharmaceutical supplies needed for response (GHD).
	4.2 Identify special resources available for the CBRN incident site from state, regional, and federal agencies.	1. Knowledge of pharmaceutical stockpiles for CBRN incidents and the supply chain logistics (FZL). 2. Know the distribution and storage of vaccines and other reagents (ZZJ).
	4.3. Ability to construct process to mobilize, request, and manage resources.	1. Know storage location of the medical supplies, how to get authorization to obtain them and how to deliver them (ZJP). 2. Be up to date with drug renewal processes (SXC & ZP). 3. Demonstrate the safe administration of vaccines (GDH).

Table 2 (*continued*)

Competency domain (definition)	Subcompetency	Example quotes coded for each subcompetency
		4. Know and communicate the recommended maintenance of the equipment (ZZJ & ZW).
5. Task management (ability to identify, monitor, and progress the work through its life cycle)	5.1. Ability to identify the critical tasks in the CBR response. (e.g. triage, detection, decontamination, psychological counseling, dispose of medical waste, specimen collection and moving, fatality management, and scene management)	1. Identify the first priority tasks on the scene (CWL). 2. Recognize the importance of psychological protection and mental support (ZZJ).
	5.2. Knowledge and maintenance of the principles, guidelines, and protocols of the critical tasks.	1. CBRN operation is characterized by professionalism. Every medical responder should have a relevant professional background (LYD). 2. You do require expertise in every field, but you must understand the core requirements and key processes to finish the task (LYD).
6. Cultural competency (ability to effectively deliver medical services that meet the social, cultural, religious, and linguistic needs of victims under ethical and legal regulations)	6.1. Knowledge of domestic health and safety legislation and its relevance to CBRN response.	1. Know relevant regulations governing infectious disease prevention and CBR response (FQS). 2. Have some knowledge of the law related to CBRN response (DB). 3. Abide by regulations on disposal of the CBR wastes (ZW). 4. Follow requirements for contaminated water disposal (GDH).
	6.2. Consider international support and conventions (IAEA, WHO, OPCW).	1. Know the core content of the international agreements and conventions, such as Chemical Weapons Convention (JJC). 2. Understand how to deal with the refugees (ZW). 3. Be aware of the legal issues when dealing with the refugees (SXC).
	6.3. Maintain general ethical principles in the context of emergence.	1. Utilize privacy considerations during decontaminations such as separate areas for men and women (ZJP). 2. Know medical ethics and how to face the expected casualties (ZP).
	6.4. Cross-cultural respect.	1. Speak native languages when operating overseas (ZP). 2. Have knowledge of the local cultural values and belief system such as cultural attitudes regarding death and burial (FQS).
7. Austere environment skills (ability to survive and maintain health in the austere environment)	7.1. Physical protection in CBRN contaminated areas.	1. Physical protection competency is imperative. Use appropriate protection but not excessive protection. Understand the protection levels required for different zones (ZP). 2. Take advantage of terrain and architecture as cover (ZJP). 3. Self-protection- the knowledge of the protective measures for the hazardous materials present is essential (FQS).
	7.2. Mental protection in CBRN contaminated areas	1. Psychological resilience is important when facing chaotic circumstances such as food contamination (FQS). 2. Be optimistic and strong-willed. Practice emotional self-control (ZZJ). 3. Overcome the psychophobia of WMD (JJC).
	7.3. Flexibility/adaptability	1. Be able to follow and understand the changing dynamics of the situation (CHL & DB). 2. Be prepared to deal with the surprise and devastation of emergency events (TH). 3. Expect the unexpected, such as communication interruptions and mass casualties (ZP).
8. Physical stamina (ability to sustain prolonged physical effort)	–	1. Physical endurance is a critical consideration. The workload is multiplied when wearing personal protection equipment (FQS). 2. Long periods of work in an austere environment requires good physical conditioning. Decontamination is an exhausting physical task (ZW). 3. Heat acclimatization is necessary (ZP).

WHO = World Health Organization; CBRN = Chemical, Biological, Radiological, and Nuclear; IAEA = International Atomic Energy Agency; OPCW = Organization for the Prohibition of Chemical Weapons.

performance of public health responders and relationship among those competencies. Moreover, studies could be conducted to further classify competencies by phases of the CBRN management and to delineate levels of proficiency needed based on occupations.

Conclusions

Non-technical competencies are as critical as technical ability for the health workers to respond effectively in CBRN emergencies. There are specific requirements in non-technical competencies for public health responders in CBRN events besides some common competencies. Those identified competencies could be useful to develop a workforce for CBRN emergencies, such as outlining competency-based training and updating job description for recruitment. The proposed competency framework can be used to support developers of public health emergency preparedness training initiatives by ensuring that public health professionals are able to demonstrate the non-technical knowledge and skills needed for successful performance when preparing and responding to CBRN incidents. It can also help update and revise job descriptions as well as orient public health practitioners to their emergency roles and responsibilities. The changing practical context and requirements for CBRN responses in the future demand the constant updating and redefining of the competency framework.

Author statements

Ethical approval

This project was approved by the Ethics Committee of Academy of Military Medical Sciences. All the interviewees gave their consent before the interviews and agreed to the dialog being recorded using audio equipment. The participants were assured that their participation would be voluntary and anonymous.

Funding

This study was supported by the Project of Logistics Research (no. BWS16J013).

Competing interests

The authors declare that they have no competing interests.

Author contributions

All the authors took part in the design of the study. X. Hu conducted the interviews and worked with H. Chen to code the text data. M. Yu supervised the data analysis and interpretation. All authors worked together on manuscript preparation and revision.

Consent for publication

Not applicable.

Availability of data and materials

The data sets generated and analyzed during the present study are not publicly available owing to consideration of the interviewees' privacy but are available from the corresponding author on reasonable request and form.

Acknowledgments

The authors would like to thank all interview participants in this study, who shared their thoughts and experiences. The authors would like to thank Dr. Shannon Houser, Mr. Jim Entrekin, and Mr. James Allen who offered professional help with English language editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2020.04.015.

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Public Health 183 (2020) 44–45

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Letter to the Editor

Firearms or SARS-Cov-2: what is the most lethal?

With 393 million guns, the US has nearly half of the firearms in the world, with more guns than US citizens (120 firearms per 100 people).[1] Fear and catastrophe are known to increase the purchase of guns,[2,3] including events such as mass shootings or terrorist attacks, and even the Barack Obama election where sections of the population felt insecure. In late 2019, a new highly contagious virus appeared in China and spread around the world with a high mortality rate. Initially named COVID-19, the virus was renamed SARS-CoV-2, which contributed to a perceived increase in fear by reminding people of the 2003 SARS epidemic. To reduce spread of the virus, massive quarantine and containments were implemented around the world. At the time of writing, nearly 4 billion people (i.e. more than half the global population) are confined to their homes and will remain here for several weeks or months, without participation in outdoor occupational or leisure activities. Fear of dying is evident among the population. In addition to a shortage of respiratory masks and essential drugs, the unprecedented financial service market crash and knowledge of Wall Street financial dynamics adds to the perceptions of insecurity. Stress and anxiety have resulted in the irrational necessity for self-defense and the purchase of guns. Purchases of guns increased by one million in March 2020 and sales are likely to increase further in April (Fig. 1). Although only basic essentials can be purchased during containment, the National Rifle Association considered firearms as essential products. Death by firearms is directly linked with firearm access (i.e. the availability of firearms to individuals) and the level of firearm ownership, both at the population, household and individual levels.[4] Owning a gun increases the risk of death by domestic violence for women by 20-fold[2,5] and the risk of suicide by 3-fold.[6] Contrary to the SARS-Cov-2 pandemic, the current increased trend for gun ownership will not only have short-term consequences, as the risk of death increases the moment the gun is purchased, but will also have long-term consequences and subsequent increases in gun violence. All countries with enforced firearm control have seen a decrease in gun violence.[4] Currently, nearly 50,000 people per year die or are injured by firearms in US;[7] thus, the current unprecedented purchase of guns, in addition to the fear of the SARS-Cov-2 pandemic, may result in a massive challenge for the country. We also want to acknowledge that, despite no available data for most countries in the world, the purchase of guns worldwide might be a related consequence of the SARS-Cov-2 pandemic, which may increase the already-staggering number of 857 million civilian firearms in the world. Moreover, victims of gun violence would utilize intensive care unit resources, which are already under great pressure with a shortage of assisted ventilation and are vital in the context of the SARS-Cov-2 pandemic. As The New York Times stated 'Please, Stop Shooting. We Need the Beds'.[8]

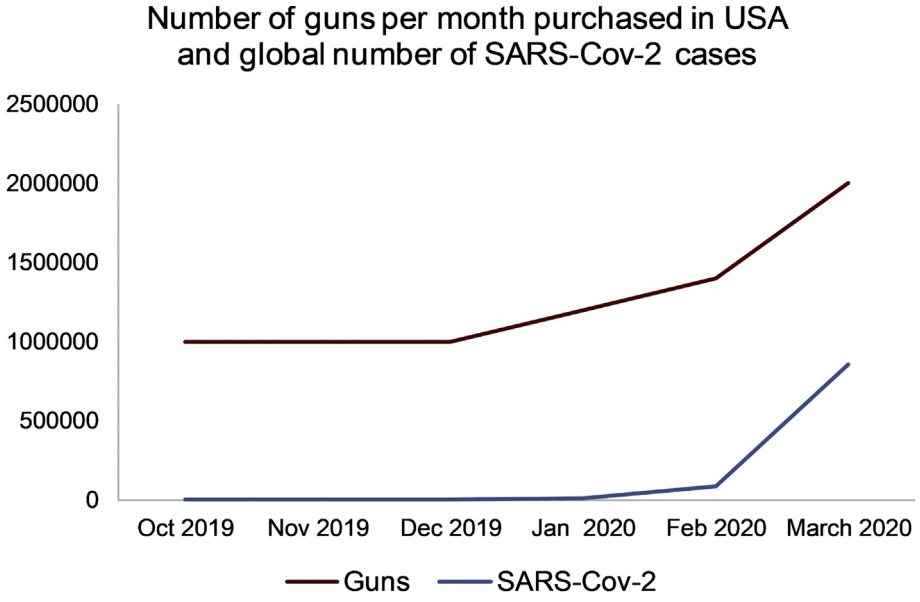

Fig. 1. Number of guns purchased in the US and the global number of SARS-Cov-2 cases per month. SARS-Cov-2, severe acute respiratory syndrome-coronavirus disease-2.

https://doi.org/10.1016/j.puhe.2020.04.033

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15 April 2020
Available online 8 May 2020

Public Health 183 (2020) 6–7

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Has there been an increased interest in smoking cessation during the first months of the COVID-19 pandemic? A Google Trends study

The city of Wuhan in China became the centre of a pneumonia outbreak of unknown cause in December 2019. On 7 January 2020, a novel coronavirus, severe acute respiratory syndrome coronavirus 2, was isolated from the patients with pneumonia in Wuhan.[1] The official name of the disease is coronavirus disease-19 (COVID-19) and common symptoms include fever, coughing and shortness of breath. Most cases resolve spontaneously; however, some develop severe complications, including pulmonary oedema, severe pneumonia and acute respiratory distress syndrome.[2,3] On 10 April 2020, the total number of COVID-19 cases reported worldwide was 1,563,857, including 95,044 deaths. The majority of deaths have been reported in Italy (18,281), the US (16,690), Spain (15,238), France (12,210) and the UK (7,978).[4] Unfortunately, the COVID-19 pandemic is continuing to spread, and there is an urgent need for measures to limit the harmful effects of the virus.

Smokers are known to be more vulnerable to infectious diseases, including influenza and Middle East respiratory syndrome–related coronavirus.[5,6] Smoking has also been found to be associated with negative progression and adverse outcomes for COVID-19.[7] The current evidence comes from five Chinese studies, which find smokers who are hospitalised with COVID-19 have 2–9 times greater risk of serious COVID-19 complications compared with non-smokers.[7] In the short-term, smoking cessation leads to reduced respiratory symptoms and bronchial hyperresponsiveness, as well as prevents unnecessary decline in lung function.[8]

The COVID-19 pandemic is having a major impact on the whole world and has gained huge public awareness. Globally, millions of people search for health-related information online, which makes Web search queries on Google Trends a valuable source of information on collective health trends.[9] The number of Google searches on 'COVID' and 'hand sanitizer' rose sharply in late February and March (Fig. 1).[10] This study aims to investigate the interest in quitting smoking during the first months of the COVID-19 pandemic. As the interest in 'COVID' and 'hand sanitizer' increased rapidly in late February, we have examined the interest in smoking cessation from January to April 2020.

Data were collected from Google Trends (trends.google.com), which provides information on how many 'hits' different words had on a given day on Google. This can be used as a measurement of public interest over time. The highest interest on a search query is quantified as 100 relative search volume (RSV), decreasing to 0 RSV indicating no interest.[9] We retrieved worldwide public query data for the following terms: 'quit smoking', 'smoking cessation', 'help quit smoking', 'how do I quit smoking' and 'nicotine gum' between 16 January 2000 and 13 April 2000 and 6 April 2020. We investigated whether there was an increased interest in quitting smoking in the late February and March compared with the preceeding weeks.

The Google Trends data for Web search queries for the terms 'smoking cessation', 'quit smoking' and 'nicotine gum' from 16 January 2000 to 13 April 2000 to 6 April 2020 are shown in Fig. 1. All search terms show stable interest over the selected time period; there was no tendency for increased interest in any of the key terms. Outputs for the terms 'help quit smoking' and 'how do I quit smoking' are not shown in Fig. 1 but are available on trends.google.com and show the same stable trend.

Previous Google Trends studies have found increased numbers of searches relating to smoking cessation in association with the launch of national smoking cessation programmes and changes in tobacco control policies.[11] We found no increase in the number of searches for smoking cessation on Google in the first months of the COVID-19 pandemic. This could indicate that there has been no actual increase in smoking cessation during the pandemic; however, this may change over the coming weeks and months, as the COVID-19 pandemic is likely far from over. We hope that public health messages will focus on smoking cessation to improve lung health during this continued pandemic. Smoking cessation campaigns are important as smokers are more vulnerable to viral infections and lung diseases, as well as appear to have worse outcomes when hospitalised with COVID-19 than non-smokers.[5–7]

https://doi.org/10.1016/j.puhe.2020.04.012

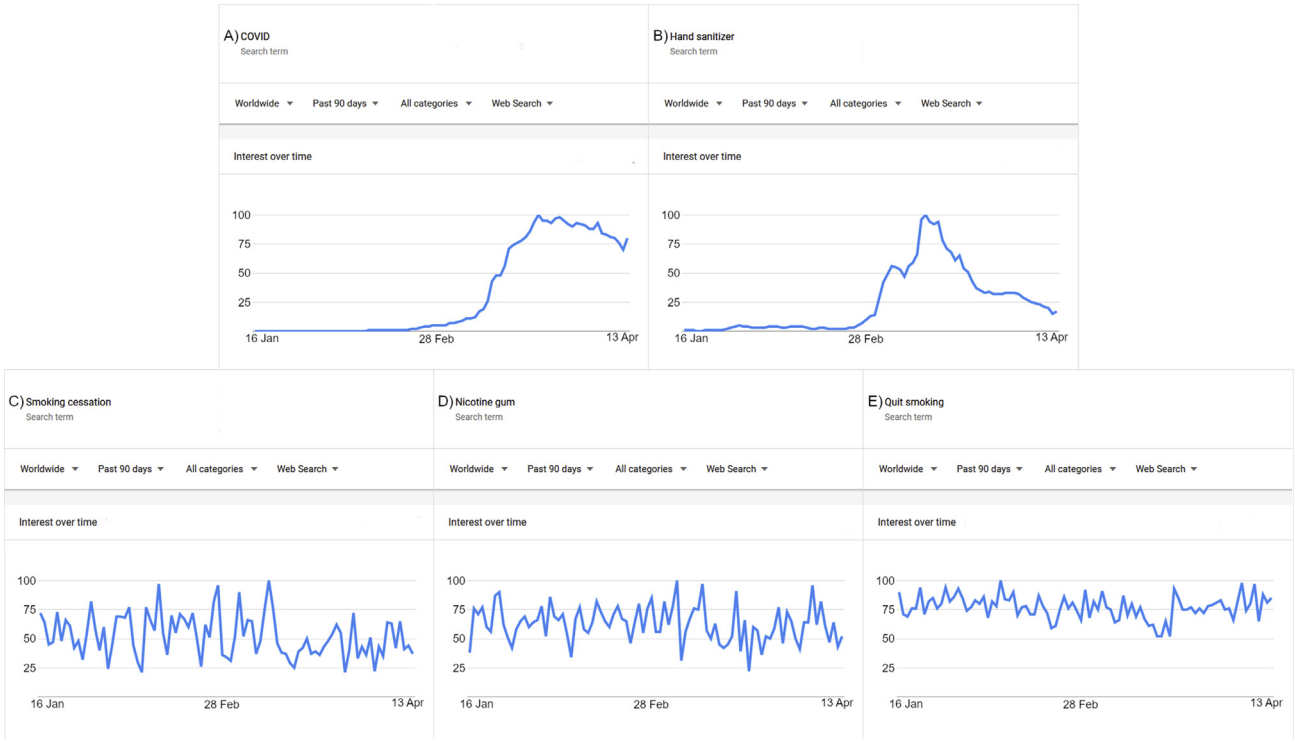

Fig. 1. Google Trends data from between 16 January 2000 and 13 April 2000. Web search queries for the terms 'COVID' (A), 'hand sanitizer' (B), 'smoking cessation' (C), 'nicotine gum' (D) and 'quit smoking' (E). The number of Google searches on 'COVID' and 'hand sanitizer' increased sharply worldwide in the late February and March. On the other hand, the interest in 'smoking cessation', 'nicotine gum' and 'quit smoking' is unchanged, with no tendency for increased interest.

Author statements

Ethical approval

No ethical approval from the Committee on Health Research Ethics was needed. The data used in this study was freely available information on trends.google.com and was completely anonymized.

Funding

None declared.

Competing interests

None declared.

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13 April 2020
Available online 20 April 2020

Public Health 183 (2020) 4–5

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Is home isolation appropriate for preventing the spread of COVID-19

At the end of 2019, the coronavirus disease 2019 (COVID-19) epidemic broke out in Wuhan, China.[1] In the early stages, it was thought that the epidemic could be controlled; however, on January 20 2020, a Chinese expert group confirmed that the spread of the virus is characterised by human-to-human transmission.[2] The spread of COVID-19 cannot be prevented by simply wearing facial masks. The only way to control this disease is to cut-off the route of transmission. After the confirmation of human-to-human transmission, the Wuhan Municipal Government announced travel restrictions in Wuhan, and population migration in Hubei Province continues to be monitored. The entire country is actively trying to prevent the spread of the epidemic.

The outbreak of COVID-19 occurred during the Chinese Spring Festival[3] when large numbers of Wuhan's population travelled to other areas, resulting in extensive spread of the infection. However, with the active efforts of the Chinese government, the epidemic has been well controlled, and the overall situation of the epidemic has improved in China.

At the beginning of the epidemic, there were insufficient hospital beds for the patients in Wuhan, and a large number of patients were required to self-isolate at home. However, patients with COVID-19 under home isolation will transmit the virus to other people in the house via human-to-human transmission. This can lead to the entire household being infected with COVID-19. Therefore, home isolation poses significant risks to the population.

The recent incident of the Diamond Princess cruise ship has served as an unintended case study.[4,5] The cruise ship has 1337 rooms and was carrying 2666 passengers from more than 50 different countries, as well as 1045 crew members. When an 80-year-old passenger was diagnosed with COVID-19 on February 1 2020, all passengers and crew (>3700 people) on the ship were ordered to remain on board in quarantine. By February 17 2020, 1219 people on board had been tested for the virus, of which 355 were infected. Of the 355 confirmed patients, 111 were asymptomatic. The number of infected persons accounted for 29% of the total population on the ship. This result suggests that if both infected and uninfected people are isolated in the same space, transmission cannot be prevented.

The Chinese government found that home isolation was not the best course of action in Wuhan, and that all patients should be brought to a hospital for further treatment. Therefore, the government quickly built two large hospitals within a matter days, namely Leishenshan Hospital and Huoshenshan Hospital.[6] Since then, mobile cabin hospitals have also been established. Chinese medical staff members from outside of Wuhan continue to arrive in Wuhan to help in these new medical facilities (Fig. 1). There are currently sufficient beds and medical staff members to provide the best conditions for the infected population and the route of transmission from person-to-person has been cut-off. At present, the number of infections in China is gradually declining.

China's COVID-19 epidemic prevention and control is currently in a relatively good situation. However, this epidemic has now spread to other countries. At present, the number of COVID-19 patients in Korea and Japan is gradually increasing.[7] It is suggested that mobile cabin hospitals are rapidly established in countries with insufficient hospital beds to treat the infected population and that home isolation should not be implemented for patients. All suspected patients should be sent to a hospital for further confirmation, monitoring and treatment.

https://doi.org/10.1016/j.puhe.2020.03.008

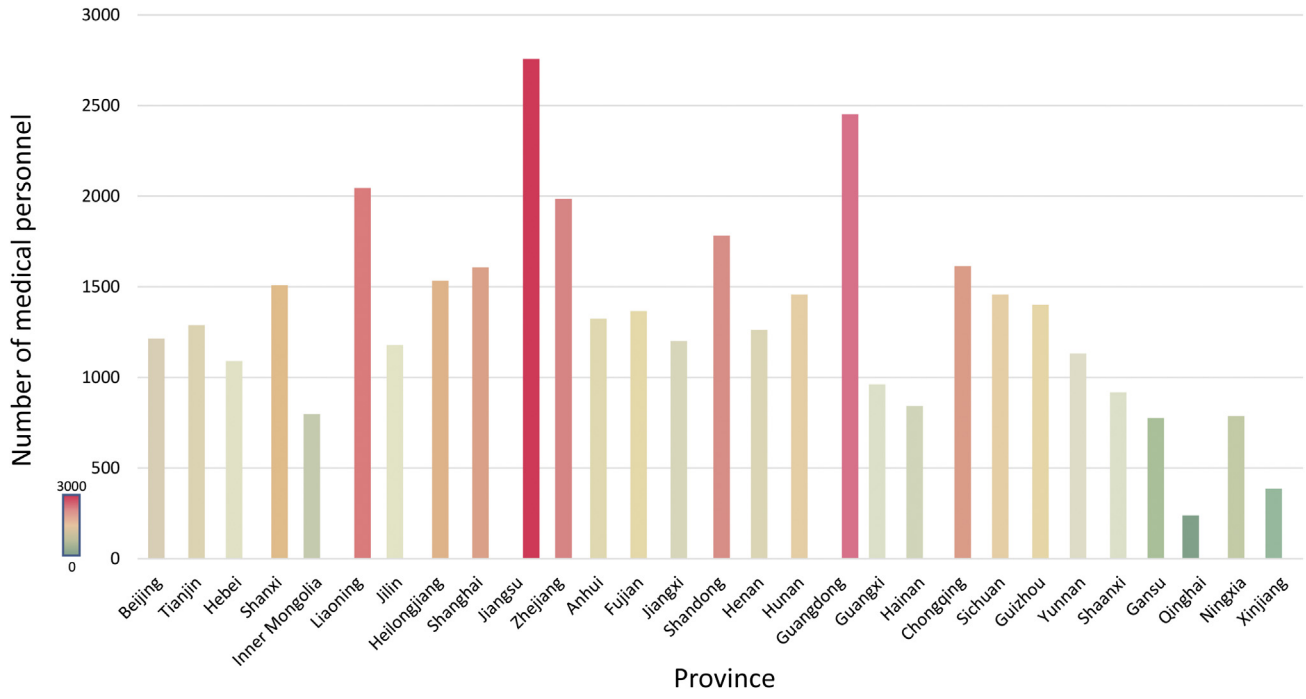

Fig. 1. Chinese medical personnel against the 2019-nCoV.

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8 March 2020
Available online 8 April 2020

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Public Health 183 (2020) 40–41

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Non-COVID-19 visits to emergency departments during the pandemic: the impact of fear

The novel coronavirus, Severe acute respiratory syndrome -CoronaVirus - 2 (SARS-CoV-2), and the resulting infection, COVID-19, is posing an enormous threat and huge workload to emergency departments (EDs) worldwide.[1] The COVID-19 pandemic is a major health emergency that is impacting the behaviour of entire populations in response to a direct threat to both individuals and communities.

Italy saw an exponential growth in COVID-19 cases from the day the first patient was identified in the north of Italy until the 9th of March, when the Italian government imposed the national lockdown. This measure represented a necessary and inevitable action to reduce the spread of infection; however, it also created an environment of strong emotions in the community, especially fear.

Recent studies have shown a significant reduction in ED visits related to different disciplines over the first weeks of the pandemic.[2,3] The consensus is that patients were avoiding going to hospitals because they feared getting infected with COVID-19. This may highlight the overuse of EDs by non-emergency and low complex cases that could be managed by general practitioners; however, there may also be a worrisome tendency to postpone consultations with specialists, even when necessary.

We compared ED visits in two major referral hospitals in the north of Italy from the 21st February to 16th April with COVID-19 daily mortality data from the Italian Civil Protection Department[4] (Fig. 1). It emerges that the two curves almost mirror one another, with a meeting point on the 16th of March and the lowest peak of ED visits corresponding with the highest peak in the COVID-19 daily mortality trend. ED visits have recently shown a timid turnaround, reaching 150 visits/day on 16th April, which suggests the two curves will meet again in the coming next weeks.

The slow upward trend of non-COVID-19 visits to EDs presents a milder slope than the reduction in COVID-19 mortality, indicating how the behaviour of a population in a negative emotional state may require a longer time to change and, mostly, that the fear of what we can get might be greater than the fear of what we have.[5]

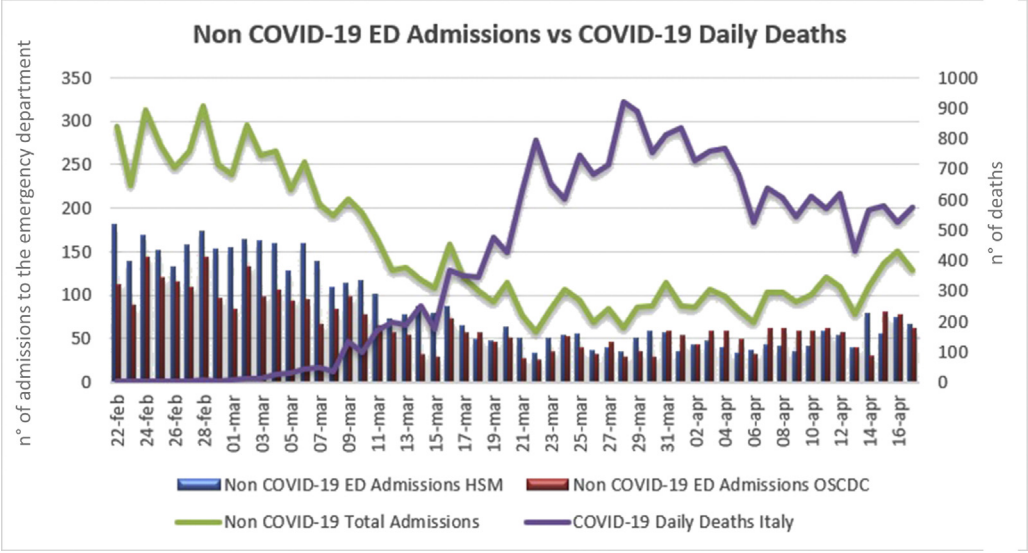

Fig. 1. Non-COVID-19 emergency department admissions vs COVID-19 daily deaths. HSM = Policlinico San Martino Hospital (Genoa, Italy); OSCDC = IRCCS Sacro Cuore Don Calabria Hospital (Negrar di Valpolicella, Italy).

https://doi.org/10.1016/j.puhe.2020.04.046

Conflicts of interest

None.

Fundings

None.

Acknowledgements

The authors sincerely thank the emergency departments of both institutions for their strong efforts during the COVID-19 emergency. The authors are grateful to Dr Claudio Duffini and Dr Francesco Oneto for their support on providing data and Carolina Benzi for the English editing.

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24 April 2020
Available online 7 May 2020

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Public Health 183 (2020) 1

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Potential threats of COVID-19 on quarantined families

The World Health Organization (WHO) has characterized[1] the new coronavirus disease (coronavirus disease 2019 [COVID-19]) as a global pandemic as it spreads in more than 114 countries, killing thousands of people. Therefore, public health authorities and governments have provided some restrictions, including commuting bans, quarantine, and isolation, as the first risk response strategies to delay the introduction and spread of COVID-19 in their communities.

In terms of public health, 'commuting bans' refers to the implementation of traffic restrictions at specific points in an at-risk area. 'Quarantine' refers to the separation of people who have been exposed to a transferable health risk. Accordingly, 'isolation' applies to the separation of people who are known to be affected.[2] Two common concepts are extracted from the strategies, staying indoors and decreasing human communication.

Despite these inevitable limitations, it is noteworthy that infectious disease outbreaks are not considered just a medical phenomenon; rather, they show more complex dimensions of human life. It has been proved that staying indoors for a long time and decreasing human communication affect personal and environmental risk factors, such as anxiety-related behaviors, stress disorders, and exposure to smoke from cooking fires.

Globally, the WHO estimated[3] that exposure to indoor air pollution was responsible for approximately 3.8 million premature deaths, in 2016 alone, owing to diseases attributed to poor indoor air quality. The most common and serious diseases associated with poor indoor air quality include acute lower respiratory infections, chronic obstructive pulmonary disease, lung cancer, cardiovascular disease, and asthma. In addition, according to the Environmental Protection Agency,[4] indoor air is around 2–5 times as polluted as the ambient air and occasionally up to 100 times as dirty. Therefore, when people are spending more time indoors than ever before, like in the current scenario of the coronavirus disease outbreak, all risks associated with indoor air must be highly considered.

The mental health of families during quarantine is another major issue that can result in various negative mental health outcomes. Therefore, countries implementing weeklong quarantine measures should consider the mental well-being of quarantined families. It has been observed that the disruption of normal daily activities is potentially stressful and anxiety provoking. Consequently, the feasibility of controlling the COVID-19 pandemic by long quarantines may be significantly affected by the impact on mental health of quarantined families.

Aiming to survey the negative mental health outcomes of quarantines to prevent all COVID-19 transmissions, a most relevant previous study was critically reviewed. Based on the reported decrease in human communication during Ebola virus isolation,[5] it is not far from mind that COVID-19 quarantines and isolations potentially will lead to several significant mental and psychosocial effects, including (a) fear associated with the experience of intense distress, (b) anxiety and mood disorders as well as obsessive compulsive disorder, (c) psychosocial problems, and (d) social problems. Especially, recently, a record-high number of divorce requests have been observed after coronavirus quarantines in Chinese cities.

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27 March 2020
Available online 21 April 2020

https://doi.org/10.1016/j.puhe.2020.04.014

Public Health 183 (2020) 110–111

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Poverty, inequality and COVID-19: the forgotten vulnerable

On various occasions, the phrase, 'COVID-19 does not discriminate' has been repeated. This, however, is a dangerous myth, sidelining the increased vulnerability of those most socially and economically deprived. In response to the pandemic, UK policymakers imposed lockdown on its 66 million citizens, an act without parallel since World War II. Although enacted for the public's wellbeing, these policies have shown disregard towards those most economically disadvantaged. To date, policymakers have targeted people with multiple comorbidities after identifying them as the most vulnerable. However, this medical model of disease risks ignoring social factors, which can increase exposure to and mortality from coronavirus disease 2019 (COVID-19).

For people of low socio-economic status (SES), a number of factors increase their exposure to COVID-19. First, economically disadvantaged people are more likely to live in overcrowded accommodation—7% of people from the poorest 20% of UK households live in overcrowded housing, a risk factor for lower respiratory tract infections.[1,2] Poor housing conditions, limited access to personal outdoor space and overcrowding will reduce compliance with social distancing. Second, financially poorer people are often employed in occupations that do not provide opportunities to work from home.[3] This includes but is not limited to supermarket and warehouse workers, those in certain forms of public transport and bus drivers, whose tragic deaths we have already witnessed.

Third, those in low SES groups are more likely to have unstable work conditions and incomes, conditions exacerbated by the responses to COVID-19 and its aftermath.[4] Such financial uncertainty disproportionately harms the mental health of those in low SES groups and exacerbates their stress.[5] Heightened stress is known to weaken the immune system, increasing susceptibility to a range of diseases and the likelihood of health risk behaviours.[5,6] Therefore, poverty may not only increase one's exposure to the virus, but also reduce the immune system's ability to combat it.

Fourth, people of low SES present to healthcare services at a more advanced stage of illness, resulting in poorer health outcomes.[7] This will likely lead to poorer health outcomes from COVID-19 for economically disadvantaged people. Fifth, access to health care is also determined by a person's ability to use health services 'with ease, and having confidence that you will be treated with respect'.[8] This can be hindered by language barriers, patients' attitudes towards healthcare providers and the behaviour and attitudes of healthcare professionals towards minority patients.[8] Health care does not exist in isolation, so discrimination in wider society influences healthcare professionals' practice and patients' expectations, such as the anticipation of being dismissed, ridiculed or humiliated, which may deter minority groups from accessing health care. These factors may also reduce access to health care for COVID-19 for patients of low SES.

Finally, there is emerging evidence that hypertension and diabetes are risk factors for death from COVID-19.[9] This is notable because poverty is itself a risk factor for these conditions, with the Marmot Review showing that it increases the risk of cardiovascular disease, obesity, diabetes and hypertension,[10] suggesting people of low SES have an increased susceptibility to COVID-19 mortality.

In summary, a combination of factors leaves the most economically disadvantaged particularly vulnerable to COVID-19. Possible causal mechanisms include an increased exposure to the virus, the stress and comorbidities associated with poverty and reduced access to health care. UK policymakers rapidly identified people with multiple comorbidities as particularly vulnerable. However, they must expand their definition of vulnerability to include social factors as risks for COVID-19. The pandemic has highlighted the stark inequalities within society, and it will likely exacerbate them. To address the vulnerabilities of the most economically disadvantaged within society, policymakers must introduce long-term legislation to improve social welfare.

Competing interests

None declared.

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1 May 2020
Available online 14 May 2020

Public Health 183 (2020) 15

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Recommendations for 'responsible behaviour' is not a sufficient policy tool in public health emergencies

In response to the ongoing coronavirus disease 2019 (COVID-19) pandemic, several countries including the USA, the UK, and Sweden initially relied on recommendations for 'responsible behaviour' of their citizens in reducing the spread of infection. Among simple things such as increased handwashing, these recommendations suggested a few unusual and inconvenient behaviours, collectively termed 'social distancing'. That meant no more handshakes, embraces, parties and even conversations among friends, neighbours, colleagues and acquaintances in close physical proximity. For these social distancing recommendations to make an impact on the COVID-19 spread rate, they had to be adhered to by the absolute majority—as much as 90%—of the population.[1]

Most countries (e.g., Italy, France, Denmark, Lithuania and so on) deemed unrealistic that the required majority of the population will be responsible enough to adhere to such recommendations voluntarily and imposed enforced restrictions of movement, including large fines for violation of social distancing regimes. Such measures have been shown to be effective in reducing the spread of a pandemic in China[2] and reducing deaths by as many as 3.7 times in Italy.[3] Some countries, such as the USA and the UK, were quite late to do that, which led to detrimental effects in terms of thousands of extra deaths. At the time of writing, some countries, such as Sweden and Belorussia, still rely on responsible behaviour instead of mandatory orders.

At the time of writing, COVID-19 deaths per million of the population in Sweden stood at 132, which is very unfavourable when compared with the neighbouring countries, which initiated population lockdowns—55 in Denmark, 28 in Norway and 14 in Finland.[4] As these mortality comparisons suggest, recommendations for responsible behaviour alone is not a viable policy tool in public health emergencies such as pandemics of highly contagious and deadly diseases such as COVID-19. For responsible behaviour to be effective, it should be practiced voluntarily by the absolute majority of the population. This is unrealistic, given that current social distancing recommendations are both unusual and inconvenient, i.e., they contradict both prevailing social customs and personal habits. Psychological research has shown that it takes at least 18 days to develop a new habit, but the average time is about 2 months.[5] Making responsible decisions concerning daily behaviours involves conscious choices with the regard to behaviours, which used to be automatic. This also requires a personal reflection on causes of behaviour, which is additionally inconvenient and may even be anxiety arousing for many. Furthermore, about half of the people fail to adhere to inconvenient health recommendations.[6] Conscious choices in favour of inconvenient behaviour tend to require significant amount of knowledge and understanding concerning the reasons for such behaviour change. Alternatively, people may switch to inconvenient, but adaptive, behaviour if they have very high trust in the source of such recommendations. Although approval ratings for Stefan Löfven, the Prime Minister of Sweden, almost doubled since the beginning of the COVID-19 crisis, at the time of writing, they were at about 50%, which was not enough to expect sufficiently high adherence to inconvenient social distancing recommendations. Thus, in emergency situations involving large populations, implementation of enforced restrictions is unavoidable.

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16 April 2020
Available online 1 May 2020

https://doi.org/10.1016/j.puhe.2020.04.026

Public Health 183 (2020) 63

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

Substance misuse during COVID-19: protecting people who use drugs

People who use drugs (PWUD) face additional risks from COVID-19, linked to drug use behaviours, settings where drug use takes place and related healthcare needs. These marginalised groups are present in countries of all incomes,[1] meaning they must be included in global public health strategies to safeguard them, their healthcare workers and the wider public.

PWUD suffer significant acute and long-term health consequences due to direct and indirect effects of drug misuse, including acute intoxication, mental ill-health and reduced access to healthcare through stigmatisation and discrimination.[2] The high prevalence of chronic conditions among PWUD, including respiratory diseases such as asthma and chronic obstructive pulmonary disease,[3] may put them at increased risk of COVID-19 infection and severe disease.[4] In addition, public health measures may exacerbate poor outcomes for PWUD, as social isolation is associated with increased substance misuse.[5]

COVID-19 is primarily transmitted by respiratory droplets and contact routes,[6] which informs public health mitigation measures including social distancing and hand hygiene. PWUD who share drugs or paraphernalia are consequently at increased risk of transmission between drug users. In addition, drug use often takes place in crowded or substandard living conditions, threatening social distancing and hand hygiene adherence and placing both PWUD and the wider public at risk. PWUD are also disproportionately represented in homeless, vulnerably housed and incarcerated populations, which face additional risks from COVID-19 infection.[7,8]

Surges in demand for emergency care during COVID-19 are forcing health systems to scale down routine services, risking discontinuity of care across many domains of health, including substance misuse services. This threatens PWUD with reduced access to vital medications, psychological support and clean drug equipment. In addition, physical distancing and self-isolation public health measures raise further barriers to accessing health and social services within this already-disadvantaged group.

There is urgent need to protect PWUD against the direct impacts of COVID-19 infection and to secure the continuity of care provided by substance misuse services. Public health messaging should sensitively target this group to discourage drug and paraphernalia sharing, promote social distancing and hand hygiene and empower PWUD to appropriately seek medical attention, while safeguarding provision of drug misuse services and protecting the health workers delivering them. This will require reimagining services, such as telemedicine and online care, and maintaining infrastructure vital to treating addiction, including housing and welfare. These actions are required by health systems globally to ensure an equitable response to COVID-19 in which PWUD are not left behind.

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1 May 2020
Available online 13 May 2020

https://doi.org/10.1016/j.puhe.2020.05.010

Public Health 183 (2020) 36–37

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

The disguised pandemic: the importance of data normalization in COVID-19 web mapping

The emergence of coronavirus disease 2019 (COVID-19) has interrupted daily life in a truly unprecedented way. The virus has highlighted weaknesses in our healthcare system and has drawn attention to many important issues, not the least of these is how we manage and visualize geographic information. To keep decision makers and the public up to date, news outlets and organizations have created visualizations to facilitate a rapid understanding of the emerging trends. Owing to the highly contagious nature and increasing expansion of the disease over large areas, maps are a popular choice. With the advent of geographic information systems, and particularly web mapping, it is more accessible than ever for individuals with little to no formal training to make and distribute maps.[1,2] Although this technology has revolutionized cartography, unfortunately, it has led to the creation of less than perfect maps that are accidentally or intentionally misleading.[2]

Many COVID-19 maps created so far are choropleth maps, which are a form of statistical map that uses intensity of color to correspond to data intensity within enumeration units.[3,4] The basic principles for their creation require normalized data (e.g., employment rate) rather than absolute data (e.g., total population). Cartographers base this criterion on the fact that the difference in enumeration unit size can alter how a spatial distribution appears. Thus, an underlying principle in choropleth mapping is to normalize data before any attempt to symbolize it.[3–5] When appropriately used, a choropleth map is an excellent choice to reveal regional patterns associated with the pandemic. In the maps produced of COVID-19, however, these principals are not always followed.

To illustrate this issue, we created a series of maps that demonstrate the importance of data normalization (Fig. 1). We adapted Fig. 1a from the daily COVID-19 update on the Centers for Disease Control and Prevention (CDC) website.[6] The map colors in Fig. 1a represent the total cases of infection. This symbolization, while not conforming to cartographic principles, may obfuscate the

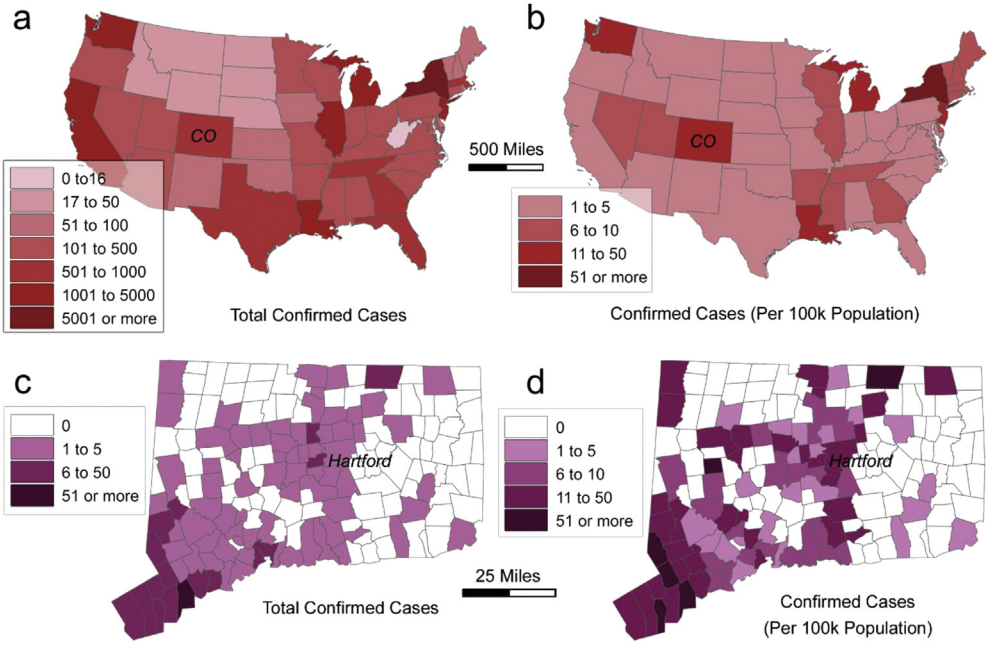

Fig. 1. COVID-19 cases: (a) total confirmed cases by US state (b) cases per 100,000 population by US state, (c) total confirmed cases by Connecticut town, and (d) cases per 100,000 residents by Connecticut town. Data were derived from the CDC and Connecticut Department of Public Health for March 23, 2020. CDC = Centers for Disease Control and Prevention; COVID-19 = coronavirus disease 2019.

https://doi.org/10.1016/j.puhe.2020.04.034
0033-3506/Published by Elsevier Ltd on behalf of The Royal Society for Public Health.

severity of the outbreak. To elaborate further, we have created another map of COVID-19 infections per 100,000 people with four classes (Fig. 1b). The new map identifies Colorado as having a significantly higher rate of cases than that of California. Because of the fewer total cases and a relatively small population in Colorado, the CDC map understates the impact of COVID-19.

The federal government is not alone in this miscommunication. Fig. 1c is a reproduction of the COVID-19 map showing the total infections by town published by the state of Connecticut.[7] The map shows the majority of the cases are in the southwest portion of the state. Similar to the map in Fig. 1a, this map is somewhat inaccurate because it does not normalize the cases based on population. To demonstrate, in Fig. 1d, we have created another map showing COVID-19 cases per 100,000 people in the state of Connecticut, and a new pattern emerges. In this map, several towns with relatively small populations near the state capital, the city of Hartford, show an alarming rate of the outbreak.

Nowadays, communication of health information at all levels of society relies heavily on web-based maps. Although web mapping facilitates the delivery of rapidly emerging public health data, the individuals tasked with creating these maps do not necessarily have professional cartographic training. Thus, a certain degree of skepticism should be maintained, even for maps published by a reputable source. As society continues to combat COVID-19, we hope this note may facilitate proper use of web mapping tools and can help uncover information gaps where health policymakers should not overlook.

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23 April 2020
Available online 7 May 2020

Public Health 183 (2020) 2–3

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

The ethics of scare: COVID-19 and the Philippines' fear appeals

The novel coronavirus disease (COVID-19), took the world by surprise; and, as of early April 2020, the virus has already claimed more than 80,000 lives and infected more than a million people around the globe.[1] To combat the pandemic, most governments strongly enforced social-distancing, area-wide lockdowns and curfews, and contact-tracing of persons under investigation. To motivate people to take preventive measures, some heads of states used what may be characterized as the 'friendlier' strategies in the form of infographics, infomercials, and hashtags.[2] On top of this, other governments have resorted to rather extreme tactics, which play on people's fears to regulate behavior. Witness some cases in the Philippines as examples.

In the country's National Capital Region, which has the most COVID-19 positive cases, most areas have an assigned town crier, who, while on a *recurida* or a mobile audio truck, threatens residents with fines of up to Php5,000 (US$100) and possible jail time for non-compliance with set curfew hours.[3] In Cainta, Rizal, a province north of Manila, local officials signal the start of the curfew by sounding the alarm from the horror movie *The Purge* (2013).[4] (*The Purge*'s story revolves around the 'purging' or violent killing of people in a single night while emergency services are suspended.) Even the Philippine president, Rodrigo Duterte, dissuades the public from disobeying the enhanced community quarantine with remarks like, '… If there is trouble or the situation arises that people fight and your lives are on the line, shoot them dead'.[5] The psychology literature refers to these scare tactics as 'fear appeals'.

Fear appeals are nothing new. As a pioneer on the subject, Howard Leventhal explains, fear-arousing communication is a tool often used to persuade others to act and behave in a certain way.[6] Parents use it to discipline children; bosses to drive staff productivity. Even medical practitioners employ 'fear-based medicine' in clinical encounters when they try to coax patients to follow a course of action by issuing 'if you don't, then …' threats.[7] Fear appeals have also permeated public health campaigns. Visual health warnings on cigarette packaging, for example, are a case in point.[8] Although some, like R.F. Soames Job, have argued that such campaigns are ineffective,[9] others, such as Kim Witte and Mike Allen found that 'strong fear appeals and high-efficacy messages produce the greatest behavior change'.[10] The verdict is still out whether such campaigns are effective or not.[9]

As Irish Olympian John Treacy once said, 'fear is a great motivator'. It pushes our survival instincts into high gear. Although fear appeals and scare tactics have been used in clear and present public health emergencies such as COVID-19, the ethics of such public health communication interventions needs to be scrutinized.[11] In particular, whether these appeals and tactics are morally acceptable and appropriate.[12]

It might be argued that scare tactics are acceptable in times of crisis so long as they urge 'large population segments, who are at moderate risk, to adopt risk-reducing practices … to influence those who are at high risk'.[11] Such a reason may perhaps be grounded on the utilitarian principle of doing what best promotes the greatest benefit for the greatest number. On the other hand, an argument premised on a Kantian, rights-based moral philosophy might say that if these tactics violate certain moral and legal rights that people hold inviolable, then such appeals are morally inappropriate. To preserve the Kantian ideal for appropriateness, it might be suggested that fear appeals 'should exclusively be used when pilot studies indicate that an intervention successfully enhances efficacy'.[13] In a time of the uncertainties of a global health crisis such as COVID-19, however, a utilitarian may question this suggestion's moral acceptability. On the whole, then, the rightness of fear-mongering might therefore be the balance of its moral acceptability and appropriateness.

The editors of this journal have stated that the global health threat of COVID-19 requires collaborative health actions from different sectors from around the world. And they called for a strong public health response to combat this pandemic.[14] Whether this call extends to the use of scare tactics is something that the public should morally examine.

One line that epitomizes a scary tactic is President Duterte's fierce pronouncement on a live telecast that COVID-19 is a 'crisis with no solution in sight'.[15] Whether the statement is true, or whether it contributes to the well-being of the general public are beside the point. We just hope that was a mere fear appeal as the very thought of it makes us shiver from sheer fright.

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10 April 2020
Available online 20 April 2020

Public Health 183 (2020) 67–68

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

The facemask in public and healthcare workers: a need, not a belief

Since the declaration of the COVID-19 pandemic, a lot of data have invaded our lives, and the conflicting findings have caused us to be frantic about the correct course action. Although the application of social distancing has been accepted worldwide, the level of enforcement varies in each country ranging from voluntary to strict legal measures. Some countries are currently verifying the utility of these measures.[1] Despite these steps, the number of infections and deaths is continuing to increase worldwide, posing a responsibility for the most developed countries to step up in this time of crisis to support the most vulnerable layers of our society. The overwhelming stress and level of danger that our frontline health care is subjecting themselves to in this pandemic as they perform their duty to serve the public has triggered astonishing questions of whether they are just a resource that can be exploited, exhausted, and used up.[2] During this pandemic, numerous healthcare workers in the world have died, and many have committed suicide in a tragedy that has touched all continents.[3,4] Our infrastructure is posing a considerable risk to our healthcare workers because numerous hospitals in Canada are old and their ventilation systems are not up to date to handle a pandemic.[5] In numerous hospitals with a lack of window access, the circulation of aerosols may be quite dramatic for both patients and healthcare workers. The 6-feet distancing is not respected inside many hospitals in several provinces because corridors, stairwells, and passages are narrow. Although experts have expressed different opinions on the airborne status of SARS-CoV-2, the virus has been isolated in the ventilation systems of several hospitals, which endangers everyone without proper personal protective equipment (PPE) in the building. The recent proof of aerosolized droplets being able to travel well over 6 feet supports the question of whether our current social distancing guidelines are even adequate.[6] There have been anecdotal reports of hospital administrative bodies not allowing their staff members from wearing their own PPE originating from outside of the hospital's supplies, with the concern of not being able to validate if the quality is not sustainable from both a legal and an ethical point of view. The concept of *primum non nocere* should still be valid for all administrators.[7] The preposterous indication that some PPE may be faulty argues against our charter of freedom. It should not be an excuse to forbid healthcare workers or patients entering hospital facilities to wear their PPE.[5] The number of community transmission is increasing exponentially, and asymptomatic carriers can infect their close contacts.[8] Healthcare workers, patients, and visitors entering the hospital facilities should be allowed to wear their PPE even when they are not interacting with symptomatic patients. In facilities where social distancing is not or cannot be implemented (e.g., laboratories, elevators, and stairwells), wearing any type of PPE may help prevent an airborne infection. A combination of the filtering action of the fabric and the seal between the mask and the face forms the basis of reducing aerosol exposure in people wearing masks.[9] Recently, Bartoszko et al.[10] reported on four randomized clinical trials (RCTs), which were meta-analyzed and adjusted for clustering. The authors conclude that there is some evidence suggesting that medical masks and N95 respirators offer similar protection against viral respiratory infection, including coronavirus in healthcare workers during non–aerosol-generating care. In a submitted manuscript, not yet peer-reviewed, Jefferson et al.[11] report on a meta-analysis of 14 trials on the use of masks vs. no masks showing no effect in either healthcare workers or community settings and no difference between the N95 respirators and other types of masks. However, the trials had not been carried out in aerosol-generating procedures and most of the studies showed poor design and incompleteness. The science would suggest that facemasks are crucial for everyone, not only healthcare workers. It does not make sense to continue to stockpile them and limit their use. Facemasks need to be used more widely and compulsorily. It has been calculated that wearing a simple cotton mask will reduce the amount of virus transmitted to a neighbor by 36 times.[12] The transmission rate (R_0) is a parameter that indicates how contagious an infectious disease is. An R_0 of 1.0 indicates each existing infection causes one new infection. In the case of the 1918 pandemic flu, the R_0 was 1.8. Although initially the R_0 of SARS-CoV-2 was 2.4, more recent and comprehensive data indicate that it was 5.7.[13] In other words, without containment measures, SARS-CoV-2 spreads far and fast. Unfortunately, many countries were slow in implementing strong public health measures, hindered by trying to maintain political correctness instead. This was evidenced by the late decision to ban non-essential air/land/sea travel in many countries. If most people wear a mask in public at any time, the transmission rate can easily decrease beneath 1.0, thus stopping the spread of the disease and limiting the long-standing lockdown measures.[13] The number of COVID-19 cases in South Korea started decreasing in February 2020, when the government supplied facemasks to every citizen. In contrast, the number of cases in Italy continued to climb in the same time period where facemasks were not freely supplied.[14] It is important to emphasize that while a protective mask may reduce the likelihood of infection, it will not eliminate the risk, particularly when a disease has more than one route of transmission, as identified in SARS-Cov-2. Vaccines against COVID-19 take time to develop. In a situation where there is a short supply of PPE, an improvized facemask should be viewed as the last possible alternative if a commercial product is not available. In China, Hong Kong, Taiwan, Japan, South Korea, and Thailand, the broad assumption is that anyone could be a carrier of the virus, even seemingly healthy people, leading to terrific results in these countries with the widespread wearing of facemasks. The

https://doi.org/10.1016/j.puhe.2020.05.009

widespread public acceptance of using facemasks in these countries, even before the onset of COVID-19, may be attributed to their experience of facing several epidemics in the past. To a certain extent, pollution has triggered the use of facemasks for protection in these countries.[15]

In conclusion, all citizens should wear a mask. Although strict isolation and social distancing measures can flatten the infectious curve, the use of facemask needs to be encouraged and facilitated where the 6-feet social distancing cannot be implemented because of physical barriers. Preservation of N95 respirators for high-risk, aerosol-generating procedures in this pandemic should be considered when in short supply, but surgical facemasks should be provided to everybody.

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21 April 2020
Available online 13 May 2020

Public Health 183 (2020) 42–43

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Letter to the Editor

The risk of COVID-19 transmission in favelas and slums in Brazil

At a time when the coronavirus disease-2019 (COVID-19) pandemic affects a large part of the continents, populations who live in subnormal clusters, especially in developing countries, appear as an additional concern.

Subnormal clusters is a group of at least 51 housing units, arranged in a disorderly and dense manner, lacking essential public services, occupying land owned by others; commonly called favelas, invasions, caves, lowlands, communities, villages, undertow, irregular subdivisions, huts, and stilts.[1]

In Brazil, these areas were home to 11,425,644 people, or 6% of the Brazilian population, in accordance with the 2010 population census, the last conducted in the country. It is known that 5.6% (3,224,529) of the total Brazilian households are located in these areas. In the country, 6329 subnormal clusters were identified, in 323 municipalities.[1]

The Southeast region, the most populous in the country, concentrated in 2010 the largest number of homes in these types of agglomerates (49.8% of the total in Brazil), with greater concentrations in the States of São Paulo (23.2%) and Rio de Janeiro (19.1%). Then, the Northeast region concentrated 28.7% of the Brazilian subnormal agglomerates, the North region, 14.4%; the South region, 5.3%; and the Midwest, 1.8%.[2] Geometric estimate of the growth of slum dwellings in Brazil shows an average growth trend of 6.93% in these numbers, between 2010 and 2020, reaching up to 11.7% in the Northeast region.[3]

The average demographic density in Brazilian settlements is 67.5 inhabitants/hectare (inhab./ha); reaching up to 99.1 inhab./ha, as observed in the Southeast region. About 72.6% (2.3 million) of the households in these agglomerations coexist without spacing between them.[3] The profile of people living in these settlements shows that the average age in these areas was 27.9 years in 2010. The range from 0- to 14-years-old corresponded to 28.3% and the range of 60-years-old or older was 6.1%.[2]

Subnormal agglomerations have a high demographic density, so it is inevitable the agglomeration of socio-economically vulnerable people, with low education, in precarious conditions of basic sanitation and with less access to health goods and services, which predisposes its inhabitants to a greater risk of contracting the new coronavirus and to perpetuate the spread of the disease.[4]

COVID-19 cases have spread throughout the country, with a tendency to exponentially increase the number of infected people in all Brazilian regions. In times when isolation of cases, quarantine of contacts and social detachment are the most effective strategies to contain the pandemic, Brazil faces a challenge that is unknown to European countries: the living conditions in the subnormal agglomerations.

In these types of houses, social distance becomes almost impossible because residents must coexist, in quarantine, within a space that does not hold all residents together at the same time. Isolating sick individuals within multigenerational households, in which five or more individuals share the same room and bathroom, becomes impractical. The precarious conditions of basic sanitation in the houses mean that there is even a lack of drinking water and minimal hygiene. The poor socio-economic conditions do not allow adequate availability of sanitizers and disinfectants, not even soap.[4]

Although the impact of the spread of COVID-19 on these clusters is not noticed, little is discussed between government and the population about these communities. There are few proposals for coping with COVID-19 in these communities, which lack differentiated strategies, considering their particularities and their spatial distribution.[4]

Health authorities have not considered the inevitable agglomeration in conditions of economic fragility and in unequal territory, which hinder the dissemination and understanding of the minimum information on hygiene and protection against the virus, and which often also make the acquisition and use of disinfectant agents unfeasible.

In this way, the peculiarities of populations living in subnormal agglomerations emerge as a major public health challenge, especially in the face of a pandemic, which can spread to these communities, with irreversible consequences for an entire country, including the inhabitants of urbanized regions.

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https://doi.org/10.1016/j.puhe.2020.04.042

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15 April 2020
Available online 8 May 2020