JULY 2021 • VOLUME 47, NUMBER 4

EMERGENCY NURSES ASSOCIATION

Journal of EMERGENCY NURSING

OFFICIAL PUBLICATION OF THE EMERGENCY NURSES ASSOCIATION

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Looking to the 12 Points of the Scout Law as Inspiration

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Here we are halfway through 2021 and my year as president of the Emergency Nurses Association. I got the inspiration for this President's Message topic as I was helping my son complete his Eagle Scout project. This message is written from the lens of my youth, my experience in scouting and some key components that factored into who I am today. I would like to acknowledge that the Scouts organization does have a past history of inequities and want to acknowledge the movement of the organization to be more inclusive. Like many organizations, communities, and individuals, we are all growing to be better around diversity and inclusion. The lessons I learned as a child in the Scouts are still relevant today and hopefully will resonate with you as well. The focus of this message is on the 12 points of the Scout Law.

The 12 points of the Scout Law were recited weekly at my Scout meetings as a youth and now as an adult leader. They are a good reminder and can serve as a compass for life. The 12 points are simple and can be examined more closely. The 12 points are recited, "A Scout is Trustworthy, Loyal, Helpful, Friendly, Courteous, Kind, Obedient, Cheerful, Thrifty, Brave, Clean and Reverent."

- *Trustworthy:* This one resonates with us as nurses because our profession has been running for 19 years as the most trusted profession.[1] What are we doing to maintain this? Are we always offering our recommendations based on fact? Let us all do our part to keep our profession trustworthy.
- *Loyal:* Do we always have each other's back? Do we return the favor for those who were there for us, and are we there for them when needed?
- *Helpful:* Do we take that extra step to help the person in the hospital who looks lost? Do we pick up that piece of trash along the sidewalk when we are out running errands or pick up and recycle the bottle we see on the hiking trail?
- *Friendly:* How are we at welcoming new members at our meetings? At taking a new nurse under our wing to ensure that they have a good transition into our department?
- *Courteous:* A great way to show respect for others. Do we smile and greet people who do not look like us? Do we acknowledge the stranger sitting outside the convenience store? How do we treat staff outside of our department at the hospital?
- *Kind:* What are we doing to seek to understand what others may be going through at the moment our paths cross? Kindness goes a long way. Personally, I recall the phrase associated with Maya Angelou, "You may not remember what a person said to you, you may not remember what a person did to you, but you will never forget how a person made you feel!" We see enough unkind things in the world around us. Be the good.
- *Obedient:* Are we doing our best to live within the constructs of the law? If we disagree with some laws or norms, how are we respectfully challenging them?
- *Cheerful:* Are we doing our best to live with PMA —positive mental attitude? We all face times when it may be difficult to be positive. Strive to build resilience in ourselves to maintain a positive mindset in the face of adversity. It will make a difference for you and others. Cheerfulness and happiness are contagious. Be infectious.
- *Thrifty:* Are we mindful of the resources we use during our shift at work? How are we treating our environment? How are we keeping thrifty with our time and talents? Take an inventory of what we do in a day or a week. Are we being thoughtful and not wasting time? Time check—we cannot get wasted time back.

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J Emerg Nurs 2021;47:509–510.
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- *Brave:* To be brave, we have to experience fear. This fear can have many forms. Are we being brave to challenge inequities we see? What are we doing to be brave in standing up for what we know is right to make our world a better place?
- *Clean:* This is more than a shower. This is clean on the inside and out. Are we doing right? Can we lay our head on the pillow and be okay with our day? Maybe not always—we are human, but we can always strive to be better.
- *Reverent:* This can be a belief in a higher being or power. This also relates to showing profound respect. How are we reverent to our patients, our colleagues, strangers, and ourselves?

These 12 points can help us *Elevate* each day as I have challenged all of us this year of 2021. Stay positive, stay focused, and be the good!

ELEVATE

REFERENCE

1. Saad L. U.S. ethics rating for medical workers and teachers. *Gallup*. Published December 22, 2020. Accessed January 29, 2021. https://news.gallup.com/poll/328136/ethics-ratings-rise-medical-workers-teachers.aspx

Trajectory of Research and Dissemination Through Mentorship and Passion

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A report by the Institute of Medicine, "The Future of Nursing," called for a doubling of the 28 369 doctorally prepared nurses in 2008 by 2020.[1] Although this goal was achieved, it was done primarily through the expansion of Doctor of Nursing Practice programs in the United States. In 2019, the number of nurses graduating with a practice-focused doctorate (Doctor of Nursing Practice) was more than 9 times higher than the number of nurses graduating with a research-focused doctorate (Doctor of Philosophy): 12 250 graduates vs 1306 graduates, respectively.[2] Given the number of nurses seeking a doctoral degree, it is important for emergency nurses to consider the meaningful aspects of the research doctorate. In this guest editorial, I relay my own career trajectory from being a stretcherside emergency nurse to my role today as an emergency nurse scientist and leader. It is my hope that emergency nurses will seek opportunities similar to the ones I was afforded through mentorship and dissemination to also become emergency nurse scientists and/or research-focused academic faculty members.

My career trajectory as a nurse scientist began in 2001 when I was selected by the *American Journal of Nursing* (*AJN*) to become a writing fellow. This program, which was cosponsored by industry, the *AJN*, and the Emergency Nurses Association (ENA), partnered me with a clinical nurse specialist and trauma coordinator to serve as my writing mentor. The most extensive writing I had done at this point was writing class papers. She helped me reflect on my clinical experience as an emergency nurse to identify a topic in which I had some level of expertise; I chose diabetic ketoacidosis. From there, she provided extensive mentorship on the writing process, editing, and using primary references. My manuscript was accepted for a special issue of the *AJN*.[3] The ENA, in collaboration with the industry sponsor, paid for my travel to ENA's annual conference in New Orleans in 2002. During this conference, the ENA hosted a reception where I met Mary Jagim, ENA's immediate past president. Jagim instructed me to keep writing about topics I knew to influence the specialty of emergency nursing; this conversation left a lasting impression on me. Since then, I have engaged with countless ENA members, Academy of Emergency Nursing Fellows, and ENA state and chapter leaders who have supported the career development and leadership aspirations of their fellow ENA members. Key takeaway points that I garnered from these experiences were the importance of obtaining a writing mentor and writing about what you know.

It would be 4 more years until I served as an author on another peer-reviewed manuscript. While matriculating in the Doctor of Philosophy program, several faculty members provided mentorship in both writing and the conduct of research. Although I recognized the importance of writing what I know about, I didn't yet recognize the importance of having *passion* for what you write about. During my initial semester in the doctoral program, I switched my research focus multiple times, initially addressing the problem of frequent use of the emergency department by homeless adults and then onto substance abuse, then police interventions, and so on. It wasn't until the week before spring break in 2006 that I met my next mentor and future dissertation chair. We had a short conversation about the problem of assaults against emergency department workers. Although I had been physically assaulted dozens and dozens of times, I never thought of this violence as a "problem." During spring break, I drafted a manuscript focused on workplace violence against emergency nurses. This manuscript written over 1 week received minimal edits from my course instructors, and the article became the second publication that I had as a first author.[4] Because I had

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J Emerg Nurs 2021;47:511–513.
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passion for my topic, my writing was more effective, told a good "story," and required much less effort than writing about something I knew but on a topic about which I was less passionate.

In fall 2007, a program officer from the National Institute for Occupational Safety and Health attended a local conference where I presented my dissertation findings. She informed my dissertation chair and me that we should write a grant application using the findings from our respective projects as pilot data for an upcoming funding opportunity announcement. My grant application was approved in 2008 as I started my new role as an assistant professor at a college of nursing. From there, I had a defined research focus to serve as the foundation for my trajectory. In addition, I now had a formal writing and research mentor as well as a research topic engulfed with my passion.

As my reputation as a workplace violence nurse scientist and academic faculty member grew, Dr Paula Grubb from the National Institute for Occupational Safety and Health contacted me about the problem of bullying against novice nurses. As a research psychologist, Grubb had become aware of this problem and was seeking a collaborator to begin developing educational interventions to prevent and mitigate the psychological consequences for novice nurses who experienced workplace bullying. Beginning in 2011, Grubb and I began our partnership to address workplace bullying against nurses. From 2011 through 2018, we developed a series of active learning interventions, including role-play simulations, case studies, and debriefing tools that were ultimately deployed at 8 universities and several hospital systems across the US.[5-7]

In 2012, I applied to the Robert Wood Johnson Foundation (RWJF) Nurse Faculty Scholars program. I was selected as 1 of 12 scholars that year and received research mentorship, leadership development training, and career coaching from several nurse leaders such as Dr Beverly Malone, chief executive officer of the National League for Nursing. Several peers in this program emphasized the importance of selecting the "right" journal to disseminate research findings in. Typically, the choice of the right journal is based on the journal's Clarivate impact factor score (Clarivate Analytics), a measure of how frequently a published article would be cited after publication.[8] Other factors for selecting a journal are the scientific rigor, editorial quality, peer-review process, reputation, and indexing status of the journal.[9] For me, I target my paper submissions on the basis of the journal's readership. For example, I purposefully submitted my papers to journals whose readers could use my research findings and implications to transform the emergency care environment to promote a violence-free work environment (eg, *Journal of Emergency Nursing, Journal of Hospital Administration*). Because I focused on the target audience of journals, I am now routinely contacted to provide consultations and lectures on building a safer work environment.

Although my research trajectory has been rewarding, my success was based on leveraging the support from, and talents of, multiple others, including past and present mentors across multiple professions (eg, psychology, victimology, public health, nursing). Through the coaching of this mentoring network, I learned to increase the breadth of my research skills. For example, in 2012, I served as the chair for the National Conference on Workplace Violence in Healthcare Settings. One of my mentors, Dr Bonnie Fisher, encouraged me to coordinate a special issue of a journal to report the best papers presented at the conference. In 2014, various conference proceedings were published in a special issue of *Work: A Journal of Prevention, Assessment & Rehabilitation*.[10] From this experience, I learned to manage a large team and coordinate a large project. Dr Corinne Peek-Asa coached me on conducting environmental assessments to determine risk for violence. Dr Rosa Maria Gonzalez-Guarda stressed the value of using community advisory boards,[11] which I now use and encourage my students to use as well.[12] Dr Treasa "Susie" Leming-Lee taught me quality improvement science and how to use it legitimately within my research focus area.[13,14] I received this mentoring over the course of years, with each experience expanding my skill set to allow me to conduct more rigorous research.

These mentoring relationships led to my roles as an ENA Board Director and Associate Dean for Research. During the RWJF Nurse Faculty Scholars program, Dr Malone served as 1 of my formal mentors. She encouraged me to use the leadership development training that the RWJF program was providing as a leader within the ENA. With her encouragement, I ran for the ENA Board of Directors 3 consecutive years and was elected as a director with a term starting in 2018, the same year that I was formally appointed as the Associate Dean for Research at the University of Cincinnati College of Nursing. As a director, I used my skills as an emergency nurse scientist while governing. For example, 1 of the duties of a board member is the "duty of care," which requires decisions to be evidence-based and made after thoughtful debate.[15] While serving on the ENA Board of Directors, I participated with fellow board members in professional development on board governance, conflict-of-interest management, effective communications, strategic planning, member accountability, media training, and how to lead during a crisis. I leveraged this professional development to be a more effective Associate Dean for

Research where my responsibilities include fostering an inclusive work environment, setting the research strategic direction and benchmarks in collaboration with the faculty, communicating expectations for job performance, and participating in budget management.

During my career, I learned that a hallmark of a great research trajectory is not merely one's personal accomplishments, but also the accomplishments of those being mentored. I strive to model the best of the mentoring I received to my colleagues and students. Partly why I was able to be successful was because my mentors had me use an individual development plan[16]; therefore, I now leverage this tool to help my students and faculty members develop short- and long-term goals that will promote a rewarding research trajectory. A component of this tool includes specific goals for manuscript dissemination. Many of my mentees do ultimately publish their research, which has resulted in their collectively having more than 40 articles published in peer-reviewed journals. As I sought for additional ways to "pay it forward" in terms of the mentoring I received over the years, I partnered with Drs Maja Djukic and Cheryl Woods Giscombé to develop a writing mentorship award program with the *AJN*,[17] which has been awarded annually since 2016. This program provides acknowledgment and conference travel support to a new author selected for having published the best paper of the year in which the first author was mentored by another author on the publication.

Key Takeaways

The purpose of this guest editorial was not to be self-flattering but to describe my research trajectory with examples that could be replicated by others. I have highlighted several successes that I have achieved during my career, but I have also experienced many failures and sidesteps. From both my successes and failures, I learned 5 key lessons that I believe can be used by others embarking on their research trajectory:

1. Seek writing and research mentors.
2. Write about what you know and have passion for.
3. Be purposeful regarding where you submit your research-based papers.
4. Develop a mentoring network to address multiple career aspects.
5. Pay it forward by mentoring others.

REFERENCES

1. Institute of Medicine (US) Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, at the Institute of Medicine. Transforming education. *The Future of Nursing: Leading Change, Advancing Health*. National Academies Press; 2011.
2. American Association of Colleges of Nursing. Latest data on diversity. Accessed April 29, 2021. https://www.acnnursing.org/Diversity-Inclusion/Latest-Data
3. Gillespie GL, Campbell M. Diabetic Ketoacidosis: rapid identification, treatment, and education can improve survival rates. *Am J Nurs*. 2002;102(suppl 9):S13-S16.
4. Gillespie GL. Consequences of violence exposures by emergency nurses. *J Aggression Maltreat Trauma*. 2008;16(4):409-418. https://doi.org/10.1080/10926770801926583
5. Gillespie GL, Brown K, Grubb P, Shay A, Montoya K. Qualitative evaluation of a role play bullying simulation. *J Nurs Educ Pract*. 2015;5(6):73-80. https://doi.org/10.5430/jnep.v5n6p73
6. Gillespie GL, Grubb PL, Brown K, Boesch M, Ulrich D. "Nurses eat their young": a novel bullying educational program for student nurses. *J Nurs Educ Pract*. 2017;7(7):11-21. https://doi.org/10.5430/jnep.v7n7p11
7. Smith CR, Palazzo SJ, Grubb PL, Gillespie GL. Standing up against workplace bullying behavior: recommendations from newly licensed nurses. *J Nurs Educ Pract*. 2020;10(7):35-45. https://doi.org/10.5430/jnep.v10n7p35
8. Clarivate. The Clarivate analytics impact factor. Published 2021. Accessed May 25, 2021. https://clarivate.com/webofsciencegroup/essays/impact-factor/
9. Suiter AM, Sarli CC. Selecting a journal for publication: criteria to consider. *Mo Med*. 2019;116(6):461-465.
10. Gillespie GL, Gates DM, Fisher BS. Individual, relationship, workplace, and societal recommendations for addressing healthcare workplace violence. *Work*. 2015;51(1):67-71. https://doi.org/10.3233/WOR-141890
11. Gonzalez-Guarda RM, Jones EJ, Cohn E, Gillespie GL, Bowen F. Advancing nursing science through community advisory boards: working effectively across diverse communities. *ANS Adv Nurs Sci*. 2017;40(3):280-290. https://doi.org/10.1097/ANS.0000000000000167
12. Gillespie GL, Fisher B, Kennebeck S, et al. Leveraging a public health framework and community advisory board to innovate workplace violence intervention strategies. *Adv Emerg Nurs J*. 2019;41(4):357-371. https://doi.org/10.1097/TME.0000000000000263
13. Gillespie GL, Leming-Lee T. Chart it to stop it: failure modes and effect analysis for the reporting of workplace aggression. *Nurs Clin North Am*. 2019;54(1):21-32. https://doi.org/10.1016/j.cnur.2018.10.004
14. Gillespie GL, Leming-Lee T, Crutcher T, Mattei J. Chart it to stop it: a quality improvement study to increase the reporting of workplace aggression. *J Nurs Care Qual*. 2016;31(3):254-261. https://doi.org/10.1097/NCQ.0000000000000172
15. Axelrod NR. *The governing board: key responsibilities for association boards and board members*. American Society of Association Executives; 2013.
16. Campbell J, Ladden MD, McBride AB, Cimino A, Kostas-Polston E, Deming K. Overview of the Robert Wood Johnson Foundation nurse faculty scholars program. *Nurs Outlook*. 2017;65(3):254-264. https://doi.org/10.1016/j.outlook.2016.12.008
17. American Journal of Nursing. Nurse faculty scholars/AJN mentored writing award. Published 2021. Accessed April 10, 2021. https://journals.lww.com/ajnonline/pages/nursefacultyscholars.aspx

A Case for Case Reviews

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"When you hear hoofbeats, think horses and not zebras." Our new locum tenens attending physician admonished my emergency nursing colleague by invoking a common metaphor. This use of the metaphor suggested that the patient's problem was most likely a common diagnosis and not a rare or unusual disease. This is usually sound advice to maintain efficiency in a crowded and under-resourced emergency department. My colleague seemed to silently weigh the risks and benefits to the patient of each course of possible action, including what it would mean to repeat his request, and with what urgency. He chose to remain silent in the exchange, nodded professionally, and walked past us whispering a barely perceptible, "Just wait until the good doctor learns about the zonkeys." We concealed our knowing smiles as his humor diffused the interpersonal tension. We knew he was referring to the local zoo's zonkey, the cross-bred offspring of a zebra and donkey. As a high-performing team, we trusted our colleague to speak up again if it was a matter of immediate patient safety and would have offered our mutual support. We could also trust our colleague to creatively advise and empower the patient to seek additional and specific testing on an outpatient basis. This nurse knew in depth which expert local providers would be empathetic to the patient's concerns if the patient wished to pursue further diagnostic testing.

In hindsight, there was so little to laugh about when examining the outcomes of the exchange. My expert emergency nursing colleague was in graduate school to become a nurse practitioner. He was from a local, low-income background and understood the community, the resources, and the power dynamics, as well as the clinical care applications in the emergency department. Once he completed his nurse practitioner credentialing process, he moved into another specialty where his skills were valued and supported by the entire interdisciplinary clinical team. In turn, he then recruited another exceptional emergency nurse coworker to follow in his footsteps.

We had a stellar team of attending physicians who earned our great respect in the ED setting. In the rural setting, we also worked many nights and weekends with physicians who were not board-certified in emergency medicine but were willing to cover the shift with exceptional backup support from anesthesia on call or advanced paramedics should emergent intubation or other acute stabilization skills be required. We rapidly formed high-functioning clinical teams with numerous newly introduced locum tenens physicians. Although most of these clinical teamwork experiences were outstanding, they were not always so. The hospital organization required a provider with physician credentials to meet reimbursement and regulatory standards set by national decision makers. These national decision makers may have no inkling about the local problems, resources, or dynamics in this rural community. There were instances where these regulatory and reimbursement requirements extracted a great financial expense from the community without an equivalent return on this monetary investment in high-quality, competent, and culturally appropriate clinical care. I have little doubt that the community would have been better served if the nurse practitioners, who were often lifelong members of the community themselves, had been welcomed, valued, invested in, trained, and supported to function to the full extent of their professional potential. This full extent of professional potential could include serving in the attending provider role when needed, after adequate training preparation with interdisciplinary preceptors who currently serve in this role. As a specialty, we can hemorrhage our best and brightest colleagues to positive career paths, trajectories, and progressions where medical teams and leadership authentically integrate and elevate the full value of advanced practice nurses' contributions. As nursing practice evolves to meet the health care needs of the public, the integration and delineation of emergency medical, nursing, and advanced practice roles and responsibilities simply cannot be viewed as zero-sum games or turf wars. Aligned with the experiences I relay in this personal narrative of my

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J Emerg Nurs 2021;47:514–517.
0099-1767

https://doi.org/10.1016/j.jen.2021.05.005

professional experience, the National Academies of Sciences, Engineering, and Medicine has just released an important report entitled "The Future of Nursing 2020-2030: Charting a Path to Achieve Health Equity."[1] This report provides a roadmap to address the need to both transform nursing education and remove practice barriers for advanced practice registered nurses to meet the health needs of the public we serve.

In regard to nurse practitioner educational preparation, Veenema et al[2] conducted a systematic review of the literature that appears in this issue of *Journal of Emergency Nursing (JEN).* The authors identified a dearth of published evidence on training specifically for practice in the emergency specialty. Of particular interest is the need for collaborative training with emergency medicine preceptors and programs. The authors synthesize evidence that most nurse practitioners have expressed a desire for an emergency medicine fellowship. However, it is unclear from this evidence that these nurse practitioners would be willing to geographically relocate as many physicians do to match with emergency clinical fellowship training opportunities. This important systematic review by Veenema et al[2] advances the scholarship related to the Emergency Nurses Association's Position Statement entitled "Advanced Practice Registered Nurses in the Emergency Care Setting," which calls for updated scopes of practice, core competencies, and specialty education.[3]

McCauley et al[4] recently published a transparent and essential debate from the academic dean's perspective about programs to prepare advanced practice nurses to complete the doctor of nursing practice (DNP) degree. Here, the academic leadership amplifies the message found in Veenema et al[2] about the potential for increasing clinical preparation hours, including debating the placement of residency or fellowship before or after degree conferment to achieve readiness for practice. DNP students invest 500 hours each in a capstone project, which is often directed at a leadership initiative topic rather than at enhanced clinical readiness. Although this leadership focus may have been understandable in the earlier evolution of the degree when most DNP students already had substantial clinical practice and may have already been prepared as nurse practitioners at the master's degree level, the contemporary preparation needs to be revisited because more students work on continuous education to the doctoral level rather than inserting periods of nursing practice and expertise development at a clinical site between degree program enrollments. Clinical experience and expertise development in the ED setting are unique. Clinical practice in the emergency department requires more preparation to respond to one of the broadest ranges of acuity, age, differential diagnoses, and affected body system than almost any other specialty. Furthermore, as implementation science and quality improvement methods and standards evolve, devoting only 500 hours to a leadership project may prove to be too time-constrained to allow for adequately meaningful methodological designs and measures. Time constraints such as those involved in completing a quality improvement–focused capstone project in 1 academic semester are especially dissonant in the ED setting where there is clear and profound seasonality in the types and volumes of presentations.[5,6] Furthermore, sustainability over time is a crucial component of implementation science and quality improvement in the clinical setting, and addressing sustainability tends to be well outside the feasible scope of the usual single DNP project time frame.[7] The emergency department in January, susceptible to patient-volume spikes from infectious epidemics such as annual influenza, is a vastly different context from the same emergency department in June wherein the team can often be found in the throes of the traumatic injuries peak of the 100 days of summer. Thus, the time is ripe to revisit, reimagine, and reinvent educational pathways for advanced emergency practice, clinical residencies or fellowships, interdisciplinary preceptorship, and capstone project focus and requirements.

At *JEN,* we strongly encourage the submission of case reviews that are relevant to care in the ED setting from authors across all levels of educational preparation and professional development using the CARE (for CAse REports) transparent reporting guidelines.[8] Astute observation of both clinical and laboratory anomalies has long been an essential starting point for far-reaching scientific discoveries and breakthroughs.[9] Case reviews have been dubbed as the "first line" of evidence-based practice in the evidence hierarchy.[10] Although we acknowledge that there is an important hierarchy of evidence to inform the efficacy of practice interventions with a high value placed on the well-designed randomized controlled trial at the top of the pyramid, case reviews serve many important additional purposes in evidence-based nursing practice and clinical reasoning development. As observational studies of a single patient's clinical course, case reviews may serve as the highest level of possible evidence for extremely rare diseases or unusual emergency presentations where a sample size with adequate statistical power would be impossible to achieve. Meanwhile, an important resource about ongoing research and evidence-based education for patients and clinicians on rare diseases can be found at the Genetic and Rare Diseases Information Center of the National Institutes of Health.[11]

Case reviews serve as an essential problem-based learning tool to develop and refine clinical reasoning processes in education and professional development. Case reviews

are also indispensable for disseminating clinical information about novel diseases or presentations; rare diseases or presentations; treatment side effects (incidentally, beneficial as well as adverse), overdose, or poisoning; complex mechanisms of disease or unusual multimorbid disease interactions; elucidating the clinical reasoning of an expert author; general education or audit; or unique, rare, or unusual presentations of common disease.[12-15] Given that clinical education continues to evolve with increasing integration of simulation as part of clinical practice preparation and educational program requirements of clinical time, published case reports may also serve as a crucial foundation for educational simulation scenarios[4] to prepare the next generation for "real world," practice-relevant cases. Last July, Metheny and Krieger[16] disseminated a publication innovation using a systematic review of case reports. Here, they furthered the systematic review methodology, allowing the clinical reader comprehensive insights into a rare toxicity. It would serve as a fruitful leadership dialogue and debate to consider if this type of in-depth systematic review of a case report could serve as a model for academic capstone projects, particularly to advance the clinical reasoning of those in graduate programs seeking qualifications as advanced emergency care practitioners. The development and depth of clinical reasoning required for an exemplary published case report may generate a greater impact for both the student and the published literature, replacing the currently more common option of a single-site, single academic semester quality improvement initiative with no contemporaneous control condition. We welcome the sharing of clinical mastery evident in a well-designed systematic review of case report manuscripts relevant to the emergency clinical setting from students, expert interdisciplinary colleagues, scholars, and clinicians across all levels of practice. Our case for case reviews is strengthened by the expert clinicians' need to anticipate, discern, and differentiate the metaphorical horse (common), zebra (rare), and zonkey (unusual and unanticipated combinations) of emergency care presentations and diagnoses.

In addition to original research evidence, evidence-based practice columns, and systematic review, we are thrilled to disseminate and integrate several case reports in this issue of *JEN*. Nicholas et al[17] provide a case example of an older adult presenting with heat-related illness to illustrate the introduction of their innovative practice mnemonic A CLIMATE framework/assessment tool for use in the emergency department. A CLIMATE stands for (1) **A**ct immediately to stabilize life-threatening conditions, (2) **C**onsciously consider climate, (3) **L**earn from a climate history, (4) **I**mplement a climate-focused assessment, (5) **M**anage ongoing climate emergency care, (6) **A**ct to integrate a plan addressing physical and mental health climate symptoms, (7) **T**ell the patient how climate affects their health, and (8) **E**valuate, educate, and refer for long-term follow-up. Consistent with the theme of health effects of climate change in this issue,[18] Baez and Suffoletto[19] provide a case report on Lyme disease sequelae in a potentially commonly overlooked differential diagnosis for an ED presentation. Hall and Hall[20] provide a case report of a patient who presented to the emergency department in circulatory shock and hypoxia and required intubation, ventilation, vasopressor support, and emergent dialysis. The case involved critical nursing interventions and astute clinical investigation in determining the differential diagnosis and causal agent. The authors have generously provided an infographic to aid in precepting and educating new emergency nurses about preparing for emergent rapid-sequence intubation. James and London[21] disseminate another case review requiring acute clinical mastery in responding to cardiogenic shock, third-degree heart block, and inability to tolerate transcutaneous pacing. Finally, McNicholas et al[22] review a case of internal abdominal hemorrhage in an adolescent with von Willebrand disease. We hope our reader's practice, education, policy, and research are enhanced with the clinical wisdom, insights, and fast-paced practice-relevant content in these case reviews. Our case for case reviews rests on the clinical practice relevance, depth of clinical mastery, and impact on clinical reasoning inherent to this form of frontline evidence.

REFERENCES

1. Wakefield MK, Williams DR, Le MS, Flaubert JL; National Academies of Sciences, Engineering, and Medicine. *The future of nursing 2020−2030: charting a path to achieve health equity*. National Academies Press; 2021.
2. Veenema TG, Lavin RP, Thornton C, Firestone SS, Seal S. Alignment of nurse practitioner educational preparation and scope of practice in U.S. emergency departments: a systematic review of the literature. *J Emerg Nurs*. 2021;47(4):563-581. doi:10.1016/j.jen.2021.04.005.
3. Winger J, Brim CB, Dakin CI; 2019 ENA Position Statement Committee. Advanced practice registered nurses in the emergency care setting. *J Emerg Nurs*. 2020;46(2):205-209. https://doi.org/10.1016/j.jen.2019.12.011
4. McCauley LA, Broome ME, Frazier L, et al. Doctor of nursing practice (DNP) degree in the United States: reflecting, readjusting, and getting back on track. *Nurs Outlook*. 2020;68(4):494-503. https://doi.org/10.1016/j.outlook.2020.03.008
5. Castner J, Yin Y, Loomis D, Hewner S. Medical Mondays: ED utilization for Medicaid recipients depends on the day of the week, season, and holidays. *J Emerg Nurs*. 2016;42(4):317-324. https://doi.org/10.1016/j.jen.2015.12.010
6. Castner J, Guo L, Yin Y. Ambient air pollution and emergency department visits for asthma in Erie County, New York 2007-2012. *Int Arch*

Occup Environ Health. 2018;91(2):205-214. https://doi.org/10.1007/s00420-017-1270-7

7. Glasgow RE, Harden SM, Gaglio B, et al. RE-AIM planning and evaluation framework: adapting to new science and practice with a 20-year review. *Front Public Health*. 2019;7:64. https://doi.org/10.3389/fpubh.2019.00064
8. Riley DS, Barber MS, Kienle GS, et al. CARE guidelines for case reports: explanation and elaboration document. *J Clin Epidemiol*. 2017;89:218-235. https://doi.org/10.1016/j.jclinepi.2017.04.026
9. Castner J. Accidental and unintentional findings from the midstream clean-catch urine contamination study: insights from applying the behavior engineering model. *J Emerg Nurs*. 2019;45(5):484-487. https://doi.org/10.1016/j.jen.2019.07.013
10. Vandenbroucke JP. In defense of case reports and case series. *Ann Intern Med*. 2001;134(4):330-334. https://doi.org/10.7326/0003-4819-134-4-200102200-00017
11. National Institutes of Health. Genetic and rare diseases information center. National Center for Advancing Translational Sciences. Accessed May 12, 2021. https://rarediseases.info.nih.gov/
12. Alsabek MB, Badi MN, Khatab M. Multiple impalement injuries of the torso with two metal bars: a case report. *Ann Med Surg (Lond)*. 2021;63:102179. https://doi.org/10.1016/j.amsu.2021.102179
13. Amr M. Acute tachycardia-induced cardiomyopathy: a case report. *Am J Case Rep*. 2021;22: e930732. https://doi.org/10.12659/ajcr.930732
14. Hauben M, Aronson JK. Gold standards in pharmacovigilance: the use of definitive anecdotal reports of adverse drug reactions as pure gold and high-grade ore. *Drug Saf*. 2007;30(8):645-655. https://doi.org/10.2165/00002018-200730080-00001
15. McClelland M, McClelland S. Case of a 21-year-old man with persistent lung collapse leading to a pericardectomy linked to vape use. *Heart Lung*. 2021;50(2):262-267. https://doi.org/10.1016/j.hrtlng.2020.12.012
16. Metheny NA, Krieger MM. Salt toxicity: a systematic review and case reports. *J Emerg Nurs*. 2020;46(4):428-439. https://doi.org/10.1016/j.jen.2020.02.011
17. Nicholas PK, Breakey S, McKinnon S, Eddy EZ, Fanuele J, Starodub R. A CLIMATE: a tool for assessment of climate-change-related health consequences in the emergency department. *J Emerg Nurs*. 2021;45(4):532-542. https://doi.org/10.1016/j.jen.2020.10.002
18. Kolbuk ME, Gillespie GL, Hilderbrand L, Stone EL; ENA Position Statement Committee. Mitigating the effects of climate change on health and healthcare: the role of the emergency nurse. *J Emerg Nurs*. 2021;47(4):621-626. https://doi.org/10.1016/j.jen.2021.05.004
19. Baez J, Suffoletto H. Migrating swollen joint and lyme disease: a case report. *J Emerg Nurs*. 2021;47(4):543-550. doi:10.1016/j.jen.2021.04.009.
20. Hall A, Hall D. Kratom ingestion and emergency care: summary and a case report. *J Emerg Nurs*. 2021;47(4):551-556. https://doi.org/10.1016/j.jen.2021.02.004
21. James DM, London K. A complicated cath: a case report detailing an inferior myocardial infarction, third-degree heart block and cardiogenic shock. *J Emerg Nurs*. 2021;47(4):557-562. doi:10.1016/j.jen.2021.04.003.
22. McNicholas A, Sharma N, Rowe E, et al. Adolescent with von Willebrand disease type 3 spontaneous abdominal hemorrhage. *J Emerg Nurs*. 2021;47(4):661-668. doi:10.1016/j.jen.2021.04.008.

Commentary on "A CLIMATE: A Tool for Assessment of Climate-Change–Related Health Consequences in the Emergency Department"

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The health manifestations of climate change are becoming increasingly common and present urgent and complex challenges for emergency clinicians.[1] As temperatures rise, air quality worsens, extreme weather events become more frequent, and those who need medical care turn to their local emergency department as their primary point of health system access. Although climate change may stress many aspects of the health system, emergency care—on the front lines of acute care nationwide and the nation's primary safety net provider—stands to bear the largest burden. In "A CLIMATE: A Tool for Assessment of Climate-Change–Related Health Consequences in the Emergency Department," Nicholas et al[2] put forth a vital framework for the integration of climate and health knowledge in the clinical setting, laying the foundation for how we can begin to save lives now and in an inevitably hotter and more unpredictable future. Crucially, this framework has broad applicability not just to nursing providers, but also to all members of the emergency care team: physicians, advanced practice providers, occupational therapists, physical therapists, social workers, and care coordinators. To demonstrate applicability, the authors present a case example that demonstrates how a clinical climate lens improves the outcome of a patient in the emergency department who is critically ill and further increases her resilience toward future climate-related health impacts by identifying and addressing the root causes of her vulnerability.

Any new or evolving disease process or exposure requires education of medical professionals to adapt and intervene. Climate change is no exception. It affects the patients we see on a daily basis as well as the very health systems whose continuous operations we rely on for the provision of clinical care. Historically, there has been very little education or training for clinicians in regard to how climate change affects human health,[3] and providers are generally unaware of how profoundly interlinked these 2 entities are. However, as Nicholas et al[2] point out, disaster preparedness, environmental emergency response, and health emergency management are core tenets of our practice that are already being affected in the face of climate change. As described by Lemery et al,[4] health care professionals have 3 primary roles in supporting broader societal efforts to address the climate crisis. First, they must protect both individual and community health from the increasingly severe health threats posed by climate change and weather extremes. Second, they can ensure that health care and public health systems are resilient in the face of climate change and weather extremes and, at the same time, are taking steps to become carbon-neutral and optimally sustainable. And third, they can bring their voices and scientific expertise to advocate for cross-sectoral solutions to the climate crisis. Clearly, to be effective in these 3 areas, health care workers and leaders must have sufficient training and access to evidence-based guidance. As stated by Nicholas et al,[2] health care professional involvement in the climate and health crisis is not only imperative to save the lives of

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J Emerg Nurs 2021;47:518–520.

0099-1767

https://doi.org/10.1016/j.jen.2021.04.004

patients, but is also deeply imbued in the ethos of our professions. Because nurses are the most trusted professionals in the United States, with physicians close behind,[5] there is a huge opportunity to use this trust to educate patients and the public and to prepare ourselves.

From a patient suffering from chronic obstructive pulmonary disease who requires intubation in the setting of poor air quality owing to the increasing frequency of wildfires to a patient with suicidal thoughts after being displaced by a hurricane, emergency providers see climate impacts on health firsthand.[6] Thus, as emergency clinicians, we have meaningful opportunities to improve patient outcomes and health care delivery.[6] The A CLIMATE framework[2] helps providers and patients understand the linkages between environmental conditions and health. When patients suffer from an acute exacerbation of a previously well-controlled disease or experience a traumatic injury from an extreme weather event, the team treating them can make a strong connection between climate change and their own personal health. By connecting the changing climate to their medical condition and framing climate change as a health emergency, we have the opportunity to make a lasting impression on patients and help them protect their own health.

Although A CLIMATE[2] is a much-needed framework, there are some limitations. These limitations include time restrictions common in many emergency departments, as well as the lack of provider knowledge regarding climate change and health. This framework would ideally be applied in every emergency department at all times; however, the reality of time constraints, patient volumes, and provider bandwidth are likely to impede that from happening. Success in executing this framework therefore requires an interdisciplinary approach. Members of the patient care team will likely execute different aspects of the framework. This practical reality underscores the importance of providing climate-and-health education to all members of the ED care team. Emergency departments are also oriented toward rapid movement of patients out of the department to the admission floor or discharge home after evaluation. Owing to this focus on ultimate disposition, it may not be feasible to accomplish the full framework within the ED visit, especially for patients who are critically ill. Therefore, it is vital to expand this framework to health care providers working in the inpatient setting as well as outpatient settings.

The individual components of the mnemonic A CLIMATE[2] provide a step-by-step process for implementing concepts of climate and health in the clinical setting. Some of the individual elements of this framework are possibly redundant (eg, Learn from a climate assessment, Implement a climate history), but there is value in having an easy way for providers to remember to keep climate in mind, even if they do not accomplish each component of the mnemonic for each patient. Importantly, knowledge of health impacts due to climate change can often initially elicit feelings of helplessness or hopelessness (for providers and patients); therefore, there must also be a focus on actionable steps for the patient and provider to take to address their health. Perhaps the last "E" could include "Empower" in addition to "Evaluate and Educate." Further, the A CLIMATE[2] mnemonic should also include a way to empower nursing professionals (and other health care providers) to take climate action even beyond their clinical roles and advocate for climate change mitigation and adaptation, as well as health care sustainability.

Providers can take actions beyond their clinical duties in many different ways. They can lead interdisciplinary research to both better understand the health and health care system effects of climate change and develop an evidence-based approach for adaptation and health protection. They can continue to strengthen partnerships with public health entities to further interventions such as health early warning systems and epidemiologic surveillance for infectious disease. They can also incorporate climate education into training programs as well as increase learning opportunities for professional education. The Global Consortium on Climate and Health Education, based out of the Mailman School of Public Health at Columbia University, has developed climate-and-health core competencies, which are recommended for all health professionals and serve as a guide for all specialties and clinical roles.[7] The National Institute of Environmental Health Sciences has also produced ample resources for climate and health education. From fact sheets and videos to complete lesson plans, there are many valuable resources available to aid in education of both members of the public as well as health professionals to learn more about the health impacts of climate change.[8] Finally, providers can work to systematically reduce the carbon footprint of emergency departments and spur larger health system changes through interventions that improve energy resource management and operational expenditures.[9]

Perhaps the most devastating aspect of climate change's impacts on health is that those who are already vulnerable owing to gender, race, ethnicity, geography, socioeconomics, or health status are most likely to suffer the worst of the impacts.[1] Health outcomes for vulnerable individuals depend on a multitude of factors, many of which can be addressed through careful application of the A CLIMATE framework[2] during clinical encounters. Because emergency providers are already trained to recognize social determinants of health and vulnerability, this framework allows for that understanding to be combined

with climate change and health awareness, ultimately acting as a positive force in protecting the most vulnerable from climate change impacts. Well known as society's safety net and primary health care providers for many of the most underserved patients, the ED team can further protect the health of vulnerable populations by adopting and enacting this framework.

Climate change is a health emergency, and its impacts are worsening the health of patients and disrupting the ability to give care.[1] The A CLIMATE framework[2] provides a much-needed next step to empower providers to integrate the concepts of climate change and health into daily clinical practice.

REFERENCES

1. Crimmins A, Balbus JL, Gamble CB, et al. *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. US Global Change Research Program; 2016. Accessed April 8, 2021. https://health2016.globalchange.gov/
2. Nicholas PK, Breakey S, McKinnon S, Eddy EZ, Fanuele J, Starodub R. A CLIMATE: a tool for assessment of climate-change-related health consequences in the emergency department. *J Emerg Nurs*. 2021;47(4):532-542. https://doi.org/10.1016/j.jen.2020.10.002
3. Ryan EC, Dubrow R, Sherman JD. Medical, nursing, and physician assistant student knowledge and attitudes toward climate change, pollution, and resource conservation in health care. *BMC Med Educ*. 2020;20(1):200. https://doi.org/10.1186/s12909-020-02099-0
4. Lemery J, Balbus J, Sorensen C, et al. Training clinical and public health leaders in climate and health. *Health Aff (Millwood)*. 2020;39(12):2189-2196. https://doi.org/10.1377/hlthaff.2020.01186
5. Gallup SL. US ethics ratings rise for medical workers and teachers. Published December 22, 2020. Accessed April 8, 2020. https://news.gallup.com/poll/328136/ethics-ratings-rise-medical-workers-teachers.aspx
6. Sorensen CJ, Salas RN, Rublee C, et al. Clinical implications of climate change on US emergency medicine: challenges and opportunities. *Ann Emerg Med*. 2020;76(2):168-178. https://doi.org/10.1016/j.annemergmed.2020.03.010
7. GCCHE Advisory Council and Coordinating Committee. Global Consortium on Climate and Health Education (GCCHE) Core Climate & Health Competencies for Health Professionals. Columbia University; 2018. Accessed April 8, 2021. https://www.publichealth.columbia.edu/sites/default/files/global_consortium_on_climate_and_health_education_key_competencies_2021.pdf
8. National Institute of Environmental Health Sciences. For educators. Accessed April 8, 2020. https://www.niehs.nih.gov/health/scied/teachers/index.cfm
9. Linstadt H, Collins A, Slutzman JE, et al. The climate-smart emergency department: a primer. *Ann Emerg Med*. 2020;76(2):155-167. https://doi.org/10.1016/j.annemergmed.2019.11.003

Incorporating End-of-Life Care into the Management of Dead on Arrival Patients in the Emergency Department: Invited Commentary

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In this issue of the *Journal of Emergency Nursing*, Bove et al[1] seek to describe the epidemiological characteristics of patients who were dead on arrival (DOA) in the emergency department. Traditionally, DOA patients have been studied by the medical and nursing communities using the term outside-of-hospital cardiac arrest (OHCA). The use of DOA, rather than OHCA, has important implications for how we think about these patients. The focus shifts to patients who arrive in the emergency department and the subsequent impact on care, particularly for emergency nurses who have a critical role in resuscitation and in supporting the families of DOA patients. From this perspective, the authors consider the extent to which emergency departments are meeting the end-of-life care needs of DOA patients. The discussion by Bove et al[1] represents a significant departure from the OHCA literature, which focuses on the interventions (eg, bystander cardiopulmonary resuscitation, airway management, optimal epinephrine dosing) that are meant to improve survival for a population of patients with notoriously poor outcomes.[2,3] With end-of-life care in mind, Bove et al[1] describe the epidemiology of DOA patients.

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J Emerg Nurs 2021;47:521–523.

0099-1767

https://doi.org/10.1016/j.jen.2021.05.001

In a single, high-volume emergency department in Denmark, Bove et al[1] found that DOA was a common event, occurring daily. The cohort was largely composed of older adults (mean age 71 years) who were found at home by their family members. The authors question whether these deaths were truly unexpected and, more integrally, whether the resuscitation attempts were consistent with the patients' goals and values. Previous research has demonstrated that patients often receive end-of-life care that is discordant with their preferences, resulting in increased suffering and disruptions in closure and grieving for their families.[4,5] Addressing these gaps in care will require creative solutions and a coordinated approach from nurses, physicians, and advanced practice providers.[6,7] To start, all resuscitations of DOA patients should prioritize rapid evaluation of prior goals of care conversations when possible. Further, both the Emergency Nurses Association[8] and American Heart Association[9] support policies and practices for family presence and family-witnessed resuscitation, as many families find reassurance in the knowledge that all possible steps were taken to revive their loved ones.[10] Although incorporating end-of-life care into the management of DOA patients will undoubtedly improve patient care and family experience, addressing the needs of DOA patients and families is ultimately an ethical issue.

Certainly, the ethical principle of autonomy should spur the medical and nursing communities toward providing end-of-life care concordant with patients' wishes and values. However, the ideals of clinical practice should inspire us to more than care concordance. The principles of beneficence and nonmaleficence guide us to move past simply delivering care designated by an individual and instead to consider how we might both provide benefit and prevent harm to patients and families at the end of life. Beyond the obvious potential physical harms of resuscitative efforts, from pneumothoraces to survival with devastating neurologic injury, being a bystander to resuscitation has been identified as a potentially traumatic event for those

involved.[11] Moreover, when the provision of cardiopulmonary resuscitation appears to be medically inappropriate (some would use the word "futile") by emergency medical personnel, such providers are at risk for moral injury.[12]

To this end, advance care planning (ACP) provides an opportunity for the medical and nursing communities not only to align the end-of-life care desired by patients with that delivered but also potentially to prevent distress experienced by families and providers alike. Rates of ACP documentation completion in the general population are exceptionally low, and access to ACP documents by hospital providers is even worse.[13,14] Fortunately, a number of tactics are being employed to increase overall ACP rates. In the United States, for instance, the Centers for Medicare & Medicaid Services instituted regulations in 2016 designed to encourage ACP documentation by specifically reimbursing providers for time spent on such activities.[15] More recently, the emergency department setting has been identified as an underutilized venue for ACP activities, and further efforts are underway to bolster emergency department-based ACP. For example, previous studies have demonstrated the efficacy of video decision aids in augmenting patients' understanding of end-of-life care in a variety of settings,[16,17] and now such interventions are being explored in the emergency department setting.[18]

But even with robust ACP documentation, significant barriers remain with regards to emergency provider access to such documentation − or at the very least to family understanding of patients' goals of care. For the medical and nursing communities to ensure that potential DOA patients receive care in alignment with their values and goals—as well as to reduce family and provider trauma—we must continue to push for clear and accessible ACP documentation. Beyond this, and possibly more importantly in the time-sensitive circumstances of emergency care, we must continue to work with patients to make their wishes known to loved ones. Empowering families to advocate for the documented/expressed desires of patients will not only prevent end-of-life care that is discordant with patient values but also free families and providers from the morally laborious acts of calling for or calling off resuscitative efforts when patient wishes are unknown.

Author Disclosures

Conflicts of interest: none to report.

We would like to thank Aileen Aylward for her input and assistance with references.

REFERENCES

1. Bove DG, Sørensen N, Timm H, Herling SF, Gjersøe P. Patient characteristics of persons dead on arrival received in a Danish emergency department: a retrospective review of health records. *J Emerg Nurs*. 2021;47(4):582-589. https://doi.org/10.1016/j.jen.2021.01.007
2. Sasson C, Rogers MA, Dahl J, Kellermann AL. Predictors of survival from out-of-hospital cardiac arrest: a systematic review and meta-analysis. *Circ Cardiovasc Qual Outcomes*. 2010;3(1):63-81. https://doi.org/10.1161/CIRCOUTCOMES.109.889576
3. Perkins GD, Ji C, Deakin CD, et al. A randomized trial of epinephrine in out-of-hospital cardiac arrest. *N Engl J Med*. 2018;379(8):711-721. https://doi.org/10.1056/NEJMoa1806842
4. Institute of Medicine. *Dying in America: Improving Quality and Honoring Individual Preferences Near the End of Life*. The National Academies Press; 2015.
5. Suhl J, Simons P, Reedy T, Garrick T. Myth of substituted judgment. Surrogate decision making regarding life support is unreliable. *Arch Intern Med*. 1994;154(1):90-96. https://doi.org/10.1001/archinte.154.1.90
6. Dundin A, Siegert C, Miller D, et al. A pivot to palliative: an interdisciplinary program development in preparation for a coronavirus patient surge in the emergency department. *J Emerg Nurs*. 2020;46(6):760-767e1. https://doi.org/10.1016/j.jen.2020.08.003
7. Beckstrand RL, Corbett EM, Macintosh JLB, Luthy KEB, Rasmussen RJ. Emergency nurses' department design recommendations for improved end-of-life care. *J Emerg Nurs*. 2019;45(3):286-294. https://doi.org/10.1016/j.jen.2018.05.014
8. Vanhoy MA, Horigan A, Stapleton SJ, et al; 2017 ENA Clinical Practice Guideline Committee. Clinical practice guideline: family presence. *J Emerg Nurs*. 2019;45(1):76.e1-76.e29. doi:10.1016/j.jen.2018.11.012
9. Kleinman ME, Brennan EE, Goldberger ZD, et al. Part 5: Adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 suppl 2):S414-435. https://doi.org/10.1161/CIR.0000000000000259
10. Critchell CD, Marik PE. Should family members be present during cardiopulmonary resuscitation? A review of the literature. *Am J Hosp Palliat Care*. 2007;24(4):311-317. https://doi.org/10.1177/1049909107304554
11. Engaging bystanders of potentially traumatic events. *Emerg Med Serv*. Published 2019. Accessed May 3, 2021. https://www.jems.com/exclusives/engaging-bystanders-of-potentially-traumatic-events/
12. Griffin BJ, Purcell N, Burkman K, et al. Moral injury: an integrative review. *J Trauma Stress*. 2019;32(3):350-362. https://doi.org/10.1002/jts.22362
13. Grudzen CR, Buonocore P, Steinberg J, Ortiz JM, Richardson LD; AAHPM Research Committee Writing Group. Concordance of advance care plans with inpatient directives in the electronic medical record for older patients admitted from the emergency department. *J Pain Symptom Manage*. 2016;51(4):647-651. https://doi.org/10.1016/j.jpainsymman.2015.12.318
14. Platts-Mills TF, Richmond NL, LeFebvre EM, et al. Availability of advance care planning documentation for older emergency department patients: a cross-sectional study. *J Palliat Med*. 2017;20(1):74-78. https://doi.org/10.1089/jpm.2016.0243
15. Dingfield LE, Kayser JB. Integrating advance care planning into practice. *Chest*. 2017;151(6):1387-1393. https://doi.org/10.1016/j.chest.2017.02.024

16. Volandes AE, Brandeis GH, Davis AD, et al. A randomized controlled trial of a goals-of-care video for elderly patients admitted to skilled nursing facilities. *J Palliat Med*. 2012;15(7):805-811. https://doi.org/10.1089/jpm.2011.0505
17. El-Jawahri A, Podgurski LM, Eichler AF, et al. Use of video to facilitate end-of-life discussions with patients with cancer: a randomized controlled trial. *J Clin Oncol*. 2010;28(2):305-310. https://doi.org/10.1200/JCO.2009.24.7502
18. U.S. National Library of Medicine. Intervention to Promote Advance Care Planning for Older Adults in the Emergency Department. National Institute of Health. Updated January 18, 2028. Accessed May 3, 2021. https://clinicaltrials.gov/ct2/show/NCT03402763

Hemolyzed Blood Samples in the Emergency Department - Finding Our "Why"

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When patients present to the emergency department, they expect strong communication from the hospital staff and short wait times and to be treated with empathy and compassion.[1,2] Patients commonly present during a time of high stress and uncertainty, so addressing these areas of patient care as well as other areas that invoke patient harm have remained a focus for ED leaders: one area for improvement of ED care that has not received as much attention as its potential warrants is the hemolysis of blood samples.

Hemolysis occurs when blood cells are disturbed owing to turbulence during the collection or analysis process resulting in cell lysis and the release of intracellular potassium (where most of the ion is stored). Any traumatic disturbance (such as excessive centrifugation), chemical contaminant (ethanol swab not allowed to dry, intravenous [IV] medications), improper temperature, or prolonged storage can thus lead to falsely elevated potassium levels. This can occur during analysis (estimated to be approximately one-third of cases) or during collection (two-thirds).[3] The American Society for Clinical Pathology has stated that there should be a baseline rate of 2% or lower for hemolysis among completed blood samples.[4] However, the emergency department remains the hospital department with the highest incidence of hemolyzed samples, as high as 32% reported in one study.[5,6] One study found that the average length of stay in the emergency department was 62 minutes longer for patients with hemolyzed blood samples, and another found that the median length of time between blood draws after a hemolyzed sample was 145 minutes.[5,7] This demonstrates a clear area for improvement in patient satisfaction as short wait times is one of the most common patient expectations.

Much of the research on this topic has focused on identifying when a hemolyzed sample does not need to be redrawn as well as methods to prevent the hemolysis from occurring. Evidence-based technique modifications that have been demonstrated to reduce the rate of hemolysis include the use of a steel-straight needle for phlebotomy, the use of an antecubital site with IV cannulation, and the use of low-vacuum tubes.[8] Thus, it is puzzling that the rate of hemolyzed blood samples in the emergency department continues to be significantly elevated despite the literature not only describing the importance of this topic but also suggesting simple methods for improvement. Is this due to unique patient characteristics in the emergency department inevitably leading to hemolysis or have we not yet found why we are accepting this status quo?

We read with great interest the study by Burchill et al[9] that sought to describe emergency nurses' knowledge, attitudes, and practices (KAP) related to hemolysis prevention as well as to explore the associations between nurse demographics and their KAP. Using an exploratory, descriptive design, the authors sought the answers to this fundamental question on the topic: Why are we not doing better? Realizing that simply education about how to prevent hemolysis may not be enough, the authors[9] sharply used the model laid out by Ajzen's[10] Theory of Planned Behavior to ultimately get to the root of the behavior itself. They surveyed 427 emergency nurses, of whom all were Emergency Nurses Association members and most were clinical staff nurses with a bachelor's degree in nursing employed in a teaching hospital that served both adults and children. The survey contained 3 multiple choice knowledge items, a series of 5 attitude items answered using a Likert scale, 7 multiple choice practice pattern items, and 8 departmental demographic items. The knowledge items, which tested key facts about hemolysis, were answered correctly by only 19.91% of the participants. They found that being board

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J Emerg Nurs 2021;47:524–526.

0099-1767

certified in emergency nursing was significantly associated with answering these knowledge items correctly. The overwhelming majority of participants agreed or totally agreed with the attitude items (59.95%-95.78%). The agreement with these attitude items demonstrates that the participants know that sticking patients multiple times for blood lowers patient satisfaction and hemolyzed samples interfere with the care for other patients in the department and delay patient care. The practice pattern items demonstrated that nurses are primarily responsible for blood draws in the emergency department and primarily responsible for being notified about hemolyzed samples. Phlebotomy is most often performed with IV insertion, and a little more than half do use low-volume tubes.

The results of this study are encouraging. Understanding the depth of the knowledge gap is imperative before developing a solution.[9] Despite developing a deeper understanding of the KAP of emergency nurses, this study does have limitations. As the authors noted, they surveyed a rather small, self-selected convenience sample that created some selection bias. However, the characteristics of the nurses surveyed seem to be representative of the general workforce.[11] In addition, some of the suggestions for improvement leave questions unanswered. For instance, the authors suggest that the use of phlebotomists in the emergency department could lower the rate of hemolysis. Despite this likely being true, the results of their study demonstrated that there is plenty of room for improvement in emergency nurses' knowledge on hemolysis, making it reasonable to attempt before reassigning the role of venipuncture.[9] Furthermore, reassignment may simply just run into the same set of systemic challenges in meeting the expectations of a population with unique needs while still minimizing the (not too) uncommon "unavoidable" mishap of hemolysis. The authors also appropriately noted that education may not be enough because of strongly held beliefs that could prevent the adoption of best practices; however, with only 19.91% of the participants answering the knowledge questions correctly, education will clearly be fundamental in creating the gradual change necessary for quality improvement. For example, the finding that most participants were unaware of blood sample hemolysis prevention initiatives when there is an Emergency Nurses Association clinical practice guideline on the topic demonstrates that there is space and need for education efforts.[12]

Moving forward with this root knowledge in mind, further research can be conducted on system requirements such as the time spent by emergency nurses repeating hemolyzed samples versus placing IVs, the impact of high emergency nursing turnover on practice change, and the ever-increasing requirements on uniquely skilled and qualified caregivers that tax their ability to multitask in an as efficient as possible manner. Understanding and predicting which patient's experiences can be most efficiently improved by using different draw techniques upfront will ultimately bring this quality improvement to the bedside. Ongoing local improvement/implementation efforts can utilize a structured approach such as the updated Behavioral Engineering Model to reevaluate progress and uptake.[13] Finally, the best methods for education and dissemination (as well as benchmarking) of this knowledge through departments and regional/national organizations will also have to be explored. The authors have laid the groundwork for understanding why practice patterns have not changed despite clear solutions for an important problem.[9] We still have a long way to go, but with the findings in this study, we have recognized an opportunity to make headway in practice pattern modification that not only raises patient satisfaction but nursing satisfaction as well.

Author Disclosures

Conflicts of interest: none to report.

REFERENCES

1. Cooke T, Watt D, Wertzler W, Quan H. Patient expectations of emergency department care: phase II—a cross-sectional survey. *CJEM*. 2006;8(3):148-157. https://doi.org/10.1017/s1481803500013658
2. Sonis JD, Aaronson EL, Lee RY, Philpotts LL, White BA. Emergency department patient experience: a systematic review of the literature. *J Patient Exp*. 2018;5(2):101-106. https://doi.org/10.1177/2374373517731359
3. Asirvatham JR, Moses V, Bjornson L. Errors in potassium measurement: a laboratory perspective for the clinician. *N Am J Med Sci*. 2013;5(4):255-259. https://doi.org/10.4103/1947-2714.110426
4. Heyer NJ, Derzon JH, Winges L, et al. Effectiveness of practices to reduce blood sample hemolysis in EDs: a laboratory medicine best practices systematic review and meta-analysis. *Clin Biochem*. 2012;45(13-14):1012-1032. https://doi.org/10.1016/j.clinbiochem.2012.08.002
5. Phelan MP, Hustey FM, Good DM, Reineks EZ. Seeing red: blood sample hemolysis is associated with prolonged emergency department throughput. *J Appl Lab Med*. 2020;5(4):732-737. https://doi.org/10.1093/jalm/jfaa073. Published correction appears in *J Appl Lab Med*. 2020;5(6):1423.
6. Grant MS. The effect of blood drawing techniques and equipment on the hemolysis of ED laboratory blood samples. *J Emerg Nurs*. 2003;29(2):116-121. https://doi.org/10.1067/men.2003.66
7. Wilson M, Adelman S, Maitre JB, et al. Accuracy of hemolyzed potassium levels in the emergency department. *West J Emerg Med*. 2020;21(6):272-275. https://doi.org/10.5811/westjem.2020.8.46812
8. Lowe G, Stike R, Pollack M, et al. Nursing blood specimen collection techniques and hemolysis rates in an emergency department: analysis of venipuncture versus intravenous catheter collection techniques. *J Emerg Nurs*. 2008;34(1):26-32. https://doi.org/10.1016/j.jen.2007.02.006.

9. Burchill C, Seballos S, Reineks E, Phelan M. Emergency nurse's knowledge, attitudes, and practices related to blood sample hemolysis prevention: an exploratory descriptive study. *J Emerg Nurs*. 2021;47(4): 590-598. https://doi.org/10.1016/j.jen.2020.12.015
10. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179-211. https://doi.org/10.1016/0749-5978(91)90020-T
11. Schumaker J, Taylor W, McGonigle T. The emergency, trauma, and transport nursing workforce: highlights of a benchmark 2019 survey. *Nurs Manage*. 2019;50(12):20-32. https://doi.org/10.1097/01.NUMA.0000605152.42445.4b
12. Bradford J Y, Reeve N E, Killian M; 2016 ENA Clinical Practice Guideline Committee. Clinical practice guideline: prevention of blood specimen hemolysis in peripherally-collected venous specimens. *J Emerg Nurs*. 2018;44(4): 402.e1-402.e22. https://doi.org/10.1016/j.jen.2018.05.017
13. Castner J. Accidental and unintentional findings from the midstream clean-catch urine contamination study: insights from applying the Behavior Engineering Model. *J Emerg Nurs.* 2019;45(5): 484–487. https://doi.org/10.1016/j.jen.2019.07.013

Letters to the Editor

Letters to the Editor are encouraged and may be submitted at jenonline.org where submission instructions can be found in the Author Instructions.

Response to Routsolias and Mycyk Letter

To the Editor:

We appreciate the interest of Drs Routsolias and Mycyk in our paper entitled, *Understanding ED Buprenorphine Initiation for Opioid Use Disorder: A Guide for Emergency Nurses.*[1] Although addressing the effects of the current coronavirus disease 2019 (COVID-19) pandemic on patients with opioid use disorder (OUD) was beyond the scope of our original paper, Drs Routsolias and Mycyk correctly point out the importance of this issue and the profound, multi-faceted challenges that the pandemic has created for this vulnerable group of patients.[2] We appreciate the opportunity to discuss this issue.

As noted by Routsolias and Mycyk, Cook County Medical Examiner data do demonstrate a record number of opioid-related deaths during 2020.[3-5] By June 2020, the Chicago Department of Public Health reported that 82% of overdose deaths were fentaNYL-involved, an increase of nearly 57% over the previous year. Additionally, they reported an 80% increase in fentaNYL-involved fatal overdoses in 2019, before the current COVID-19 pandemic, demonstrating the tremendous impact that the increased availability of this powerful synthetic opioid has had on Chicagoans.[5] Medical examiner data further reveal that by mid-2020, methadone-involved overdoses had increased by 156% over the previous year. These data clearly indicate that increased use of synthetic opioids such as fentaNYL and methadone have contributed to the growing number of fatal overdoses in Chicago, and do not indicate improved access to buprenorphine or buprenorphine-naloxone as a key factor, as suggested by our colleagues.[2] The pandemic may be contributing to increased opioid overdose deaths by disrupting existing drug supply chains, replacing heroin with fentaNYL because it is more powerful, less expensive to produce, and easier to smuggle, and by increasing the number of individuals using in isolation.[6,7] Overdose death data from the Centers for Disease Control and Prevention support the same trend on a national level—the increase in drug overdose mortality began in 2019 and continued through 2020, before the national pandemic emergency was declared in March 2020.[8] Further, data from the Centers for Disease Control and Prevention also indicate that the primary driver of the increase in overdose deaths has been wide use of synthetic opioids, in particular, fentaNYL.[8]

In addition, we would like to reiterate that, unlike methadone, buprenorphine is a partial μ-receptor agonist. Therefore, patients with opioid withdrawal symptoms benefit from its agonistic properties in the form of diminished cravings; however, its ceiling effect prevents the consequences of respiratory depression and euphoria present with full μ-receptor agonists such as methadone.[1] These characteristics contribute to buprenorphine's excellent safety and efficacy profiles, protecting patients with OUD from overdose and death. In addition, as we previously discussed, the use of combination buprenorphine-naloxone products decreases the potential for diversion and nonmedical use because the injection or inhalation of the naloxone-containing product activates its antagonistic effects.[1] Importantly, patients who take prescribed buprenorphine-naloxone have less frequent heroin and fentaNYL use that place them at much higher risk for fatal overdose. Finally, we respectfully disagree with the notion that "medication alone is not sufficient treatment for OUD."[2] As discussed in our full paper, research evidence demonstrates that medical management with buprenorphine is an effective treatment for OUD, and whereas there is also benefit in multimodal treatment programs, patients' preferences for medication alone should not preclude them from receiving opioid agonist treatment.[1,9,10] The National Academies of Science, Engineering, and Medicine consensus report on medications for OUD concluded that "Lack of availability or utilization of behavioral interventions is not a sufficient justification to withhold medications to treat OUD."[11] Further, they also conclude that "confronting the major barriers to the use of medications to treat OUD is critical to addressing the opioid crisis."[11]

In addition to the difficulties accessing treatment for OUD—including buprenorphine or buprenorphine-naloxone—that our colleagues in Chicago describe and we have seen in Maine as well, emerging literature points to other pandemic-related challenges.[12,13] First, evidence suggests that people with OUD may be at higher risk for

J Emerg Nurs 2021;47:527–531.

experiencing COVID-19 infection due to a higher prevalence of pre-existing conditions, smoking, opioid-related immunosuppression, and the presence of structural lung disease.[14-17] In addition, those with OUD are more likely to reside in congregate living situations such as group recovery housing, shelters, and correctional facilities where they may be unable to maintain social distancing.[14,15] People with OUD also make up a disproportionate share of the United States unsheltered and unstably housed population, placing them at further risk for exposure to COVID-19.[16,18]

Although social distancing is an important public health measure, there is potential for the isolation associated with COVID-19 to cause harm for those with OUD.[19] There is a strong association between social isolation, mood, and substance use disorders.[20] Isolation can act as a trigger for some, exacerbating existing patterns of substance use or contributing to a return to use for those who are in recovery.[19] In addition, many supportive and harm-reducing services for people with OUD are unavailable as a result of the current pandemic, including support groups, treatment programs, daily medication dispensing clinics, and needle exchanges. Social isolation is increasing the risk of fatal overdose for those with OUD, as many who typically follow harm reduction guidance to not use alone are doing so during the pandemic. This lessens the potential for administration of bystander naloxone, contributing to overdose deaths.[16]

There is also evidence that pandemic-related disruptions to existing drug trafficking patterns and supply chains increase risk for those with OUD.[16,19,21] Faced with a lack of usual supply, people who use drugs are forced to seek substances from places other than their known and trusted sources, increasing the risk of exposure to adulterated or contaminated substances.[16,19] Recent research conducted by Niles et al[22] documented a 50% increase in the risk of urine positivity for nonprescribed fentaNYL during the pandemic, despite a substantial decrease in urine drug testing overall. They also observed significant increases in positivity for high-risk drugs (heroin, fentaNYL, opioids, benzodiazepines) and dangerous drug combinations (eg, fentaNYL and opioids).

We agree with Drs Routsolias and Mycyk that additional attention to the merging of the COVID-19 pandemic and the continuing opioid epidemic is sorely needed.[2] Of note, there is an active study, funded through the National Institutes of Health's Helping to End Addiction Long-term Initiative, examining the effects of the COVID-19 pandemic on ED visits for opioid-related issues as well as ED buprenorphine prescribing patterns in a diverse group of EDs from across the US (PI D'Onofrio, Co-I Hawk). We look forward to the results of their analysis for a more comprehensive look at this issue. Whereas we understand the serious constraints many of our nation's emergency departments are facing because of the pandemic, the crisis facing our patients with OUD is also of critical importance. Emergency departments continue to be the lowest barrier setting for patients with OUD to receive the evidence-based, high quality, compassionate care that they need and deserve. We call for the continued expansion of ED-based buprenorphine programs and ED-based teaching around harm reduction strategies, removal of barriers to buprenorphine prescribing for advance practice providers, and as much as possible, the safe re-opening of outpatient supportive and treatment resources.—*Tania D. Strout, PhD, RN, MS, Department of Emergency Medicine, Maine Medical Center, Portland, ME and Tufts University School of Medicine, Boston, MA.* ***Twitter:*** *@tania_strout.* ***ORCID identifier:*** *https://orcid.org/0000-0001-9053-1523*; *E-mail: Strout@mmc.org*; *Michael R. Baumann, MD, Department of Emergency Medicine, Maine Medical Center, Tufts University School of Medicine, Boston, MA.* ***Twitter:*** *@mikebaumann_EM.* ***ORCID identifier:*** *0000-0001-7420-5613; Lauren Wendell, MD, MS, Department of Emergency Medicine, Maine Medical Center, Portland, ME and Tufts University School of Medicine, Boston, MA.* ***Twitter:*** *@ltwendell.* ***ORCID identifier:*** *0000-0002-9026-2017; Gail D'Onofrio, MD, MS, Yale School of Medicine, New Haven, CT.* ***Twitter:*** *@DonofrioGail.* ***ORCID identifier:*** *https://orcid.org/0000-0002-3833-1871; Kathryn Hawk, MD, MHS, Department of Emergency Medicine, Yale School of Medicine, New Haven, CT.* ***Twitter:*** *@kathryn_hawk*, ***ORCID identifier:*** *https://orcid.org/0000-0001-7435-5945*.

https://doi.org/10.1016/j.jen.2021.03.012

REFERENCES

1. Strout TD, Baumann MR, Wendell LT. Understanding ED buprenorphine initiation for opioid use disorder: a guide for emergency nurses. *J Emerg Nurs*. 2021;47(1):139-154. https://doi.org/10.1016/j.jen.2020.10.001
2. Routsolias JC, Mycyk MB. The COVID-19 pandemic continues to challenge patients in need of buprenorphine for opioid use disorder. *J Emerg Nurs*. 2021;47(3):376-377. https://doi.org/10.1016/j.jen.2021.01.011
3. Cook County Government. Medical examiner case archive. Updated February 3, 2021. Accessed February 3, 2021. https://datacatalog.cookcountyil.gov/Public-Safety/Medical-Examiner-Case-Archive/cjeq-bs86/data
4. Chicago Department of Public Health. Health alert network. Published December 31, 2020. Accessed February 3, 2021. https://www.chicagohan.org/
5. Chicago Department of Public Health. Chicago opioid update: mid year. Published August 31, 2020. Accessed February 3, 2021. https://

www.chicago.gov/content/dam/city/depts/cdph/tobacco_alchohol_and_drug_abuse/Mid-Year%20Opioid%20Report%202020%20final.pdf
6. McGhee A. Chicago department of public health responds to rising number of opioid overdoses centered on the city's west side. Chicago. Public Health. Published August 31, 2020. Accessed February 3, 2021. https://www.chicago.gov/city/en/depts/cdph/provdrs/healthy_living/news/2020/august/chicago-department-of-public-health-responds-to-rising-number-of.html
7. Buckley M, Keilman J. Opioid overdoses skyrocket in the face of COVID-19 pandemic; stronger drugs, scarce treatment blamed. *Chicago Tribune*. Published July 20, 2020. Accessed February 3, 2021. https://www.chicagotribune.com/coronavirus/ct-opioid-deaths-spiking-covid-19-20200720-2ulyztrprzgrzffasff5c4l4hq-story.html
8. Emergency Preparedness and Response. Increase in fatal drug overdoses across the United States driven by synthetic opioids before and during the COVID-19 pandemic. Centers for Disease Control and Prevention. Published December 17, 2020. Accessed February 3, 2021. https://emergency.cdc.gov/han/2020/han00438.asp
9. Fiellin DA, Pantalon MV, Chawarski MC, et al. Counseling plus buprenorphine-naloxone maintenance therapy for opioid dependence. *N Engl J Med*. 2006;355(4):365-374. https://doi.org/10.1056/NEJMoa055255
10. Amato L, Minozzi S, Davoli M, Vecchi S. Psychosocial combined with agonist maintenance treatments versus agonist maintenance treatments alone for treatment of opioid dependence. *Cochrane Database Syst Rev*. 2011;10:CD004147. https://doi.org/10.1002/14651858.CD004147.pub4
11. National Academies of Sciences, Engineering, and Medicine. *Medications for Opioid Use Disorder Save Lives*. The National Academies Press (US); 2019.
12. Sorg MH, Daley K. Maine drug death report, January–September 2020. Accessed February 3, 2021. https://www.maine.gov/ag/news/article.shtml?id=3484620
13. Russell E. 2020 will likely set new record for most drug overdose deaths in Maine. *Portland Press Herald*. January 11, 2021. Accessed April 23, 2021. https://www.pressherald.com/2021/01/11/2020-likely-to-set-record-for-drug-overdose-deaths-in-maine/
14. Davis CS, Samuels EA. Opioid policy changes during the COVID-19 pandemic – and beyond. *J Addict Med*. 2020;14(4):e4-e5. https://doi.org/10.1097/ADM.0000000000000679
15. Alexander GC, Stoller KB, Haffajee RL, Saloner B. An epidemic in the midst of a pandemic: opioid use disorder and COVID-19. *Ann Intern Med*. 2020;173(1):57-58. https://doi.org/10.7326/M20-1141
16. Cowan E, Khan MR, Shastry S, Edelman EJ. Conceptualizing the effects of the COVID-19 pandemic on people with opioid use disorder: an application of the social ecological model. *Addict Sci Clin Pract*. 2021;16(1):4. https://doi.org/10.1186/s13722-020-00210-w
17. Schimmel J, Manini AF. Opioid use disorder and COVID-19: biological plausibility for worsened outcomes. *Subst Use Misuse*. 2020;55(11):1900-1901. https://doi.org/10.1080/10826084.2020.1791184
18. Galea S, Vlahov D. Social determinants and the health of drug users: socioeconomic status, homelessness, and incarceration. *Public Health Rep*. 2002;117(suppl 1):S135-S145.PMID: 12435837.
19. LeSaint KT, Snyder HR. Impact of social distancing on individuals who use drugs: considerations for emergency department providers. *West J Emerg Med*. 2020;21(5):1102-1104. https://doi.org/10.5811/westjem.2020.7.47896
20. Chou KL, Liang K, Sareen J. The association between social isolation and DSM-IV mood, anxiety, and substance use disorders: wave 2 of the National Epidemiologic Survey on alcohol and related conditions. *J Clin Psychiatry*. 2011;72(11):1468-1476. https://doi.org/10.4088/JCP.10m06019gry
21. Linas BP, Savinkina A, Barbosa C, et al. A clash of epidemics: impact of COVID-19 pandemic response on opioid overdose. *J Subst Abuse Treat*. 2021;120:108157. https://doi.org/10.1016/j.jsat.2020.108158
22. Niles JK, Gudin J, Radcliff J, Kaufman HW. The opioid epidemic within the COVID-19 pandemic: drug testing in 2020. *Popul Health Manag*. 2021;24(S1):S43-S51. https://doi.org/10.1089/pop.2020.0230

The Other Side of Immediate Bedding: A Call to Action to the Research Community

Dear Editor:

It is every triage nurse's worst nightmare to lose a patient in their lobby who was waiting for care.[1] But could patients also be at risk of suboptimal outcomes in a patient care room while waiting to see a provider? This question and the unintended consequences of direct bedding are worthy of rigorous, systematic exploration.

In "Triaging the Emergency Department, not the Patient: United States Emergency Nurses' Experience of the Triage Process," Wolf et al[2] define immediate bedding, or "pull until full," as the intake process of bringing patients directly to treatment areas without screening, triage, or physiological assessment.

Lack of timely, accessible primary care and ED crowding are well established concerns in the emergency department.[3] These concerns contribute to delays in completing triage within the recommended time frames.[2-4] Studies have shown that direct bedding can significantly reduce door-to-provider times and left-without-being-seen rates.[5,6] But before we consider increasing patient throughput as synonymous with quality care, consider this illustrative scenario.

At 2 PM, a triage nurse leaves the ED lobby with an older adult, who speaks English as a second language, with a chief complaint of shortness of breath and palpitations. The triage nurse rooms the patient after paging the communication devices of the primary nurse, Sarah, and the technician, Rob. At this time, Sarah has received a critically ill patient who just arrived by ambulance and whom she is attending to next door. This patient will likely require intubation. Rob has been temporarily reassigned to another area, with no one available to cover his assignment. The triage nurse assists the patient from the wheelchair to the gurney. "Your doctor and nurse will be in shortly," they say to the patient. Briskly, they return to the lobby, which has now been unattended for 10 minutes. At 2.30 PM, as Sarah heads to the computed tomography department with her intubated patient, she notices a patient in a room that normally does not have patients in it. She asks the charge nurse to follow up on this because she will likely

www.chicago.gov/content/dam/city/depts/cdph/tobacco_alchohol_and_drug_abuse/Mid-Year%20Opioid%20Report%202020%20final.pdf
6. McGhee A. Chicago department of public health responds to rising number of opioid overdoses centered on the city's west side. Chicago. Public Health. Published August 31, 2020. Accessed February 3, 2021. https://www.chicago.gov/city/en/depts/cdph/provdrs/healthy_living/news/2020/august/chicago-department-of-public-health-responds-to-rising-number-of.html
7. Buckley M, Keilman J. Opioid overdoses skyrocket in the face of COVID-19 pandemic; stronger drugs, scarce treatment blamed. *Chicago Tribune*. Published July 20, 2020. Accessed February 3, 2021. https://www.chicagotribune.com/coronavirus/ct-opioid-deaths-spiking-covid-19-20200720-2ulyztrprzgrzffasff5c4l4hq-story.html
8. Emergency Preparedness and Response. Increase in fatal drug overdoses across the United States driven by synthetic opioids before and during the COVID-19 pandemic. Centers for Disease Control and Prevention. Published December 17, 2020. Accessed February 3, 2021. https://emergency.cdc.gov/han/2020/han00438.asp
9. Fiellin DA, Pantalon MV, Chawarski MC, et al. Counseling plus buprenorphine-naloxone maintenance therapy for opioid dependence. *N Engl J Med*. 2006;355(4):365-374. https://doi.org/10.1056/NEJMoa055255
10. Amato L, Minozzi S, Davoli M, Vecchi S. Psychosocial combined with agonist maintenance treatments versus agonist maintenance treatments alone for treatment of opioid dependence. *Cochrane Database Syst Rev*. 2011;10:CD004147. https://doi.org/10.1002/14651858.CD004147.pub4
11. National Academies of Sciences, Engineering, and Medicine. *Medications for Opioid Use Disorder Save Lives*. The National Academies Press (US); 2019.
12. Sorg MH, Daley K. Maine drug death report, January–September 2020. Accessed February 3, 2021. https://www.maine.gov/ag/news/article.shtml?id=3484620
13. Russell E. 2020 will likely set new record for most drug overdose deaths in Maine. *Portland Press Herald*. January 11, 2021. Accessed April 23, 2021. https://www.pressherald.com/2021/01/11/2020-likely-to-set-record-for-drug-overdose-deaths-in-maine/
14. Davis CS, Samuels EA. Opioid policy changes during the COVID-19 pandemic – and beyond. *J Addict Med*. 2020;14(4):e4-e5. https://doi.org/10.1097/ADM.0000000000000679
15. Alexander GC, Stoller KB, Haffajee RL, Saloner B. An epidemic in the midst of a pandemic: opioid use disorder and COVID-19. *Ann Intern Med*. 2020;173(1):57-58. https://doi.org/10.7326/M20-1141
16. Cowan E, Khan MR, Shastry S, Edelman EJ. Conceptualizing the effects of the COVID-19 pandemic on people with opioid use disorder: an application of the social ecological model. *Addict Sci Clin Pract*. 2021;16(1):4. https://doi.org/10.1186/s13722-020-00210-w
17. Schimmel J, Manini AF. Opioid use disorder and COVID-19: biological plausibility for worsened outcomes. *Subst Use Misuse*. 2020;55(11):1900-1901. https://doi.org/10.1080/10826084.2020.1791184
18. Galea S, Vlahov D. Social determinants and the health of drug users: socioeconomic status, homelessness, and incarceration. *Public Health Rep*. 2002;117(suppl 1):S135-S145.PMID: 12435837.
19. LeSaint KT, Snyder HR. Impact of social distancing on individuals who use drugs: considerations for emergency department providers. *West J Emerg Med*. 2020;21(5):1102-1104. https://doi.org/10.5811/westjem.2020.7.47896
20. Chou KL, Liang K, Sareen J. The association between social isolation and DSM-IV mood, anxiety, and substance use disorders: wave 2 of the National Epidemiologic Survey on alcohol and related conditions. *J Clin Psychiatry*. 2011;72(11):1468-1476. https://doi.org/10.4088/JCP.10m06019gry
21. Linas BP, Savinkina A, Barbosa C, et al. A clash of epidemics: impact of COVID-19 pandemic response on opioid overdose. *J Subst Abuse Treat*. 2021;120:108157. https://doi.org/10.1016/j.jsat.2020.108158
22. Niles JK, Gudin J, Radcliff J, Kaufman HW. The opioid epidemic within the COVID-19 pandemic: drug testing in 2020. *Popul Health Manag*. 2021;24(S1):S43-S51. https://doi.org/10.1089/pop.2020.0230

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start tissue plasminogen activator therapy once she returns from the computed tomography department.

Rob was relieved of his temporary assignment by an incoming technician and could return to his pod at approximately 3.45 PM. When he returns to his side of the department, he quickly learns that no one has seen this patient and on the basis of the patient's chief complaint he meets the protocol for an immediate electrocardiogram. Once an electrocardiogram (revealing ST elevation) is performed, the emergency physician and charge nurse are notified immediately. Sarah returns from the intensive care unit at 4.15 PM just after the ST-segment elevation myocardial infarction notification was paged out. She jumps into the room to start an intravenous catheter and provide care to the patient.

Sarah described the situation in the hospital's occurrence reporting system. It was not the first one she had submitted, and she knew that it would likely not be the last. This dynamic, in addition to the brand-new and much larger emergency department that they had moved into, was making the recently implemented direct-bedding intake process extremely risky.

Additional, more complex studies need to be performed that consider factors such as nurse staffing levels, including demographics, certifications, and experience; delays in care; patient quality outcomes; and perhaps an emergency department's physical design before pull-until-full, direct-bedding, or quick-look models are declared a best practice.[2,5,6] For a pull-until-full intake process to maintain or improve the quality of care delivered, resources must be present and aligned to nursing, patient, and unit needs.[6,7] Appropriate staffing can increase throughput, improve flow, and decrease costs; and solely focusing on productivity can compromise quality of care.[8] The Emergency Nurses Association[9] confirms that adequate staffing has contributed to the reported success of prior initiatives regarding pull-until-full/direct-bedding practices, but this cannot be validated until research that examines this intake practice includes staffing levels and other vital information in its analyses. In their most recent investigation to establish research priorities for the Emergency Severity Index, Wolf and Delao[10] found the work environment and its effect on triage accuracy and processes to be the lowest priority focus. I am aware that emergency nurses who work triage regularly may feel differently, but I am reassured by the intentional focus of future research on triage in general and ESI in particular.

I would like to reiterate the conclusion of Wolf et al[2] and stress that "Future research should focus on intervention and comparison studies examining the effect of staffing, nurse experience, hospital policies, and length of shift on the accuracy of triage decision making." Before we consider pull-until-full intake models as a safe or best practice, let us make sure that the research that is coming out on this topic is comprehensive and includes quality outcomes beyond the time metrics of door-to-doctor times and throughput and even beyond left-without-being-seen rates and patient satisfaction.[5,6] These are important, but experience suggests that there are deeper implications to this practice than are evident in the existing literature. Perhaps Dr Wolf and her research team would be willing to provide specific study design ideas to emergency nurses wishing to examine direct-bedding triage models further.

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https://doi.org/10.1016/j.jen.2020.11.010

REFERENCES

1. Reinhardt MR. A systematic approach to evaluation of performance deficiencies in ED triage. *J Emerg Nurs*. 2017;43(4):329-332. https://doi.org/10.1016/j.jen.2017.01.003
2. Wolf LA, Delao AM, Perhats C, Moon MD, Zavotsky KE. Triaging the emergency department, not the patient: United States emergency nurses' experience of the triage process. *J Emerg Nurs*. 2018;44(3):258-266. https://doi.org/10.1016/j.jen.2017.06.010
3. Stone E, Winger J. ENA Practice Guidelines: crowding, boarding and patient throughput. *J Emerg Nurs*. 2018;44(2):176-183 https://doi.org/10.1016/j.jen.2018.01.011
4. Benabbas R, Shah R, Zonnoor B, Mehta N, Sinert R. Impact of triage liaison provider on emergency department throughput: a systematic review and meta-analysis. *Am J Emerg Med*. 2020;38(8):1662-1670 https://doi.org/10.1016/j.ajem.2020.04.068
5. Porter JA, Frye K, Rodriguez R, Velez Arias M, VanDenburg G. 23 Impact of implementing a direct bedding process on emergency department throughput and leaving without being seen rates. *Ann Emerg Med*. 2018;72(4):S11-S12. https://doi.org/10.1016/j.annemergmed.2018.08.028
6. Flood R, Szwargulski P, Qureshi N, et al. Immediate bedding and patient satisfaction in a pediatric emergency department. *J Emerg Med*. 2016;50(5):791-798. https://doi.org/10.1016/j.jemermed.2015.10.008
7. Desseyn P. Triage is a process, not a destination. *J Emerg Nurs*. 2017;43(4):375-377. https://doi.org/10.1016/j.jen.2017.03.015
8. Stenson BA, Anderson JS, Davis SR. Staffing and provider productivity in the emergency department. *Emerg Med Clin North Am*. 2020;38(3):589-605. https://doi.org/10.1016/j.emc.2020.04.002
9. Leaver SL. Staffing and productivity in the emergency department. Emergency Nurses Association. Accessed October 7, 2020. Available at: https://www.ena.org/docs/default-source/resource-library/practice-resources/position-statements/staffingandproductivityemergencydepartment.pdf?sfvrsn=c57dcf13_10
10. Wolf LA, Delao AM. Establishing research priorities for the Emergency Severity Index using a modified Delphi approach. *J Emerg Nurs*. 2021;47(1):50-57. https://doi.org/10.1016/j.jen.2020.09.005

Response to Amberson Letter

Dear Editor:

We appreciate the comments and suggestions of Amberson[1] on our research[2] on the conditions necessary for accurate triage of ED patients. Our work and that of other researchers[3,4] suggests that there are both individual and environmental factors that contribute to effective triage decision-making.

A significant environmental factor is the socioclinical understanding and operationalization of the role of the triage nurse as one who assesses for patient risk and is not solely a facilitator of throughput. In ED environments that identify time metrics as the driving outcomes measure, the important safety concerns that triage nurses identify can be less valued. Amberson points out, correctly, that there is little evidence examining this problem; in fact, the outcomes measures identified in the few studies around immediate bedding processes are entirely focused on left-without-being-seen numbers and door-to-provider times.[5-7]

Although patient outcomes are not examined in studies of immediate bedding, qualitative findings suggest that there is concern from emergency nurses about the safety of these processes regarding missed diagnoses, delayed care, and failure to rescue. Our recent studies in the exploration of triage processes around pregnancy-capable people[8] and occultly suicidal people[9] suggest that immediate bedding processes are a source of great concern to emergency nurses because critical assessments are delayed or not done, compromising patient care and safety.

This leaves us with the excellent question of how best to study the impact of different triage processes on nursing and patient outcomes. We agree with Amberson that the workplace environment is a critical element in clinical decision-making and associated patient outcomes. A useful theoretical framework that describes the intersection between the socioclinical environment and the individual nurse as it affects decision-making is the study "Integrated, ethically driven environmental model of clinical decision making in emergency settings" by Wolf.[4] It is an ED setting–specific theory that can examine these overlapping and interwoven threads.[10]

More concretely, we offer research priorities for Emergency Severity Index triage[11] and suggest that correlational study designs that explore the relationships between triage elements (eg, number of triage nurses, triage processes and decision-making, and nurse time in triage) and outcomes measures (eg, accuracy of Emergency Severity Index level assigned, time to triage, time to first diagnostic, and time to first intervention) would be a valuable place to start. These studies can be population-specific (eg, triage of patients classified as pediatric, geriatric, obstetrical, or psychiatric) or complaint-specific (eg, chest pain and shortness of breath), as the situation demands. Overall, each emergency department is unique in its community served and in the triage processes it uses to rapidly identify and treat patients who are acutely ill; the questions grounded in one's own emergency department present research opportunities to determine if these processes are effective in providing safe care.—*Lisa Adams Wolf, PhD, RN, CEN, FAEN, FAAN, Director, Emergency Nursing Research, Emergency Nurses Association, 930 E Woodfield Road, Schaumburg, IL 60173 E-mail: Lisa.wolf@ena.org*

https://doi.org/10.1016/j.jen.2021.02.005

REFERENCES

1. Amberson T. The other side of immediate bedding: a call to action to the research community. *J Emerg Nurs*. 2021;47(3). https://doi.org/10.1016/j.jen.2020.11.010
2. Wolf LA, Delao AM, Perhats C, Moon MD, Zavotsky KE. Triaging the emergency department, not the patient: United States emergency nurses' experience of the triage process. *J Emerg Nurs*. 2018;44(3):258-266. https://doi.org/10.1016/j.jen.2017.06.010
3. Hessels AJ, Flynn L, Cimiotti JP, Cadmus E, Gershon RR. The impact of the nursing practice environment on missed nursing care. *Clin Nurs Stud*. 2015;3(4):60-65. https://doi.org/10.5430/cns.v3n4p60
4. Wolf L. An integrated, ethically driven environmental model of clinical decision making in emergency settings. *Int J Nurs Knowl*. 2013;24(1):49-53. https://doi.org/10.1111/j.2047-3095.2012.01229.x
5. Wiler JL, Gentle C, Halfpenny JM, et al. Optimizing emergency department front-end operations. *Ann Emerg Med*. 2010;55(2):142-160. https://doi.org/10.1016/j.annemergmed.2009.05.021
6. Flood R, Szwargulski P, Qureshi N, et al. Immediate bedding and patient satisfaction in a pediatric emergency department. *J Emerg Med*. 2016;50(5):791-798. https://doi.org/10.1016/j.jemermed.2015.10.008
7. Ioannides KL, Blome A, Schreyer KE. Impact of a direct bedding initiative on left without being seen rates. *J Emerg Med*. 2018;55(6):850-860. https://doi.org/10.1016/j.jemermed.2018.09.008
8. Wolf LA, Delao AM, Zavotsky KE, Baker KM. Triage decisions involving pregnancy-capable patients: educational deficits and emergency nurses' perceptions of risk. *J Contin Educ Nurs*. 2020;52(1):21-29. https://doi.org/10.3928/00220124-20201215-07
9. Wolf LA, Perhats C, Delao AM, Clark PR, Moon MD, Zavotsky KE. Assessing for occult suicidality at triage: experiences of emergency nurses. *J Emerg Nurs*. 2018;44(5):491-498. https://doi.org/10.1016/j.jen.2018.01.013
10. Wolf L. Research in triage?!?: using an integrated, ethically driven framework for clinical decision making. *J Emerg Nurs*. 2013;39(1):104-106. https://doi.org/10.1016/j.jen.2012.09.009
11. Wolf LA, Delao AM. Establishing research priorities for the emergency severity index using a modified Delphi approach. *J Emerg Nurs*. 2021;47(1):50-57. https://doi.org/10.1016/j.jen.2020.09.005

A CLIMATE: A Tool for Assessment of Climate-Change–Related Health Consequences in the Emergency Department

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CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

- The current literature lacks a specific framework for the integration of climate and health knowledge for addressing the health history, physical examination, management, and evaluation of climate-related conditions.
- This article contributes to the increasing clinician awareness and engagement in understanding the deleterious health impacts of climate change.
- Key implications for emergency nursing practice include the A CLIMATE tool for health assessment in the emergency department and other settings.

Abstract

Climate change is an urgent public health problem that has looming implications and associated deleterious health consequences. The intersection of climate change and health has broad implications for health professionals in a variety of settings but especially for ED settings. Climate change is already affecting human health and health systems—which includes impacts on ED care. Disaster response and emergency preparedness are critically important public health interventions in our climate-changing world, and the contributions of emergency nurses are essential. Disaster preparedness, environmental emergency response, and health emergency management are important elements of emergency nursing and are explicated in *Sheehy's Emergency Nursing Principles and Practices, 7th Edition*. The purpose of this article is to present an overview of a clinical tool and mnemonic, A CLIMATE, developed by the authors with application to a case review. It is imperative that the nursing profession—particularly emergency clinicians—address the intersection of climate and health to engage in the assessment, intervention, management, evaluation, education, and referral of those who present to emergency departments with potential climate-related health impacts.

Key words: Climate change; Climate and health; Emergency department assessment; Global warming

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J Emerg Nurs 2021;47:532-542.
Available online 3 December 2020
0099-1767

https://doi.org/10.1016/j.jen.2020.10.002

Introduction

Climate change is an urgent public health problem that has looming implications and associated deleterious health consequences. The intersection of climate change and health has broad implications for health professionals in a variety of settings but especially for ED settings. Climate change is associated with physical health consequences—acute and chronic—and mental health sequelae that are well described in the literature.[1-6] Haines and Ebi[2] note that climate change is already affecting human health and health systems—which includes impacts on ED care. Disaster response and emergency preparedness are critically important public health interventions in our climate-changing world, and the contributions of emergency nurses are essential. Disaster preparedness, environmental emergency response, and health emergency management are important elements of emergency nursing and are explicated in *Sheehy's Emergency Nursing Principles and Practices, 7th Edition.*[7] The purpose of this article is to present an overview of a clinical tool and mnemonic, A CLIMATE, developed by the authors with application to a case review.

A growing body of scientific literature urges climate action as a moral imperative to avoid catastrophic health effects by 2050.[4,5,8,9] Climate effects on health manifest as air quality issues, respiratory illnesses, and allergies related to aeroallergens; vector-borne and waterborne illnesses; food and water insecurity; heat stress, heat strain, and heat stroke, particularly in older persons and occupational workers (construction workers and migrant farmworkers); and acute and chronic kidney illnesses (renal calculi and Mesoamerican nephropathy) related to dehydration and lack of heat breaks. The American Nurses Association[10] developed environmental principles that encompass health in our climate-changing world and explicitly address global climate change. The Canadian Nurses Association developed a position statement in 2009 that was updated in 2017 dealing with the role of nurses in addressing climate change and health. It is imperative that the nursing profession—particularly emergency nurses—address the intersection of climate and health to engage in the assessment, intervention, management, evaluation, and referral of those who present to emergency departments with potential climate-related health impacts.

TABLE 1
Roles of ED providers in addressing the health impacts of climate change

Health care provider	Roles in addressing climate-related health impacts.
Advanced practice provider (physician, nurse practitioner, physician assistant)	Acute stabilization of life- and limb-threatening conditions. Perform a focused medical history and physical examination that incorporates knowledge of climate-related illness common to the region and identifies patients from vulnerable groups to ensure a comprehensive plan of care.
Registered nurse	Acute stabilization of life- and limb-threatening conditions. Assess for risk of developing, or the presence of, climate-related illnesses; provide climate-informed patient and family education aimed at prevention of future health threats and reduction in severity of climate-related illnesses; ensure a comprehensive approach to care.
Occupational therapist	Address occupation deprivation—the potential loss of meaningful roles and occupations owing to climate change—and support patients who experience life-role disruptions.
Mental health professional	Screen for climate-related mental health sequelae, and initiate a plan to provide psychological care and support.
Social worker	Coordinate outreach to appropriate community services to address individual climate vulnerabilities (eg, elder services and transportation).
Care coordinator	Ensure that all relevant inpatient or outpatient follow-up referrals to address physical and mental health sequelae are made and integrated into hospital admission or ED discharge planning.
Physical therapist	Optimize activities of daily living for those with chronic and complex illnesses exacerbated by climate change.

The Professional Obligation, Leadership, Education, Accountability, Science, and Engagement Framework and A CLIMATE Mnemonic

As 1 exemplar of a mnemonic, the Professional Obligation, Leadership, Education, Accountability, Science, and Engagement (PLEASE) framework[9] was illustrative in the development of our A CLIMATE mnemonic. Developed by Schenk,[11] the PLEASE framework is a key approach to addressing the impact of climate change and greenhouse gas emissions and the importance of environmentally safe and healthy practices. The PLEASE framework[11] was built on 3 foundational American Nurses Association documents: *Scope and Standards of Practice,*[12] *Code of Ethics with Interpretive Statements,*[13] and *Nursing's Social Policy Statement.*[14] From these documents, Schenk[11] gleaned key concepts to develop the PLEASE framework, aimed at environmentally safe and healthy practices. These specific areas are explicated in the online supplementary material for consideration of their relevance in the integration of the A CLIMATE mnemonic for ED clinicians and interprofessional assessment, planning, intervention, and evaluation of climate-related health consequences. In the ED setting, a framework for determining the etiology of climate-related health challenges may be relevant for the accurate, time-sensitive, and important contributions of members of the ED team.

The A CLIMATE Assessment Framework for Addressing Health Consequences in Our Climate-Changing World

There is a paucity of frameworks, assessment tools, or teaching tools on climate change for clinical practice. Our previous scoping review[15] suggested that nursing is increasingly engaging in publishing about the health impacts of climate change. Frameworks that were elicited from the literature include the United Nations Sustainable Development Goals framework and climate;[15] the Building Resilience Against Climate Effects framework from the Centers for Disease Control and Prevention with a public health approach;[16] a climate change and sleep framework;[17] a climate change and mental health causal pathways framework;[18] and an environmental protection framework.[19] These climate-and-health–related frameworks did not yield applicability for a framework for climate and health that would be relevant for interprofessional or ED clinicians; thus, we developed an innovative approach to the assessment of health consequences in our climate-changing world and a mnemonic—A CLIMATE—as a clinical tool for adoption in emergency settings.

Here we focus on the development of the A CLIMATE clinical tool and mnemonic, which is based on our model of contributing factors to climate-related health challenges (Table 1); this mnemonic was developed and aimed at assessing, managing, intervening, and evaluating climate-and-health–related challenges. The A CLIMATE mnemonic includes the following domains: A—Act immediately to stabilize life- and limb-threatening conditions; C—Consider the climate-and-health etiology of symptoms; L—Learn from a climate health history; I—Implement a climate-and-health–focused assessment; M—Manage the ongoing care of the climate-related emergency; A—Act to integrate an action plan that includes physiological and psychological climate symptoms; T—Treat urgent climate symptoms and consequences; and E—Evaluate, educate, and refer for long-term follow-up.

The A CLIMATE clinical assessment framework and mnemonic were developed on the basis of our understanding of contributing factors to climate-related health challenges and are meant to guide the assessment, management, interventions, and evaluation of care through a lens of climate change and its impact on health and well-being. This framework was developed from an interprofessional perspective and can be used by all members of the ED team providing patient care (Table 1). The mnemonic comprises 8 domains (Figure 1), which are described below.

A—ACT IMMEDIATELY TO STABILIZE LIFE- AND LIMB-THREATENING CONDITIONS

This domain addresses the importance of the emergency clinician in a lens of a focused primary and secondary assessment and priority intervention to address the critical first moments of rapid care in the emergency encounter. Mawardi et al[20] urge that disaster preparedness in our climate-changing world should be an essential priority in emergency and disaster preparedness in the community within a multidisciplinary approach. Thus, bringing the unique lens of emergency nurses to consider the health impacts of climate change in emergency settings and incorporating the rapid emergency nursing process are critical aspects of care. For example, potential life- and limb-threatening emergencies linked with climate disasters are key aspects of emergency assessment.

In the emergency setting, it is critical to triage the patient and assign a triage category and consider initiating special alerts (eg, stroke alert). For example, when heat stroke is suspected, other key interventions are to secure large-bore intravenous access and use critical-thinking skills to administer a fluid bolus for hypotension or intravenous therapy to reduce the risk of fluid overload in an elderly patient. It is

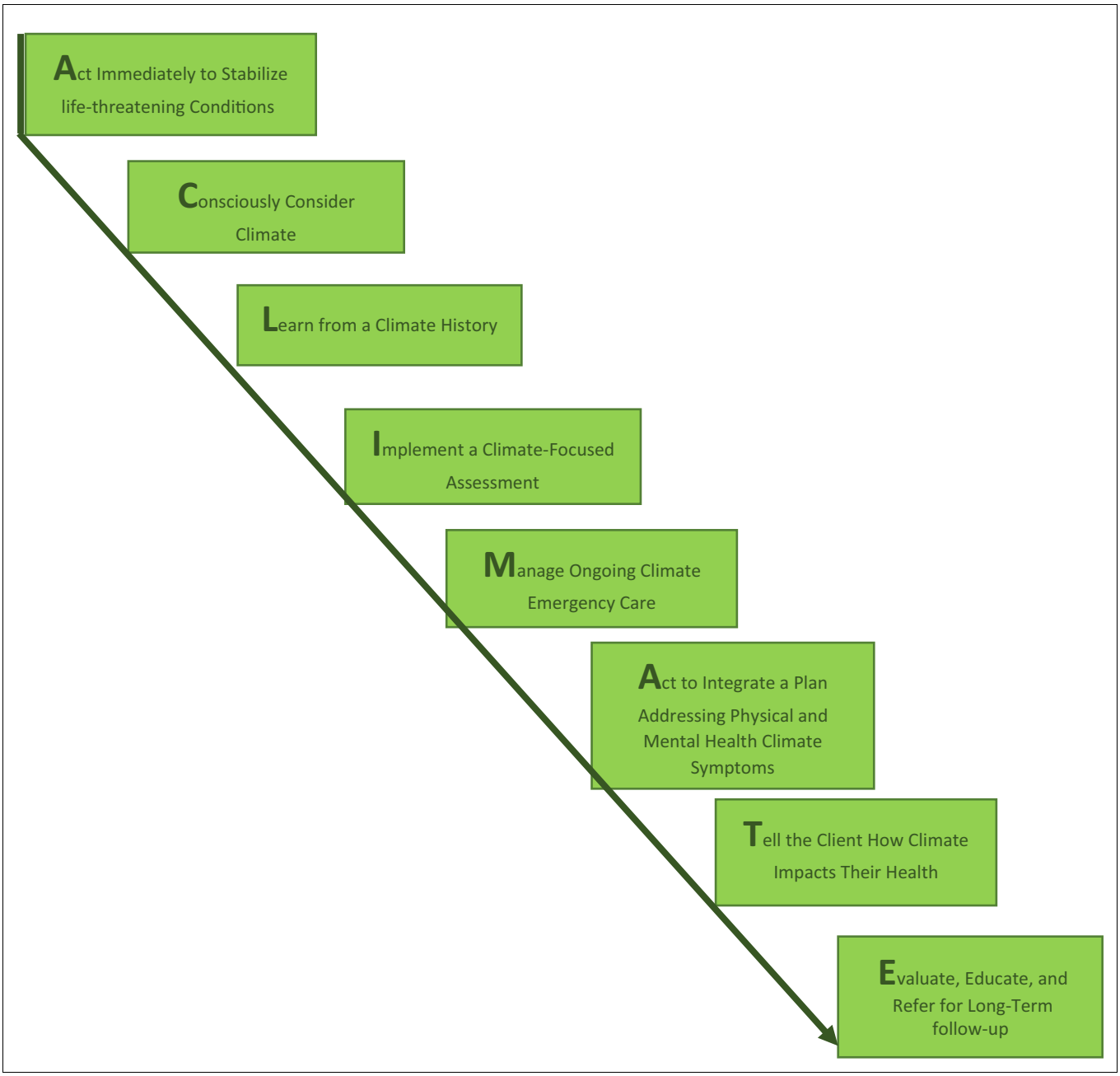


FIGURE 1
A CLIMATE mnemonic and framework.

also essential to immediately initiate cooling measures (place ice packs to groin and axillae, remove clothing, and use a spray mist with a fan). It is important to consider whether an indwelling catheter is needed to measure output and check for rhabdomyolysis or disseminated intravascular coagulation and place a special indwelling catheter device to measure core temperatures. Monitoring core temperature through a rectal temperature probe or other indwelling device while obtaining a licensed independent provider's engagement for medication to control shivering and also collect blood specimens for laboratory testing including electrolyte imbalance are critical emergency actions.

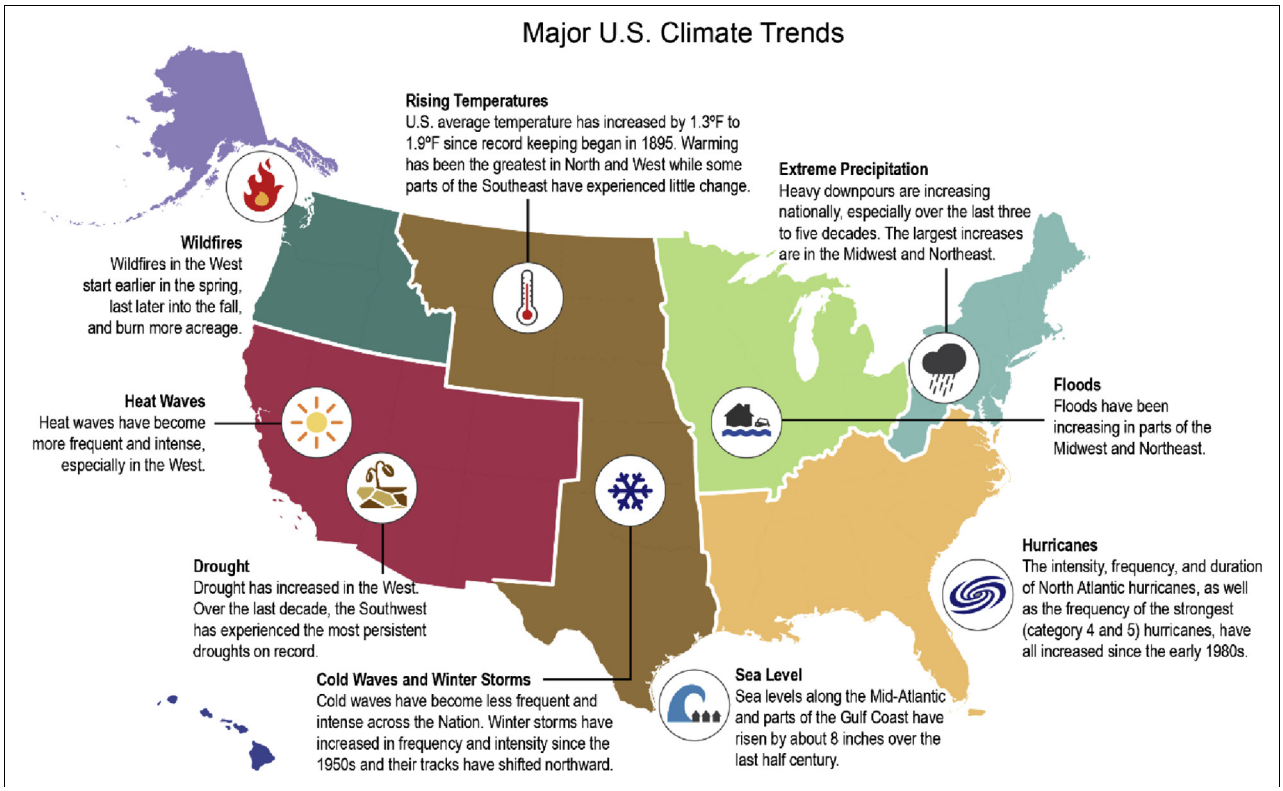


FIGURE 2

Major United States climate trends. (Reproduced with permission.)[21]

C—CONSCIOUSLY CONSIDER THE HEALTH IMPACTS OF CLIMATE CHANGE SPECIFIC TO THE REGIONS IN WHICH YOU PRACTICE

It is important that health care providers are aware of local and regional climate trends (Figure 2). For example, extreme precipitation has increased over the last 30 to 50 years, and the largest increases have been in the Midwest and Northeast. In addition, there has been an increase in floods in these same regions,[21] resulting in traumatic injury, mental health impacts, preterm birth and low birth weight, increases in infectious diseases, and carbon monoxide poisoning related to power outages.[22] Understanding regional climate trends and being aware of physical and mental health impacts related to extreme precipitation and flooding will allow ED providers to anticipate and plan for surges in ED admissions. Similarly, heat waves are more intense and are occurring with greater frequency, particularly in the western United States.[1] Providers who work in regions that experience increasing extreme heat events can anticipate more ED visits related to heat-related illnesses, particularly in older adults, young children, and certain occupational groups.[23] Moreover, ED clinicians can also anticipate an increase in admissions related to violence and aggression because there is a causal link between increasing temperatures and aggression.[24] A key factor is that the "C" in the A CLIMATE mnemonic encompasses a regional-level and a hospital/departmental-level response as part of the preparation for care of an individual patient by ED clinicians.

L—LEARN FROM A CLIMATE–HEALTH HISTORY

A climate–health history can be a key element for clinical practice in the emergency department. Understanding the associated health consequences of these impacts and knowing which groups are most vulnerable will inform how providers approach a focused health assessment, which can be key to identifying health problems that are exacerbated by climate issues. It is critical for ED clinicians to be aware of those individuals, communities, and populations who are most vulnerable to the health threats associated with climate change. Vulnerability is variable, and health impacts differ by location, pathways of exposure, adaptive capacity, and underlying susceptibility.[25]

However, there are certain groups who have been identified as populations of concern. These include those with low socioeconomic status, some communities of color, indigenous peoples, immigrant groups, children, pregnant women, older adults, persons with disabilities, and those with preexisting physical and mental or chronic conditions.[24,25]

Hastings[26] examined the impact of climate change and the role of the emergency nurse linking the integration of climate change knowledge, how climate change affects health, and the emergency nurse's role in fighting climate change (Supplementary Figure). It is important to inquire about the environments where patients live, work, and play and the impact that their environment has on their health. For example, when a child presents to the emergency department with increasing and more severe asthma attacks, learning through a climate history that the child lives, and goes to school, close to a congested, high-traffic roadway would be a significant factor in care planning. In addition, it would be equally as important to know if the same child lives in an urban area that experiences the urban heat island effect because the combination of increased greenhouse gas emissions coupled with temperature rise further decreases air quality, which will significantly affect the severity of their disease.[27] This aspect of the mnemonic addresses the unit level of ED care.

I—INDIVIDUALIZE A CLIMATE-AND-HEALTH–FOCUSED ASSESSMENT TO ENSURE RELEVANT, CLIMATE-RELATED IMPACTS ARE ADDRESSED

A climate–health history and knowledge of regional climate trends are important factors that will guide the focused assessment. The Global Consortium on Climate and Health Education (GCCHE) based out of the Mailman School of Public Health at Columbia University has developed climate-and-health core competencies, which are recommended for all health professionals. The competencies address 5 areas of practice: climate-and-health knowledge and analytical skills; climate change and public health practice; climate change and clinical practice; climate change and health policy; and communication. One of the goals for practicing clinicians is to demonstrate competence in diagnosing and managing climate-sensitive and climate-induced illness.[28] The outcomes they identify have relevance for conducting a climate-and-health–focused assessment. For instance, a competency specific to the assessment is to "identify and describe patient presentations and triage considerations as manifestations of direct and indirect climate change conditions."[28] Examples of direct effects would include trauma and heat-related illnesses, whereas indirect effects would include symptoms related to either vector-, food-, or waterborne illnesses.

M—MANAGE ACUTE, CHRONIC, AND COMPLEX CLIMATE-AND-HEALTH CONSEQUENCES

Climate-related health consequences can manifest as acute problems, chronic problems, and/or complex problems. Case in point: consider a patient who presents to the emergency department with symptoms of a myocardial infarction. The history reveals that the patient has been under a lot of stress because a hurricane resulted in the loss of her home and the subsequent need to relocate. Although the initial care and management will focus on stabilizing the patient's physical condition, it will be important to address the potential mental health impacts related to her loss of home and sense of belonging. Therefore, the plan should include mental health screening. The impact will be 2-fold: to provide psychological support and to potentially improve her cardiac health because chronic compounded stress results in increased cortisol levels that have negative cardiovascular effects.[24] Climate-related environmental health challenges also overlap with well-known environmental exposures such as heat illness, heat stroke, and fluid and electrolyte imbalance that are well described in *Sheehy's Emergency Nursing Principles and Practices, 7th Edition*.[7] In this edition, Worley[7] also addresses environmental emergency content that has important relevance for the treatment of urgent climate symptoms and consequences.

A—ACT COMPREHENSIVELY TO ADDRESS PHYSIOLOGICAL AND PSYCHOLOGICAL CLIMATE SYMPTOMS

Formulating an action plan to address both physiological and psychological climate symptoms is key for the individual level of emergency care. Physiological symptoms require unique action plans that are driven by the patient's presenting diagnosis and level of acuity. Mental health consequences—particularly for those with previous mental health challenges—are also important to recognize and address. Early recognition of, and intervention with, patients at risk for climate-related mental health sequelae can reduce the occurrence of both acute and long-term impacts; acute impacts may include depression, anxiety, increased substance use, and long-term impacts may include post-traumatic stress disorder.[24] As an illustration, it would be a priority to attend to the physical needs of a patient who presents to the emergency department with trauma resulting from an extreme weather event such as a hurricane or flood because it would perhaps involve life- and/or limb-saving interventions. However, to mitigate psychological effects such as post-traumatic stress disorder, anxiety, or depression, initiating treatment such as

psychological first aid should be included in the planning and implementation of care[24] at the individual level of care.

The earlier "A" (Acting immediately to stabilize life- and limb-threatening conditions addressed in this mnemonic) should be followed up with the second "A" (Act comprehensively to address physiological and psychological climate symptoms). This stage should include the need to re-evaluate the effectiveness of initial interventions to stabilize the patient, continue ongoing monitoring and stabilization, following up on the return of diagnostic results, and alerting the interdisciplinary team of priority findings such as results consistent with rhabdomyolysis or disseminated intravascular coagulation.

T—TELL THE PATIENT EXPLICITLY IN WHAT WAYS CLIMATE CHANGE HAS INFLUENCED THEIR HEALTH

Since 2014, there has been an increase in the number of Americans who believe that the degree to which climate change is harming human health and will become more common is concerning.[29] On the basis of the results of a survey addressing 10 areas that focused on impacts related to extreme heat, severe storms and hurricanes, asthma and lung disease, wildfires, vector-borne disease, flooding, food- and waterborne illness, pollen-related allergies, severe anxiety, and depression, the authors found increases ranging from 13% to 28% across all categories. Of the 10 areas addressed, the 3 areas with the greatest change since 2014 include bodily harm from wildfires (28% change), bodily harm from flooding (25% change), and bodily harm from severe storms and hurricanes (21% change). Yet, only 4 in 10 Americans think that they will be personally harmed by climate change;[29] therefore, it is important to make explicit how climate change is affecting their health and incorporate strategies to mitigate negative health consequences and symptoms into patient education. Moreover, it is also important to offer an individualized patient approach and discuss ways to optimize the health co-benefits that come from adaptive strategies such as using alternative transportation options, including walking and biking. Patient education is a key role of the emergency clinician whereby there is explicit dialogue with the patient regarding the risk of a recurrence of a climate-change–related health consequence.

E—EVALUATE THE EFFECTIVENESS OF INTERVENTIONS AND ENSURE APPROPRIATE REFERRALS AND FOLLOW-UP

One of the most important roles that ED clinicians have is to initiate appropriate referrals on the basis of the individual patient's response to the interventions delivered. Most patients who are seen in the emergency department are either admitted to the hospital or discharged to home or another health care facility. It is critical that clinicians work collaboratively not only to provide safe, effective care, but also to ensure comprehensive handoffs that include information obtained from the climate-health history and physical assessment and the initiation of appropriate referrals. Patient education is a part of the discharge, admission, or transfer process, and a key aspect of the ED encounter. Using the example given above of the patient who presents with a myocardial infarction who reports increased life stressors such as losing her home during a hurricane, it would be important to ensure that a referral to a social worker or mental health provider—both during the inpatient stay and on discharge—be completed.

Application of the A CLIMATE Assessment Framework to a Case Review in the ED Setting

Table 2 illustrates a case involving an older adult with potential heat stroke—a common yet preventable life-threatening medical condition that is exacerbated in our climate-changing world. The patient is a 74-year-old woman who resides at home alone in low-income senior housing in a densely populated urban area. Applying the A CLIMATE framework allows for a comprehensive approach that can mitigate future climate-related events and ED admissions, thus addressing the likelihood that patients such as her receive optimal care and follow-up. Below is a description of how the A CLIMATE framework could be applied in the most favorable circumstances where the patient is successfully treated and well enough to be discharged home.

A—ACT IMMEDIATELY TO STABILIZE LIFE- AND LIMB-THREATENING CONDITIONS

It is essential for the emergency clinician to immediately assess this patient for priority interventions to address the critical first moments of rapid care in the emergency encounter. For this patient, prioritizing acute neurologic changes and the potential for a diagnosis of heat stroke or acute cerebrovascular accident/stroke are important differential diagnoses for the emergency clinician to consider and rapidly assess and plan urgent interventions to stabilize the patient.

C—CONSCIOUSLY CONSIDER THE HEALTH IMPACTS OF CLIMATE CHANGE SPECIFIC TO THE REGIONS IN WHICH YOU PRACTICE

In this case, it is important to take into consideration that the heat index has been above "32.22" °C (90 °F) for several days. Heat index accounts for the combined effects of

TABLE 2

Case example of vulnerable older adult presenting to emergency department with a heat-related illness

Background

This case takes place in early August in the northeast United States. The heat index has exceeded 32.22 °C (90 °F) for 4 days. The patient is a 74-year-old African American woman who lives in low-income senior housing in a heavily populated urban area. She does not have an air conditioner. The patient is found by her son in apparent distress; he calls 911.

Prehospital setting

The first responders find her to be febrile with acute neurologic changes (lethargic, confused, incoherent, and unable to follow commands), hypotensive, and tachycardic. Vital signs at the scene: temperature 40 °C (103.3 ºF) orally, HR 110 ST, BP 84/50, RR 30, and oxygen saturation 90% on room air. An intravenous line is placed, and a 500-mL bolus of normal saline is administered. The patient is transported to the local emergency department.

Emergency department

Past medical history: HTN (stage II), hypercholesterolemia, and mild congestive heart failure (diagnosed 10 y ago); ejection fraction 40%.

Social history: The patient lives alone in low-income urban senior housing. She is a retired US postal worker. Her apartment lacks air-conditioning, but she does have a fan. She receives Meals on Wheels 3 times a week. Her husband of 45 years died 10 years ago. She has 2 children who visit approximately every 2 to 3 weeks. Other than family, she has limited social interaction outside the housing complex, apart from an occasional visit with neighbors and a visiting nurse and social worker.

Family history: Mother had hypertension, history of a myocardial infarction. Father had diabetes and died from complications of stroke. Adult children with unknown health backgrounds.

Medications: Furosemide 80-mg by mouth daily; Lisinopril 20-mg by mouth daily; Metoprolol SR 50-mg by mouth daily; Simvastatin 20-mg by mouth daily.

Allergies: No known allergies.

Objective data

Vital signs: temperature 40 °C (102.5 ºF) core, HR 106 ST, BP 90/58, RR 28, and oxygen saturation 96% on 2-L/min nasal cannula.

Review of systems:

General: The patient is a 74-year-old African American woman; height 1.55 meters; weight 52.2 kilograms; no obvious signs of injury or distress noted; lying on stretcher; she is awake, unable to follow commands consistently, and appears restless. HEENT: Lips are pale and dry; buccal mucosa and tongue are dry; no nodes or masses palpated.

Neurologic: Oriented to person only; speech slurred; pupils are 3-mm equal and reactive to light and accommodation; no obvious focal deficits noted; difficult to assess systematically owing to patient's mental status. Moving limbs equally.

Cardiac: Normal S1, S2; no murmurs or bruits noted. Radial and distal pulses are 1+, equal bilaterally; +CSM; no peripheral edema noted. Decreased skin turgor, tenting noted.

Respiratory: Lungs are clear bilaterally; patient tachypneic but does not seem to be in distress; no nasal flaring or use of accessory muscles noted.

Abdominal/GI: Abdomen soft, nontender; bowel sounds present in all 4 quadrants; no pain; no masses; no bruits noted.

Musculoskeletal: Gait not assessed owing to neurologic changes. Hip flexion $< 90^{\circ}$.

Skin/dermatologic: Skin is hot, dry, and intact.

HR, heart rate; ST, sinus tachycarida; BP, blood pressure; RR, respiratory rate; HTN, hypertension; HEENT, head, eyes, ears, nose, throat; CSM, circulation, sensory and movement; GI, gastrointestinal.

temperature and humidity. When the relative humidity is high, the rate of evaporation, a process of cooling, decreases. In general, extreme caution should be taken when the heat index ranges from "32.22" to "40" °C (90-103 °F).[30] Health care providers should consider these climate-related factors and be aware that older adults are more vulnerable to heat-related illness. Understanding these environmental factors will help providers to proactively plan for potential surges related to climate-change–related illnesses such as in the patient case presented here. An example of a commonly found disease is Lyme disease—its spread is increasing owing to warming of the environment—which should also be consciously considered by ED clinicians.

L—LEARN FROM A CLIMATE–HEALTH HISTORY

The patient's age and socioeconomic status identify her as vulnerable to climate-related health impacts. In addition to her age, the patient's pre-existing conditions (congestive heart failure and hypertension) increased her risk for heat-related illness. Her medications also contributed to this risk. For instance, taking a diuretic in the context of a

prolonged high heat index will exacerbate dehydration, and cardiac medications such as Metoprolol can further decrease cardiac output. The patient presented with both tachycardia and hypotension in the emergency department, despite having Metoprolol prescribed. Moreover, it is important to note that the patient does not have an air conditioner at home, which also contributed to her current condition, and that she lives in an urban heat island. Furthermore, her history revealed that she has minimal social contacts. Social isolation, particularly in older adults, is a risk factor for developing heat-related illness.

I—INDIVIDUALIZE A CLIMATE-AND-HEALTH–FOCUSED ASSESSMENT TO ENSURE RELEVANT, CLIMATE-RELATED IMPACTS ARE ADDRESSED

Whereas heat stroke is part of the differential diagnosis, there are other diagnoses to consider, such as acute stroke, encephalitis, and infection/sepsis.[31] Taken together, her history and physical examination indicate signs and symptoms of heat stress or stroke and also suggest objective signs of other potential diagnoses. Therefore, considering a heat-related illness as a potential diagnosis is important. ED clinicians have recognized and treated heat stress and heat stroke in ED settings for years. However, with the increase in ambient heat in our climate-changing world, there is a significantly increased prevalence of heat-related illness in vulnerable populations, including older adults, children, and occupational workers that may include farmworkers, construction workers, and others exposed to heat.[32,33]

M—MANAGE ACUTE, CHRONIC, AND COMPLEX CLIMATE-AND-HEALTH CONSEQUENCES

Given the emergent nature of heat stroke, interventions should not be delayed while other diagnoses are being ruled out. Interventions for cooling for a likely diagnosis of heat stroke while obtaining a computed tomography scan to rule out a cerebrovascular accident/stroke and considering other possible differential diagnoses are critical for the ED clinician. It is important to consider the potential for a diagnosis of heat stroke to avoid progression of the condition, which may lead to organ failure and death.[31] In addition to ruling out other diagnoses, it is a priority that interventions aimed at decreasing the patient's temperature and rehydrating her (while monitoring her carefully, given her diagnosis of congestive heart failure) is an important priority of the entire ED team.

A—ACT COMPREHENSIVELY TO ADDRESS PHYSIOLOGICAL AND PSYCHOLOGICAL CLIMATE SYMPTOMS

It is unclear if the patient has significant mental health sequelae from this event. Physiological and psychological climate symptoms are important in the assessment. These may include disorientation, delirium, and agitation as both physiological and psychological manifestations. However, it can be very distressing for patients who are confused and who may be aware of their actions and behaviors while disoriented. Therefore, it would be important to explore this with the patient and her family once she is stabilized. This aspect of the plan of care would also be inclusive of a comprehensive understanding of her baseline neurocognitive status. Teaching the family the importance of a daily check-in during hot weather and perhaps every day should also be incorporated in the action plan.

T—TELL THE PATIENT EXPLICITLY IN WHAT WAYS CLIMATE CHANGE HAS INFLUENCED THEIR HEALTH

Once the patient has stabilized and her neurologic status has returned to baseline, it will be important to begin patient education and discharge teaching. Communication with patients and families is critical to address population health needs related to climate change and its health impacts.[34] Information that should be discussed and reinforced include the following:

- What are heat-related illnesses and how can they be prevented?
- The importance of staying hydrated and the changes to perceptions of thirst that occur in older adults.
- The importance of avoiding errands, going outdoors during peak temperatures.
- How medications can impact hydration status and heart rate and blood pressure.
- Strategies for cooling such as air conditioners (if financially feasible), shades to block the sun, or local cooling centers.
- What kinds of symptoms should be reported to her primary care provider?

E—EVALUATE THE EFFECTIVENESS OF INTERVENTIONS AND ENSURE APPROPRIATE REFERRALS AND FOLLOW-UP

The patient should be referred to her primary care physician and a comprehensive team to optimize her home care and for follow-up. A referral for a visiting nurse is necessary to

continue physiological monitoring, medication teaching, and home safety. Other key members of her home care team can be engaged by the case management team and should include a home health aide, occupational therapist, physical therapist, and social worker. An occupational therapy practitioner referral would be beneficial to assess her home to determine if there are environmental factors contributing to her potential for heat-related illness, whereas a physical therapist can work on strength training and mobility. A social worker referral will also be important to ensure that she is optimizing the services for which she qualifies, such as Meals on Wheels and other elder services located in her community. Initiating other available services can also reduce her level of social isolation and minimize her chances of having another heat-related event. Implementing a comprehensive, interprofessional approach to care is critical for at-risk older adults, particularly because the frequency, intensity, and duration of extreme heat events is increasing. Education of patients about cooling centers and public spaces that can be accessed to offset exposure to heat during periods of high ambient temperatures is important. Social work or community programs that donate or support funds for air conditioners or fans for those with chronic illnesses may be another opportunity for referral. Daily check-in by the individual's professional care team and family during heat-related weather events and perhaps daily on a regular basis are important aspects of follow-up care.

Conclusion

The emergency nurse, along with the interdisciplinary team, must intervene to reduce the impacts of climate change on health, particularly for vulnerable populations who frequently use the emergency department for acute, chronic, and complex health problems. Using the A CLIMATE framework and mnemonic may increase the ability for emergency nurses and clinicians to uncover climate-related health challenges, increase screening of patients, offer interventions, and address education for those at risk of the deleterious health consequences of climate change. This framework may guide emergency specialty practice in our climate-changing world and address the important focus on symptom identification; management; gathering a comprehensive health history; in-depth physical examination; and accurate diagnosis, intervention, referral, and follow-up. Although the prevalence of climate-change–related health consequences is increasing, intervention by emergency nurses and other health professionals is imperative to optimizing professional care.

Acknowledgments

The authors gratefully acknowledge the editorial assistance of Jessica Castner, PhD, RN, CEN, AE-C, FAEN, FAAN, Editor-in-Chief, *Journal of Emergency Nursing*.

Author Disclosures

Conflicts of interest: none to report.

Supplementary Data

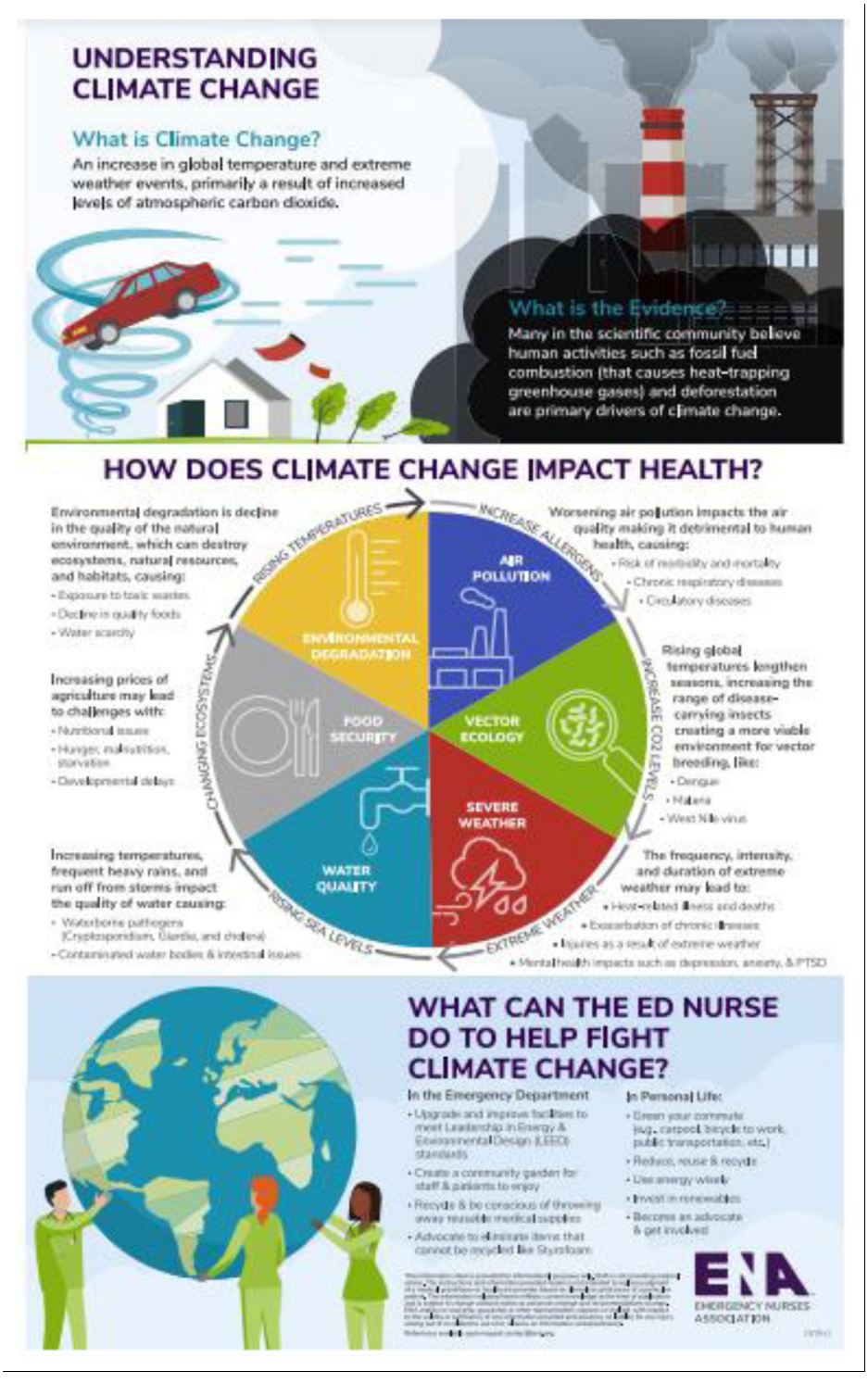
Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2020.10.002.

REFERENCES

1. Crimmins AJ, Balbus J, Gamble JL, et al. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. *U.S. Global Change Research Program*. 2016:1-24.
2. Haines A, Ebi K. The imperative for climate action to protect health. *N Engl J Med*. 2019;380:263-273. https://doi.org/10.1056/NEJMra1807873
3. Intergovernmental Panel on Climate Change, 2014a. AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability. https://www.ipcc.ch/report/ar5/wg2/
4. Intergovernmental Panel on Climate Change. Summary for policymakers, Special Report: Global Warming of 1.5 °C. *World Meteorological Organization*. 2018:32.
5. Watts N, Amann M, Arnell N, et al. The 2018 report of the Lancet countdown on health and climate change: shaping the health of nations for centuries to come. *Lancet*. 2018;392(10163):2479-2514. https://doi.org/10.1016/S0140-6736(18)32594-7. Published correction appears in Lancet. 2020;395(10239):1762.
6. Watts N, Amann M, Arnell N, et al. The 2019 report of the Lancet countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet*. 2019;394(10211):1836-1878. https://doi.org/10.1016/S0140-6736(19)32596-6
7. Sheehy SB, Hammond BB, Zimmermann PG. Sheehy's manual of emergency care. 7th ed. Philadelphia: Elsevier/Mosby; 2013.
8. Salas RN, Knappenberger P, Hess JJ. Lancet countdown on health and climate change: brief for the United States of America. American Public Health Association. Published 2018. Accessed November 4, 2020. https://storage.googleapis.com/lancet-countdown/2019/10/2018-lancet-countdown-policy-brief-usa.pdf
9. Salas RN, Knappenberger P, Hess JJ. Lancet countdown on health and climate change: brief for the United States of America. American Public Health Association. Published November 2019. Accessed November 4, 2020. https://www.lancetcountdownus.org/2019-lancet-countdown-us-brief

10. American Nurses Association. ANA's Principles of environmental health for nursing practice with implementation strategies. Published November 1, 2007. Accessed November 4, 2020. http://ojin.nursingworld.org/MainMenuCategories/WorkplaceSafety/Healthy-Nurse/ANAsPrinciplesofEnvironmentalHealthforNursingPractice.pdf
11. Schenk EC. Environmental stewardship in nursing: introducing the "WE ACT-PLEASE" framework. *Creat Nurs*. 2019;25(3):222-230. https://doi.org/10.1891/1078-4535.25.3.222
12. American Nurses Association. *Scope and Standards of Practice: The Essence of the Profession.* 3rd ed. American Nurses Association; 2015.
13. American Nurses Association. *Code of Ethics for Nurses With Interpretive Statements*. American Nurses Association; 2015.
14. American Nurses Association. *Nursing's Social Policy Statement*. American Nurses Association; 2004.
15. Lilienfeld E, Nicholas PK, Breakey S, Corless IB. Addressing climate change through a nursing lens within the framework of the United Nations sustainable development goals. *Nurs Outlook*. 2018;66:482-494. https://doi.org/10.1016/j.outlook.2018.06.010
16. Centers for Disease Control and Prevention. CDC's Building Resilience Against Climate Effects (BRACE) Framework. U.S. Department of Health and Human Services. Accessed November 4, 2020. https://www.cdc.gov/climateandhealth/BRACE.htm
17. Rifkin DI, Long MW, Perry MJ. Climate change and sleep: a systematic review of the literature and conceptual framework. *Sleep Med Rev*. 2018;42:3-9. https://doi.org/10.1016/j.smrv.2018.07.007
18. Berry JL, Bowen K, Kjellstrom T. Climate change and mental health: a causal pathways framework. *Int J Public Health*. 2010;55(2):123-132. https://doi.org/10.1007/s00038-009-0112-0
19. Weaver CP, Miller CA. A framework for climate change-related research to inform environmental protection. *Environ Manage*. 2019;64(3):245-257. https://doi.org/10.1007/s00267-019-01189-0
20. Mawardi F, Lestari AS, Randita ABT, Kambey DR, Prijambada ID. Strengthening primary health care: emergency and disaster preparedness in community with multidisciplinary approach. *Disaster Med Public Health Prep*. Published online July 9, 2020. https://doi.org/10.1017/dmp.2020.143
21. Balbus JA, Crimmins A, Gamble JL, et al. *Climate change and human health*. In: *The Impacts of Climate Change on Human Health in the United States: a Scientific Assessment*. U.S. Global Change Research Program; 2016:25-42.
22. Bell JE, Herring SC, Jantarasami L, et al. Ch. 4*: impacts of extreme events on human health*. In: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. U.S. Global Change Research Program; 2016:99-128.
23. Sarofim MC, Saha S, Hawkins MD, et al. Ch. 2*: temperature-related death and illness*. In: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. U.S. Global Change Research Program; 2016:43-68.
24. Clayton S, Manning C, Krygsman K, Speiser M. *Mental Health and Our Changing Climate: Impacts, Implications, and Guidance*. American Psychological Association and EcoAmerica; 2017.
25. Gamble JL, Balbus J, Berger M, Bouye K, Campbell V, Chief K, Wolkin AF. Populations of concern. In: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. U.S. Global Change Research Program; 2016.
26. Hastings M. Climate change impact and the role of the emergency nurse. *J Emerg Nurs*. 2020;46(4):407-409. https://doi.org/10.1016/j.jen.2020.05.007
27. Wong LP, Haridah A, Nasrin A, Sima A, Nik MNS. Physical, psychological, and social health impact of temperature rise due to urban heat island phenomenon and its associated factors. *Biomed Environ Sci*. 2018;31(7):545-550. https://doi.org/10.3967/bes2018.074
28. GCCHE Advisory Council and Coordinating Committee. *Global consortium on climate and health education (GCCHE) core climate & health competencies for health professionals*. Columbia University; 2018.
29. Leiserowitz A, Maibach E, Rosenthal S, et al. Climate change in the American mind: April 2019. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication. Published June 27, 2019. Accessed November 4, 2020. https://climatecommunication.yale.edu/wp-content/uploads/2019/06/Climate_Change_American_Mind_April_2019c.pdf
30. National Weather Service. What is the heat index? National Oceanic and Atmospheric Administration. Accessed July 15, 2020. https://www.weather.gov/ama/heatindex
31. Bouchama A, Knochel JP. Heat stroke. *N Engl J Med*. 2002;346(25):1978-1988. https://doi.org/10.1056/NEJMra011089
32. Mac VVT, McCauley LA. Farmworker vulnerability to heat hazards: a conceptual framework. *J Nurs Sch*. 2017;49(6):617-624. https://doi.org/10.1111/jnu.12327
33. Mutic AD, Mix JM, Elon L, et al. Classification of heat-related illness symptoms among Florida farmworkers. *J Nurs Scholarsh*. 2018;50(1):74-82. https://doi.org/10.1111/jnu.12355
34. Ros Av, LaRocque R, Fortinsky R, Nicholas P. Addressing climate change communication: effective engagement of populations for climate action in the US and globally. *Ann Glob Health*. 2020;86(1):54. https://doi.org/10.5334/aogh.2900

Supplementary Data



SUPPLEMENTARY FIGURE

Understanding climate change and the role of the emergency nurse. (Reproduced with permission from the Emergency Nurses Association.)

Migrating Swollen Joint and Lyme Disease: A Case Report

Authors: Jose Baez, MD, and Heidi Suffoletto, MD, Buffalo, NY

CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

- The current literature on Lyme disease indicates that early treatment can help prevent progression to early and late disseminated disease, which often lead to conditions such as heart block, Bell palsy, and arthritis.
- This case report highlights the importance of prompt diagnosis of Lyme disease and the different diagnostic modalities that can assist providers in establishing a diagnosis.
- Key implications for emergency nursing practice found in this article are remembering to keep tick-borne illnesses high on the differential in patients presenting with a history of joint pain/swelling, rash, and influenza-like symptoms.

Abstract

This article discusses a case involving a pediatric patient who presented to a large urban children's hospital in the Northeastern United States with complaints of migratory monoarticular joint swelling. The patient had presented with a swollen and painful left knee but with no other associated symptoms. He was nontoxic appearing, afebrile, and had normal vital signs. On examination, he was noted to have a tender and swollen left knee that was not erythematous, bruised, or warm to the touch. There was a history of fevers over the summer after returning home from a camping trip in a park located in the northeastern United States. A plain film knee x-ray showed signs of joint effusion but no osseous abnormalities. A bedside ultrasonography of the knee showed a pocket of fluid in the joint space. With parental consent, the left knee joint was aspirated under direct ultrasound guidance, with collection of dark yellow synovial fluid. This was sent for analysis that included cultures, Gram stain, crystal analysis, and Lyme antigens. The patient was admitted, and his symptoms improved during his hospitalization. The results were positive for Lyme and he was discharged home on a 3-week course of Amoxicillin with complete resolution of his symptoms.

Key words: Lyme disease; Joint effusion; Migratory arthritis; Erythema migrans; Case report

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J Emerg Nurs 2021;47:543–550.
Available online 11 June 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.04.009

Introduction

A 9-year-old boy was brought into the children's hospital emergency department for evaluation of left knee pain and swelling for the past 2 days. The patient was seen ambulating with the assistance of crutches to his room. His parents had been giving him ibuprofen and Tylenol with mild relief of symptoms. He was afebrile with normal vital signs. Of note, he had been dealing with intermittent pain and swelling of the right knee for nearly 2 weeks, which had spontaneously resolved the day before the onset of his left knee swelling. He denied any antecedent trauma or injury to either knee. He also denied having any other symptoms such as fever, chills, nausea, vomiting, cough, or a rash in the recent past. He was an otherwise healthy boy with up-to-date vaccinations and no known medical problems.

From the history provided by his mother, the patient spontaneously developed right knee pain and swelling nearly 2 weeks ago. He had been in his usual state of health and had no recent illnesses or infections. Other than his knee, no other joints were affected. He was not involved in any sports or any recent bicycle or motor vehicle accidents. One week prior, he was evaluated at an outpatient orthopedic clinic for the right knee pain and swelling. At that

facility, the staff obtained knee x-rays that were reportedly unremarkable. He was sent home with a plan in place for him to return to the clinic for a magnetic resonance imaging scan of the right knee if his symptoms persisted. There was no family history of rheumatoid arthritis, juvenile idiopathic arthritis (JIA), or any other rheumatologic or autoimmune disease. No recent travel outside the country or visits to parks within the past few weeks were reported. It was noted that he did go camping with his father approximately 2 months before the onset of symptoms. They went on a 3- to 4-day trip to a local state park. Shortly after returning home, he developed intermittent fevers with no associated rash, cough, chest pain, vomiting, or diarrhea. He denied any tick or bug bites.

On physical examination, the patient's left knee was visibly swollen compared with his right. It was not erythematous or warm to the touch. There was no obvious bruising or deformity of the knee. He had mild pain on active and passive motion of the knee joint. He had no significant pain on valgus or varus stress of the knee and no laxity, clicks, or obvious knee dislocation. Overall, the patient was noted to have normal strength, tone, and reflexes. Lower extremity pulses were normal, and capillary refill was less than 2 seconds. The rest of his physical examination was unremarkable, with no murmurs auscultated, rashes appreciated, or erythema of the tympanic membranes or adenoids detected.

The Painful and Swollen Knee

The etiology of a painful or swollen knee in any pediatric patient is largely broken down into 2 categories: traumatic or atraumatic. With traumatic knee injuries, the signs and symptoms can be obvious or subtle, depending on the clinical presentation and physical examination. Although a small compartment, the knee is associated with multiple bony, ligamentous, and muscular components.[1] Among many other things, the pain and swelling could be a result of a patellar fracture or dislocation; distal femur, proximal tibia, and/or fibula fracture or contusion; or a complete/incomplete medial, lateral, or anterior collateral ligament tear. Workup and management generally involve imaging, pain relief, provision of assistive devices, and possible orthopedic follow-up. A subgroup may need admission for operative repair. With atraumatic injuries, the history and associated symptoms play a large role in establishing a diagnosis. The differential can be vast and may include diseases such as septic arthritis, JIA, rheumatoid arthritis, and Lyme disease. There can be a family history component, particularly with many of the autoimmune diseases. It can also be a consequence of a medical condition such as lupus or rheumatic fever. These results, however, do not indicate whether this is an acute or past infection. At presentation, the patient was afebrile and did not exhibit symptoms of strep throat, such as sore throat, swelling, or exudates.

Lyme Disease

Lyme disease is a tick-borne illness that is caused by the *Borrelia burgdorferi* bacterium. Multiple ticks carry and transmit the disease, but in the United States the most common Lyme-carrying tick is *Ixodes scapularis*.[2] The tick itself is normally carried by deer and mice and, as a result, can spread over long distances.[2,3] This disease-carrying tick is endemic to the Northeast, and there are more than 300 000 people affected yearly, although only a small percentage of the affected individuals go on to develop symptoms.[3] When symptomatic, the disease has a broad spectrum of clinical manifestations that can vary in severity and length.

For an individual to develop Lyme disease, the tick must be latched onto their body for approximately 36 to 48 hours. If the tick is present for less time, the likelihood of transmission is low.[4] Those at greatest risk are typically campers or hikers in the Northeastern portions of the United States who are not wearing protective long-sleeve clothing or approved repellents. Spring and summer tend to be the most common seasons when people are affected. Once infected, most people tend to develop symptoms within 1 to 2 weeks.[1,5] The most common sign and presenting symptom of Lyme disease is a rash called erythema migrans, which is also known as a bull's-eye rash owing to its appearance on the skin. This is the presenting feature in approximately 70% to 80% of those affected by Lyme disease.[4,6] The rash itself does not tend to be pruritic or painful in nature and does not develop associated vesicles or bullae. It is found wherever the tick bite occurred, a bite that most of those affected do not remember getting or one that was attributed to being caused by another insect such as a mosquito. From here forward, the clinical manifestations of Lyme are broken into 3 categories: early localized, early disseminated, and late disseminated disease.[4,7]

Early localized disease is defined by a constellation of relatively nonspecific symptoms. Although the appearance of erythema migrans at the bite site is pathognomonic, it is not always present. The most common areas affected are the arms, legs, and skin folds. With the development of the rash come influenza-like symptoms such as fever, chills, fatigue, myalgias, and headaches.[5] A prospective study involving 79 patients with known Lyme disease found that fatigue was the most common complaint at 54%, followed

by myalgias and headaches, at 42% and 44%, respectively.[4] The presence of upper respiratory or gastrointestinal symptoms is rare and could suggest a different etiology. Early disseminated disease tends to occur weeks to months after the initial infection. It is characterized by a multitude of neurologic manifestations. These include meningitis, peripheral neuropathy, and facial palsies. A small percentage of patients will present to the hospital with bilateral facial palsy. Early disseminated disease may also manifest with cardiac complications, the most well known being atrioventricular nodal heart block.[8] Late disseminated disease tends to occur months to years later. In this group of patients, identifying Lyme as a possible cause of their symptoms can be difficult because a subset of individuals lack the earlier manifestations of Lyme disease. Approximately 50% to 60% of those untreated for Lyme disease will go on to develop migratory arthritis, as in our patient.[1,4] On presentation to the emergency department, the patient had developed these symptoms nearly 2 months after the suspected time of infection. The more commonly affected joints include the hip, knee, and elbow. Other manifestations of late disseminated disease include peripheral neuropathy, encephalopathy, and cutaneous rashes.[4]

The diagnosis of Lyme disease requires analysis of body fluids for antigens specific for Lyme. The use of Western blot and enzyme-linked immunosorbent assay is the most common method in establishing the diagnosis of Lyme because these tests have both high sensitivity and specificity.[2,9] The accepted protocol at most institutions involves a two-step confirmation process. The first step is to start with the enzyme-linked immunosorbent assay and then move on to the Western blot if the initial test is positive or equivocal. The Centers for Disease Control and Prevention, which focuses on infectious disease control and prevention, emphasizes this 2-step process. Because it takes time for the body to make antibodies, it is suggested that Lyme testing should occur 3 to 4 weeks after the presumed exposure.[4]

In confirmed cases of Lyme disease, it is imperative to treat the patients with antibiotics to prevent the progression of the condition. The first-line antibiotic for the treatment of early Lyme disease is doxycycline. Doxycycline is not only useful for Lyme, but also for other diseases carried by these ticks. It is highly effective against the disease but should be avoided in children aged below 8 years and women who are pregnant or breastfeeding owing to the risk of permanent teeth discoloration. The alternatives include Amoxicillin, Augmentin, and Azithromycin.[5,10] In those with disseminated or late-stage Lyme disease, intravenous cefTRIAXone is first-line treatment, with doxycycline and cephalosporins such as Cefotaxime serving as second-line alternatives. On average, the length of treatment will be between 2 and 4 weeks. Those who present with severe disease such as meningitis or encephalitis will require admission and intravenous antibiotics.[1] The antibiotics of choice include cefTRIAXone and Cefotaxime. Adjunct therapies include Tylenol and ibuprofen for joint pain and potentially a pacemaker in those who develop second-degree type 2 or complete heart block.[8] The use of corticosteroids should be avoided even in those who develop neurologic complications because they have not shown benefit in prior studies.[3]

Other Considerations

Not all ticks cause Lyme disease, and it is important to be able to distinguish erythema migrans from other rashes when considering the diagnosis of Lyme disease. Cellulitis, viral rash, or bites from other organisms can lead providers down inaccurate diagnostic pathways. Cellulitis tends to be more confluent in nature and lacks the central clearing of erythema migrans. Bites from spiders, for example, tend to be more pruritic, painful, and likely have a necrotic center compared with what is seen in Lyme disease. In addition, it is imperative to rule out conditions such as septic arthritis and osteomyelitis. The following are a few of the many conditions one must consider when a patient with a similar story to this case seeks treatment in the emergency department. It is the physical examination, history, symptoms, laboratory tests, and location that will help providers make the proper diagnosis.

JIA is a condition that generally affects younger children and is characterized by swelling and pain of multiple joints.[11,12] It tends to occur unexpectedly and is noticed by the parents when they see the child limping. Many of these patients have pain and swelling that are noted earlier in the day but later completely resolve on their own.[11] Although the joint may feel warm and be swollen as well as tender to touch, these patients rarely have the constitutional symptoms one would expect with Lyme disease.[12] No specific markers are available to test for JIA, although inflammatory markers such as erythrocyte sedimentation rate (ESR) may be useful. The diagnosis is more likely to be one of exclusion.[11] There are subsets of JIA, such as systemic JIA and polyarticular JIA, that can make it more difficult to form a diagnosis because these can have systemic symptoms associated.[11] This is where obtaining Lyme titers can help the provider not to miss the diagnosis.

Southern tick–associated rash illness (STARI) is a disease caused by another common tick, in this case the lone star tick. Like Lyme, STARI is characterized by the appearance of erythema migrans and influenza-like symptoms.[13] Its distribution is usually in the Southern and Midwestern

states compared with the Eastern and Northeastern states where Lyme is endemic.[13] Unlike Lyme, there are no specific tests to confirm the diagnosis, and the presence of Lyme titers is very useful in ruling in Lyme as the etiology. Overall, the rash and symptoms that accompany STARI are less significant than those that accompany Lyme. There are rarely any long-term consequences such as arthritis and heart block. Of note, STARI can be treated with the same antibiotics as Lyme disease.

Babesiosis is a disease caused by protozoa, most commonly *Babesia microti*, that are carried by certain ticks in the US.[14] It is most endemic to the Midwestern US, although there are documented cases in the Northeast as well.[14] Generally, people who are affected are asymptomatic. Otherwise, the most common symptoms are fever and hemolytic anemia. The incubation period is generally 2 to 4 weeks before the onset of symptoms. The patients otherwise develop generalized influenza-like symptoms and recover within 1 to 2 weeks. A small percentage can go on to develop high fevers, severe anemia, and multiorgan failure, leading to death.[15] Unlike in the case of Lyme, a rash is rare, and the appearance of a rash should heighten suspicion of Lyme co-infection or another etiology. Diagnosis is obtained by identification on a blood smear and looking for the pathognomonic Maltese cross formation.[14,15] Certain laboratories may also perform serologic and polymerase chain reaction testing for babesiosis. Treatment is usually successful after 1 to 2 weeks of antibiotics. The treatment of choice is a combination of Azithromycin and Atovaquone.[14,15]

Rocky Mountain spotted fever (RMSF) is a disease caused by the *Rickettsia rickettsii* bacterium that is primarily found in the tick *Dermacentor variabilis.*[16,17] The incidence of RMSF is most common during the summer months, and although it is present throughout most of the United States, the highest incidence occurs in the Central, Southeastern, and Northern United States.[16] Once the disease has been transmitted from the tick to the human host, the severity of illness is broad, ranging from a mild influenza-like illness to death. The average incubation period is between 5 and 14 days.[18] The current death rate for the disease is approximately 0.5%. As in the case of Lyme disease, the hallmark of RMSF is a rash. Unlike individuals affected with Lyme, those affected with RMSF do not develop erythema migrans. The rash is a blanching erythematous rash that usually begins on the wrist and ankles and then spreads to the trunk.[17,18] This helps in aiding providers to distinguish the 2 rashes, but it is important to remember that not all cases feature a rash. Laboratory tests may aid in the diagnosis, with notable hyponatremia, thrombocytopenia, and elevated liver function enzymes.[16,17] Treatment is similar to that for other tick-borne illnesses, with doxycycline being the first-line antibiotic even for children and pregnant women.[18]

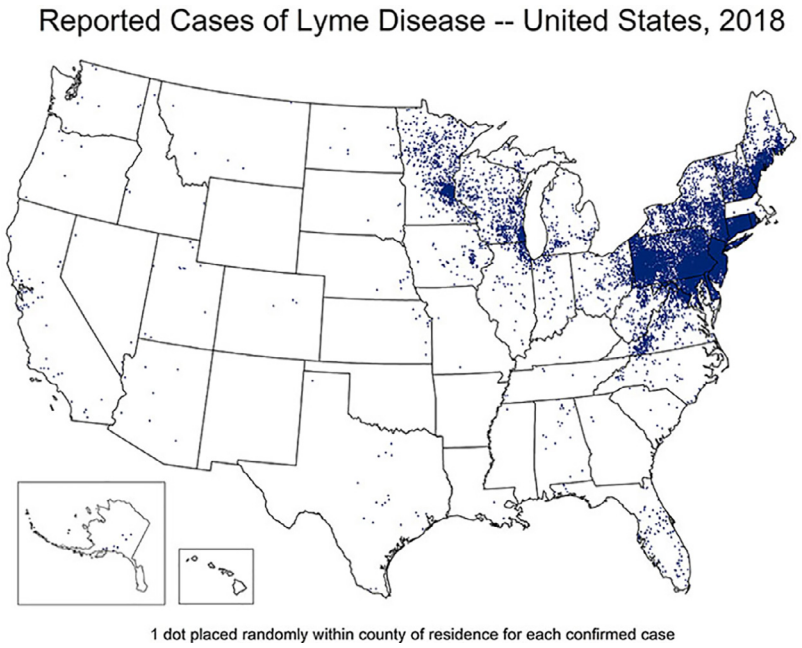

FIGURE 1

Geographical distribution of reported Lyme cases in the United States (2018). Copyright: Materials developed by the Centers for Disease Control and Prevention (CDC).

Return to the Case

A plain film knee x-ray was obtained that showed a joint effusion but no osseous abnormalities. A bedside ultrasonography of the left knee was performed and demonstrated a moderate-sized knee effusion. After parental consent was obtained, knee arthrocentesis under direct ultrasound guidance was performed, and approximately 7 to 8 cc of dark yellow fluid was obtained and sent for laboratory analysis. Figures 2 through 4 are images of the bedside ultrasonography showing a collection of fluid in the patient's left knee joint space.

Owing to concern regarding an infectious or autoimmune etiology, laboratory tests were obtained that included complete blood count, comprehensive metabolic panel, ESR, and C-reactive protein. The synovial fluid was sent for culture, cell count, Lyme, and crystal analysis. During this time the patient was given ibuprofen, which, combined with the removal of synovial fluid from the left knee, significantly improved the patient's pain. The patient was admitted while laboratory test results were still pending. At that time, the orthopedics service staff were consulted for their recommendations in this case. In addition to what had already been done, they recommended an infectious disease consult. The patient was found to have positive antistreptolysin and anti-DNase antibodies, which are indicative of a prior streptococcal infection such as streptococcal pharyngitis or rheumatic fever.[1,5]

While admitted, the patient's clinical course was unremarkable, and he remained stable. The laboratory test results indicated no significant leukocytosis or bandemia and a normal ESR but an elevated C-reactive protein level. Additional laboratory tests were performed, and these showed a negative rheumatoid factor, positive antinuclear antibodies with low titers, and positive antistreptolysin and anti-DNase antibodies. His synovial fluid analysis showed 37 000 white blood cells but no growth or organisms, and it was negative for crystals but positive for Lyme disease. In addition, he was noted to have high Lyme titers. He was sent home after 1 day in the hospital on a 3-week course of Amoxicillin 500 mg 3 times a day. The patient did well on the antibiotics with no complications or adverse effects. His symptoms resolved, and he did not develop any other clinical manifestations of Lyme disease.

Discussion

Lyme disease is an infectious disease caused by the *Borrelia burgdorferi* bacterium. The *Ixodes scapularis* tick is the most common vector that carries this bacterium and helps its spread. These ticks are most commonly found in the Eastern and Northeastern United States and are normally

FIGURE 2
Transverse view of left knee joint effusion.

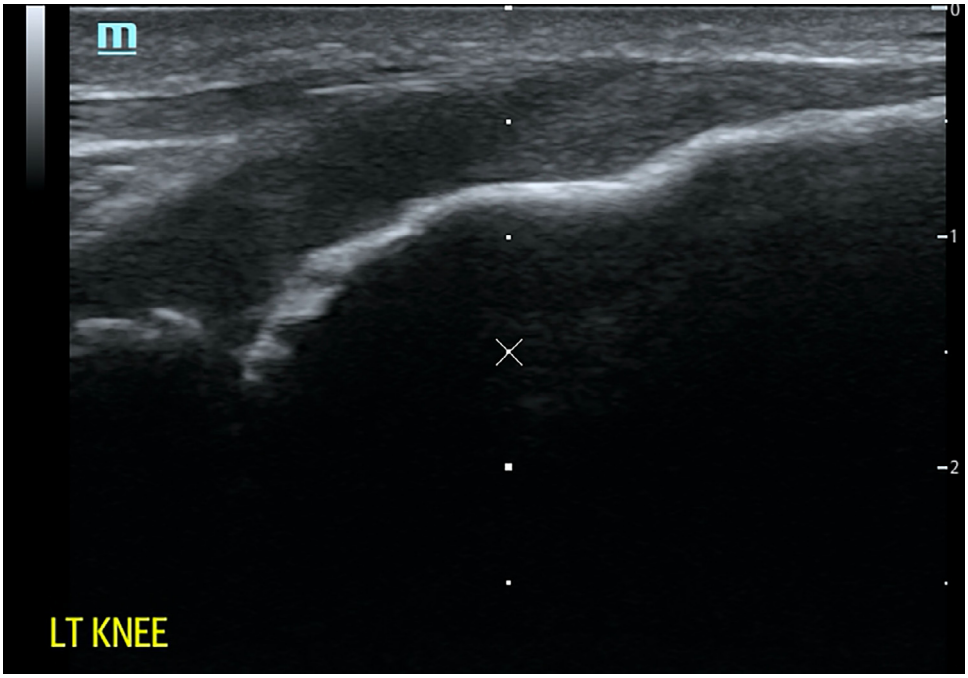

FIGURE 3
Longitudinal view of left knee joint effusion.

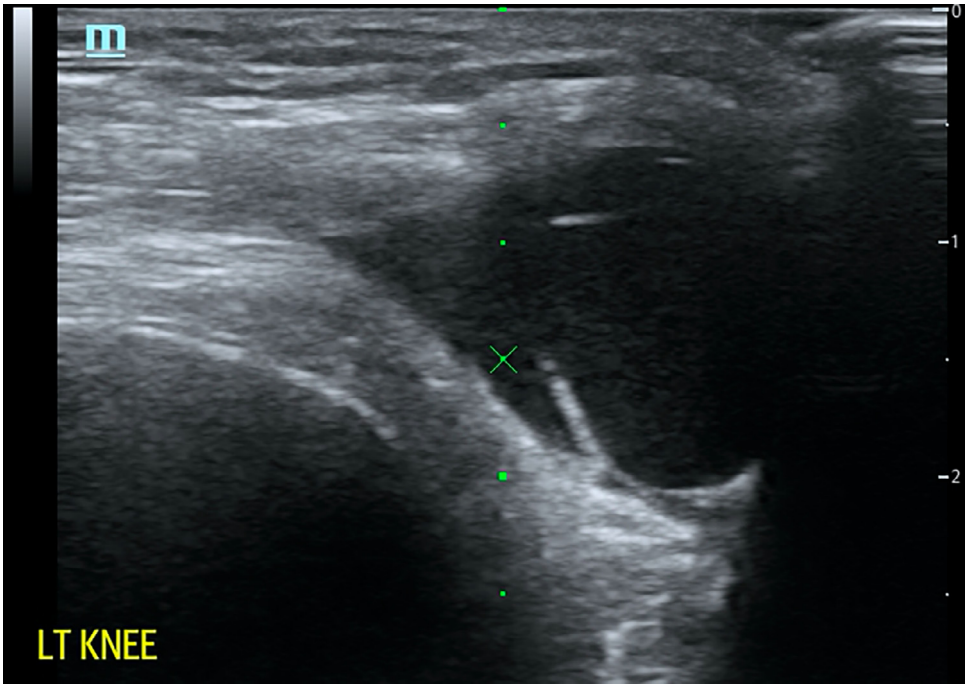

FIGURE 4
Partial visualization of the needle in the left knee joint space, indicated by the hyperechoic (bright) line next to the green "X."

found on animals such as deer. Those at the highest risk of infection include hikers and campers who do not wear or use protective gear. This includes using repellents and wearing long-sleeve clothing. For one to develop Lyme disease, the tick must be attached for a period of at least 36 hours after which the patient will begin to manifest symptoms within the next 1 to 2 weeks.

The early stages of Lyme disease are characterized by influenza-like symptoms and, at times, the distinctive bull's-eye rash known as erythema migrans. Not making a diagnosis soon enough or patients not presenting early enough for treatment puts patients at risk of developing early and late disseminated disease. This leads to the possible development of heart block, Bell palsy, and other conditions. The presence of migratory arthritis, rash, unexplained fevers, and influenza-like symptoms should prompt exploration of possible Lyme disease infection, especially in areas where the incidence is high. When there is a suspicion of Lyme, it is essential to explore and extract the right history and risk factors during history taking. Other tick-borne illnesses and rashes must be excluded as much as possible through the history and physical examination. One must then rely on modalities of examination such as x-rays and laboratory tests. The use of ultrasound is useful in evaluating swollen joints and in obtaining fluid samples when performing joint aspiration, as was the case with our patient. The treatment of choice is doxycycline in all patients, except for children aged below 8 years and pregnant women. Many of the other tick-borne illnesses that can mimic Lyme disease or make the diagnosis difficult are conveniently treated with the same antibiotics.

Implications for Emergency Clinical Care

Emergency nurses play a vital role in assisting providers with a differential diagnosis and executing the plan of care. They are usually the first ones to see the patient and overall spend more time than the providers with the patient and their family. Once triaged and brought into a room, it is important that any patient with complaints of rash or influenza-like symptoms be undressed and placed in a gown. Emergency nurses are astute at asking the right questions and identifying any abnormalities on physical examination. They may identify information or findings that were missed on the provider's physical examination. It is important that open lines of communication are maintained between emergency nurses and providers to assist in establishing an accurate diagnosis.

The differential in a case like this is broad. Patients and families may not remember a tick bite that occurred a few weeks before the onset of their symptoms. It is important to identify the small clues provided by patients and families. In cases of atraumatic joint pain and swelling, rheumatologic and infectious conditions should be at the top of the list of differential diagnoses. It is critical to promptly diagnose Lyme disease or other tick-borne illnesses to prevent severe or lifelong consequences.

Conclusion

Overall, this patient's presentation was a classic example of the manifestation and disease progression of Lyme disease. The patient's presentation, combined with his symptoms, helped to broaden the differential and lead us to our diagnosis. The history of camping during the summertime along with what the family thought were innocuous fevers further gave rise to the suspicion that Lyme disease could potentially be the culprit. A thorough physical examination and use of ultrasonography allowed us to hone in on these suspicions and execute the appropriate plan of care. This plan included laboratory workup and a knee arthrocentesis. The results showed Lyme titers, and the patient was placed on appropriate antibiotics, which led to a resolution of symptoms and avoidance of further complications. Depending on the geographic location, the differential may change. A provider in Arizona will have Rocky Mountain Spotted Fever higher up in their differential than one who is seeing patients in New Hampshire. It is important to have some knowledge of the epidemiology of tick-borne illnesses and their overall distribution across the United States to provide the best possible care and prevent lifelong health consequences.

Author Disclosures

Conflicts of interest: none to report.

Ethical statement of consent: Parental consent was obtained for the publication of the case and images. There is no identifying information in the case report, nor is there any identifying information in the ultrasound images published. This case adheres to Elsevier's patient consent policy.

REFERENCES

1. Tintinalli J. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. 8th ed. New York, NY: McGraw-Hill Education; 2016.
2. Steere AC, Strle F, Worser GP, et al. Lyme borreliosis. *Nat Rev Dis Primers*. 2016;2:16090. https://doi.org/10.1038/nrdp.2016.90
3. Rosenberg R, Lindsey NP, Fischer M, et al. Vital signs: trends in reported vectorborne disease cases — United States and territories, 2004-2016. *MMWR Morb Mortal Wkly Rep*. 2018;67(17):96. https://doi.org/10.15585/mmwr.mm6717e1

4. Stanek G, Wormser GP, Gary J, Strle F. Lyme borreliosis. *Lancet*. 2012;379 (9814):461-473. https://doi.org/10.1016/S0140-6736(11)60103-7
5. Wolfson B A, Cloutier R, Hendey W G, Ling J L, Rosen L C, Schaider J J. *Harwood-Nuss' Clinical Practice of Emergency Medicine: Sixth Edition*. 6th ed. Philadelphia, U.S.: Lippincott Williams & Wilkins; 2014.
6. Steere AC, Dhar A, Hernandez J, et al. Systemic symptoms without erythema migrans as the presenting picture of early Lyme disease. *Am J Med*. 2003;114(1):58-62. https://doi.org/10.1016/s0002-9343(02)01440-7
7. Feder Jr. HM. Lyme disease in children. *Infect Dis Clin North Am*. 2008;22(2):315-326. https://doi.org/10.1016/j.idc.2007.12.007
8. Walls R, Hockberger R, Gausche-Hill M. *Rosen's Emergency Medicine: Concepts and Clinical Practice*. 9th ed. Elsevier; 2017.
9. Kalish RA, Kaplan RF, Taylor E, Jones-Woodward L, Workman K, Steere AC. Evaluation of study patients with Lyme disease, 10-20-year follow-up. *J Infect Dis*. 2001;183(3):453-460. https://doi.org/10.1086/318082
10. Kowalski TJ, Tata S, Berth W, Mathiason MA, Agger WA. Antibiotic treatment duration and long-term outcomes of patients with early Lyme disease from a Lyme disease–hyperendemic area. *Clin Infect Dis*. 2010;50(4):512-520. https://doi.org/10.1086/649920
11. Giancane G, Consolaro A, Lanni S, Davì S, Schiappapietra B, Ravelli A. Juvenile idiopathic arthritis: diagnosis and treatment. *Rheumatol Ther*. 2016;3(2):187-207. https://doi.org/10.1007/s40744-016-0040-4
12. Barut K, Adrovic A, Şahin S, Kasapçopu Ö. Juvenile idiopathic arthritis. *Balkan Med J*. 2017;34(2):90-101. https://doi.org/10.4274/balkanmedj.2017.0111
13. Varela AS, Luttrell MP, Howerth EW, et al. First culture isolation of *Borrelia lonestari*, putative agent of southern tick–associated rash illness. *J Clin Microbiol*. 2004;42(3):1163-1169. https://doi.org/10.1128/JCM.42.3.1163-1169.2004
14. Vannier E, Krause PJ. Human babesiosis. *N Engl J Med*. 2012;366 (25):2397-2407. https://doi.org/10.1056/NEJMra1202018
15. Krause PJ. Human babesiosis. *Int J Parasitol*. 2019;49(2):165-174. https://doi.org/10.1016/j.ijpara.2018.11.007
16. Dantas-Torres F. Rocky Mountain spotted fever. *Lancet Infect Dis*. 2007;7(11):724-732.
17. Gottlieb M, Long B, Koyfman A. The evaluation and management of Rocky Mountain spotted fever in the emergency department: a review of the literature. *J Emerg Med*. 2018;55(1):42-50. https://doi.org/10.1016/j.jemermed.2018.02.043
18. Chapman AS, Bakken JS, Folk SM, et al. Diagnosis and management of tickborne rickettsial diseases: Rocky Mountain spotted fever, ehrlichioses, and anaplasmosis–United States: a practical guide for physicians and other health-care and public health professionals. *MMWR Recomm Rep*. 2006;55(RR-4):1-44. https://doi.org/10.15585/mmwr.rr6502a1

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Kratom Ingestion and Emergency Care: Summary and a Case Report

Authors: Alex Hall, DHSc, MS, RN, and Dora Hall, PharmD, Atlanta and Decatur, GA

CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

- Kratom is a plant native to southeast Asia with psychoactive properties commonly ingested for recreational intent, pain relief, or self-treatment of opioid withdrawal symptoms. Kratom is easily obtainable through purchase over the internet.
- This article provides a single-patient report of respiratory failure and shock after kratom ingestion and a brief overview of kratom's clinical features and pharmacologic properties.
- Key implications for emergency nursing practice found in this article include understanding a less-familiar psychoactive substance and unique patient presentation that will help identify and treat patients who present to the emergency department after kratom ingestion.

Abstract

Kratom ingestion for its psychotropic effect or to self-treat opioid withdrawal symptoms has increased over the last 10 years in the United States. Although mild adverse effects have been observed in users, reports of respiratory failure and shock after kratom consumption remain rare. In this case, a 35-year-old man initially presented to the emergency department with profound circulatory shock, metabolic acidosis, hypoxia, and symptoms of autonomic nervous system dysfunction. The patient required vasopressor support, multiregimen sedation and rapid sequence intubation, mechanical ventilation, and emergent hemodialysis. Within 72 hours, the patient's condition stabilized, and he was extubated. The patient reported regular consumption of large quantities of kratom as well as injection of heroin and cocaine. In this report, a rare clinical presentation after kratom ingestion is described.

Key words: Kratom; Critical care; Case report; Emergency nursing

Background

Kratom, also known as *Mitragyna speciosa,* is a tropical tree native to southern Thailand. The leaves of kratom can be chewed, brewed as a drink, smoked, or ingested orally.[1-3] Kratom is sold over the internet as well as in tea shops, bars, and convenience stores. The substance can be found in a variety of forms, including loose, chopped leaves; capsules; compressed tablets; and concentrated extracts under the name kratom, ketum, and *M speciosa*. As previously reported,[4] kratom use has increased in the United States and Europe over the last 5 years, and consumers generally believe that there is little or no risk with using.[5,6] Kratom is currently illegal in Alabama, Arkansas, Indiana, Tennessee, Vermont, Rhode Island, and Wisconsin, as well as in Thailand and Malaysia.[3] However, there are minimal data regarding the pharmacokinetics and toxicity of kratom in humans. Clinical presentations of the adverse effects of kratom use vary, and critical illness or fatality has been rarely reported.[7-9] In this case report, an unusual clinical presentation with critical illness after kratom ingestion is reported.

Case Report

A 35-year-old man was presented by emergency medical services to the emergency department for a suspected drug overdose. Paramedics had found the patient unresponsive

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J Emerg Nurs 2021;47:551-556.
Available online 13 April 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.02.004

and apneic with a respiratory rate of 6 breaths per minute and a heart rate of 120 beats per minute. The patient was given 2 mg intravenous (IV) naloxone before ED arrival, with improvement in mentation and respiratory status. A bystander reported to the paramedics that the patient had a known illicit drug use history, but the drug(s) of choice were unknown. In the emergency department, the patient was alert, anxious, and severely agitated but cooperative, with a Glasgow coma score of 14, heart rate of 118 beats per minute, respiratory rate of 28 breaths per minute, blood pressure 60/33 mm Hg, temperature 34.5 °C (94.1 °F), and oxygen saturation was 95% on a nonrebreather mask. The physical examination was notable for 3-mm pupils, normal breath sounds, and bilateral lower extremity fixed plantar flexion with mild clonus on passive ankle dorsiflexion. The patient reported a primary complaint of being unable to hear (ie, subjective sensorineural hearing loss); however, the patient responded to clinician communication after the clinician spoke loudly and repeated questions. The patient endorsed taking pills but could not provide the names or class. Other past medical history was unattainable. Approximately 10 minutes after arrival, the patient developed central cyanosis, peripheral mottling, and signs of profound mixed cardiogenic and distributive shock with impending cardiorespiratory arrest. Differential diagnoses or etiologies included psychotropic drug overdose, other toxic ingestion, blunt traumatic injury, hypovolemia, metabolic derangement, environmental exposure, neuroleptic malignant syndrome, serotonin syndrome, infection, intracranial injury or lesion, aortic dissection, and pulmonary embolism.

INVESTIGATIONS

Initial laboratory investigations included arterial blood gas; serum kidney function, electrolyte, and liver function panel; cardiac enzymes; total creatine kinase; lactic acid; complete blood count with differential; coagulation studies; urinalysis; urine drug screen (UDS); and serum toxicology panel. Additional studies included electrocardiogram, chest x-ray, noncontrast head computed tomography, and computed tomography angiography of the chest, abdomen, and pelvis. The Table details all relevant abnormal laboratory results of the initially performed tests. The remaining ED laboratory investigations were normal. No intracranial, thoracic, or abdominal abnormalities were seen on imaging. The 5-panel UDS was positive for cocaine (enzyme immunoassay) only, and the serum toxicology panel was negative (ie, alcohol, acetaminophen, and salicylates).

TABLE
Relevant abnormal blood and urine test results obtained in the emergency department

Laboratory test	Normal values	Results
pH	7.35-7.45	7.01
pCO_2 (mm Hg)	35-45	8.8
pO_2 (mm Hg)	75-100	20.0
HCO_3 (mEq/L)	22-26	2.2
BE (mEq)	–2 to +2	–25.0
White blood cells (K/mcL)	4-11	27.6
Hemoglobin (g/dL)	12-17	12.9
Glucose (mg/dL)	70-130	94
BUN (mg/dL)	7-20	21
Creatinine (mg/dL)	0.6-1.2	2.8
Sodium (mEq/L)	135-145	140
Potassium (mEq/L)	3.5-5.0	6.4
Chloride (mEq/L)	95-105	102
Anion gap (mEq/L)	3-10	18
Calcium (mg/dL)	8.5-10.5	7.8
Lactic acid (mmol/L)	<2	5.9
Urine drug screen	Negative	Positive for cocaine, negative for opioids

BE, base excess; BUN, blood urea nitrogen; HCO_3, bicarbonate.

INTERVENTIONS

Immediately on arrival to the emergency department, the patient was continued on supplemental oxygen through a nonrebreather mask, triaged as an Emergency Severity Index level 1 acuity, and the ED physician attending was called to the bedside owing to the need for immediate lifesaving interventions. Two large-bore peripheral IV catheters were placed in the antecubital fossa bilaterally, and a 2000-mL sodium chloride 0.9% bolus was administered using pressure bags. Because of a reported improvement in patient condition by Emergency Medical Services, continued agitation, and hemodynamic instability, an additional dose of naloxone (0.4 mg IV) was administered without effect. A subdissociative[10] IV bolus of ketamine (50 mg or 0.50 mg/kg) was administered, which improved agitation but had no effect on improving hemodynamics. Therefore, a peripheral IV norepinephrine infusion was initiated for cardiovascular support. The ED physician performed a bedside ultrasonography that showed no free fluid in the abdomen, no tamponade, good cardiac squeeze, and no pulmonary edema. The norepinephrine infusion was rapidly increased to more than 0.5 mcg/kg/min (50 mcg/min) with no improvement in blood pressure. Therefore, an EPINEPHrine infusion was initiated that resulted in an increased systolic blood pressure of more than 90 mm Hg. The patient was intubated for severe hypoxia and respiratory distress in the setting of severe anion gap metabolic acidosis (Table).

Controlled rapid sequence intubation was performed using 20 mg IV of etomidate and 100 mg IV of rocuronium. A rapid and unexpected sedation and induction reaction occurred. Immediately after the administration of etomidate, the patient exhibited extreme agitation and seemed to be in severe pain (ie, loud screaming, grimacing, and combativeness). This was followed by full-body muscle rigidity. Rocuronium was administered and resulted in total contraction of the masseter muscle, preventing direct laryngoscopy despite multiple attempts over a 4- to 5-minute onset period, which prohibited intubation. Continuous bag-valve-mask ventilation was maintained, and an IV bolus of 100 mg of ketamine was rapidly administered that subsequently relaxed the masseter muscle and facilitated endotracheal intubation through direct laryngoscopy. The patient was initiated on propofol and dexmedetomidine infusions for sedation and placed on assist-control mechanical ventilation at a rate of 28 breaths per minute, tidal volume 450 mL, fraction of inspired oxygen 1.0, and positive end-expiratory pressure of 5 cm of water. A central venous catheter was placed for continued administration of vasopressors. Hyperkalemia protocol was administered: 10 units IV insulin, 25 g IV dextrose 50%, 1 g IV calcium chloride, and 100 mEq sodium bicarbonate. A sodium bicarbonate infusion was prescribed at 100 mL/h. Hemodynamics improved with norepinephrine and EPINEPHrine infusions. The regional poison control center was consulted, and poison control personnel recommended continued supportive care.

OUTCOME

The patient was admitted to the intensive care unit, a trialysis catheter was placed, and 1 session of emergent hemodialysis was performed. Passive warming and other supportive measures were provided per usual care. The remainder of the intensive care unit course was unremarkable, and the patient was extubated within 72 hours. On interview, the patient endorsed regular kratom use, which was primarily ingested for heroin self-detoxication and to prevent withdrawal symptoms. The patient also reported cocaine use; however, he stated that the last cocaine use was more than 24 hours before admission. On hospital day 4, the patient was discharged to inpatient rehabilitation with good cognitive function.

Discussion

Reporting of toxicity from kratom use is rare.[9] Clinical presentations vary significantly in the literature. The reported adverse effects of kratom have included tachycardia, hypertension, hypotension, agitation, nausea, vomiting, confusion, tremor, diaphoresis, seizures, coma, and death.[6,9,11-14] Between 2011 and 2017, 6 cases of respiratory arrest and 5 cases of cardiac arrest were reported to US poison control centers.[9] However, the Centers for Disease Control and Prevention reported 90 deaths where kratom was found on postmortem toxicology analysis between July 2016 and December 2017.[15] This suggests that kratom toxicity may be more widespread, and clinicians may be unaware. Of note, most clinical laboratories are not capable of confirmatory or quantitative analysis; therefore, clinical evaluation and history are the initial methods of diagnosis.

The pharmacokinetics of kratom in humans remains unclear.[16] The leaves of *M speciosa* contain more than 20 biologically active alkaloids of kratom.[3-16] The 2 most important alkaloids are mitragynine and 7-hydroxymitragynine, with 66% and 2% total alkaloid content, respectively.[3-17] These compounds bind the opioid mu receptors and delta receptors, whereas mitragynine is also an agonist of the alpha-2 adrenergic, adenosine, dopamine, and serotonin

receptors.[3,17-19] On the basis of the stimulation of alpha-2 adrenergic receptors, kratom can attenuate the symptoms of opioid withdrawal.[3,18] It was also found that 7-hydroxymitragynine is 46-fold more potent than mitragynine and 13-fold stronger than morphine.[3] Kratom's major alkaloids (eg, mitragynine and ciliante) are cytochrome P450 (CYP) inhibitors, with high inhibition of the 2D6 enzyme that is responsible for xenobiotic metabolism.[20] When combined with other CYP substrates such as codeine, HYDROcodone, fentaNYL, methadone, oxyCODONE, and traMADol, their effect is increased.[3] It has been reported that other substances that are used in combination with kratom include caffeine, codeine, and dextromethorphan (CYP substrates), as well as diphenhydrAMINE (CYP inhibitor), leading to an increased drug effect.[3] Mitragynine is a lipophilic alkaloid that is poorly soluble in water but is soluble in alcohol, chloroform, and acetic acid.[1,3] The pharmacokinetics in humans is not well known; however, in animal models, the oral and IV duration of action demonstrated an elimination half-life of 3.9 to 9.4 hours and a very high distribution of 37.9 to 89.5 L/kg.[3,21]

Aggarwal et al[1] recently described a case of the death of a patient who presented to the emergency department in cardiopulmonary arrest after an unknown quantity ingestion of kratom 24 hours earlier. Taking advantage of the lipophilic nature of mitragynine, the authors report the use of an IV intralipid bolus in attempts to counteract the effects of kratom. The authors described a 30% reduction in vasopressor needs as well as improved oxygenation and ventilation; however, the effects were short-lived. The optimal dosage for intralipid infusion therapy has not been established for kratom, but the toxicology-recommended dosing includes a bolus of 1.5 mL/kg followed by 0.25 mL/kg/min over 30 to 60 minutes.[1,3]

In this case report, despite the lack of confirmatory laboratory test results, it was determined that kratom was the primary contributor to the observed symptoms. However, the patient's self-reported polysubstance ingestion was a potential confounding factor. Although the UDS was positive for cocaine, the patient denied acute use before admission, and endorsed cocaine use in the 1 to 2 days before admission. In addition, it is unlikely that acute heroin use contributed to the clinical presentation because the initial UDS was negative for opiates, and the ED administration of naloxone had no effect. Because quantitative analyses of kratom, cocaine, and heroin were not obtainable, the ED clinical presentation was initially assumed to be of a mixed toxic ingestion. The initial improvement in respiratory and mental status after administration of naloxone is consistent with mu-opioid antagonism, which has been seen in at least 1 other case report where concurrent opioid use was not present.[22] Very few cases of shock or severe acidosis have been reported after kratom ingestion before a cardiopulmonary arrest.[1,7,8] In this case, despite multiple investigations, other etiologies of severe acidosis or shock were not identified.

The limitations in this report were the unknown concurrent illicit substance use, chronic impacts of kratom use with or without other polysubstance abuse, and other unknown medical conditions exacerbating toxicity. Of note, the dose and duration of kratom use were not known. Acute heroin and cocaine use was ultimately denied by the patient; however, owing to the lack of more sensitive testing and quantitative analysis, concurrent ingestion could not be definitively ruled out. Furthermore, the literature on kratom's interactions with concurrent heroin and cocaine remains minimal. The patient reported purchasing kratom over the internet, but no further sourcing information was available.

Implications for Emergency Nursing

Illicit drug ingestion, especially involving synthetic or herbal substances, requires rapid assessment to determine the need for aggressive airway, cardiovascular, and respiratory support.[23] Hypotension refractory to crystalloids may require early vasopressor support. Administration of peripheral venous vasopressor agents has been considered safe, with low incidence of complications.[24-26] Emergency nurses should administer peripheral vasopressors through large-gauge catheters at the most proximally available location (ie, antecubital fossa). When patients present with symptoms associated with neuroleptic malignant syndrome or serotonin syndrome, antipsychotics (eg, haloperidol and metoclopramide) and serotonergic drugs should be avoided.[23,27] Gordon and Schmelzer[28] previously described the pathophysiology and clinical practice when caring for a patient with excited delirium, and benzodiazepines are generally the first-line agent for the control of agitation, neuromuscular dysfunction, tachycardia, and hypertension.[23] However, when patients are hemodynamically unstable or concern for potentiating respiratory depression exists, benzodiazepines are less ideal, and ketamine may be considered.[29,30] Ketamine produces anesthesia and analgesia by antagonizing the N-methyl-D-aspartate receptor while preserving cardiopulmonary status and potentially increasing cardiac output.[29] In many presentations, intubation and mechanical ventilation may be required, and emergency nurses should be prepared to assist with emergent airway support (eg, suction, bag-valve-mask ventilation, oxygen administration, and rapid sequence intubation; see Supplementary Infographic). Depolarizing

neuromuscular blockers (ie, succinylcholine) should not be administered owing to the risk of increasing serum potassium levels or worsening rhabdomyolysis.[23,27]

Conclusion

Although illegal in some regions, kratom is widely available to the public and frequently purchased over the internet.[5,6] Toxic effects of kratom consumption are rare; however, cases describing critical illness with varying clinical presentations have been reported.[1,9,11,13,31] Health care providers who evaluate patients with acute toxidromes should consider kratom consumption as a causal agent for unusual presentations when the substances are not known. Further research is needed to understand acute kratom toxicity and differentiate from other toxidromes in the emergency department.

Acknowledgments

We thank Drs Ziad Kazzi, MD, and Jonathan Ratcliff, MD, for their input and expertise in writing this case report.

Author Disclosures

Alex Hall reports grants from the National Institute of Neurological Disorders and Stroke (1U24NS100673-01), the Centers for Disease Control and Prevention (U01 CE002939-01), Nico Corporation, Sense Diagnostics Inc, and the Marcus Foundation. Dora Hall does not report any conflicts.

REFERENCES

1. Aggarwal G, Robertson E, McKinlay J, Walter E. Death from Kratom toxicity and the possible role of intralipid. *J Intensive Care Soc*. 2018;19(1):61-63. https://doi.org/10.1177/1751143717712652
2. LaBryer L, Sharma R, Chaudhari KS, Talsania M, Scofield RH. Kratom, an emerging drug of abuse, raises prolactin and causes secondary hypogonadism: case report. *J Investig Med High Impact Case Rep*. 2018;6:2324709618765022. https://doi.org/10.1177/2324709618765022
3. White CM. Pharmacologic and clinical assessment of kratom. *Am J Health Syst Pharm*. 2018;75(5):261-267. https://doi.org/10.2146/ajhp161035
4. Pizarro-Osilla C. Introducing... Kratom. *J Emerg Nurs*. 2017;43(4):373-374. https://doi.org/10.1016/j.jen.2017.03.016
5. Prozialeck WC, Avery BA, Boyer EW, et al. Kratom policy: the challenge of balancing therapeutic potential with public safety. *Int J Drug Policy*. 2019;70:70-77. https://doi.org/10.1016/j.drugpo.2019.05.003
6. Veltri C, Grundmann O. Current perspectives on the impact of Kratom use. *Subst Abuse Rehabil*. 2019;10:23-31. https://doi.org/10.2147/SAR.S164261
7. Palasamudram Shekar S, Rojas EE, D'Angelo CC, Gillenwater SR, Martinez Galvis NP. Legally lethal kratom: a herbal supplement with overdose potential. *J Psychoactive Drugs*. 2019;51(1):28-30. https://doi.org/10.1080/02791072.2018.1562591
8. Alsarraf E, Myers J, Culbreth S, Fanikos J. Kratom from head to toe—case reviews of adverse events and toxicities. *Curr Emerg Hosp Med Rep*. 2019;7(4):144-168. https://doi.org/10.1007/s40138-019-00194-1
9. Post S, Spiller HA, Chounthirath T, Smith GA. Kratom exposures reported to United States poison control centers: 2011-2017. *Clin Toxicol*. 2019;57(10):847-854. https://doi.org/10.1080/15563650.2019.1569236
10. Seder DB, Riker RR, Jagoda A, Smith WS, Weingart SD. Emergency neurological life support: airway, ventilation, and sedation. *Neurocrit Care*. 2012;17(suppl 1):S4-S20. https://doi.org/10.1007/s12028-012-9753-6
11. Nelsen JL, Lapoint J, Hodgman MJ, Aldous KM. Seizure and coma following Kratom (Mitragynina speciosa Korth) exposure. *J Med Toxicol*. 2010;6(4):424-426. https://doi.org/10.1007/s13181-010-0079-5
12. Suwanlert S. A study of kratom eaters in Thailand. *Bull Narc*. 1975;27(3):21-27. https://pubmed.ncbi.nlm.nih.gov/1041694/
13. Wang C, Walker AE. Fatal mitragynine-associated toxicity in Canada: a case report and review of the literature. *Acad Forensic Pathol*. 2018;8(2):340-346. https://doi.org/10.1177/1925362118782076
14. Swogger MT, Walsh Z. Kratom use and mental health: a systematic review. *Drug Alcohol Depend*. 2018;183:134-140. https://doi.org/10.1016/j.drugalcdep.2017.10.012
15. Olsen EO, O'Donnell J, Mattson CL, Schier JG, Wilson N. Notes from the field: unintentional drug overdose deaths with kratom detected - 27 states, July 2016-December 2017. *MMWR Morb Mortal Wkly Rep*. 2019;68(14):326-327. https://doi.org/10.15585/mmwr.mm6814a2
16. Trakulsrichai S, Sathirakul K, Auparakkitanon S, et al. Pharmacokinetics of mitragynine in man. *Drug Des Devel Ther*. 2015;9:2421-2429. https://doi.org/10.2147/DDDT.S79658
17. Chittrakarn S, Keawpradub N, Sawangjaroen K, Kansenalak S, Janchawee B. The neuromuscular blockade produced by pure alkaloid, mitragynine and methanol extract of kratom leaves (Mitragyna speciosa Korth). *J Ethnopharmacol*. 2010;129(3):344-349. https://doi.org/10.1016/j.jep.2010.03.035
18. Boyer EW, Babu KM, Adkins JE, McCurdy CR, Halpern JH. Self-treatment of opioid withdrawal using kratom (Mitragynia speciosa Korth). *Addiction*. 2008;103(6):1048-1050. https://doi.org/10.1111/j.1360-0443.2008.02209.x
19. Matsumoto K, Mizowaki M, Suchitra T, et al. Central antinociceptive effects of mitragynine in mice: contribution of descending noradrenergic and serotonergic systems. *Eur J Pharmacol*. 1996;317(1):75-81. https://doi.org/10.1016/s0014-2999(96)00714-5
20. Kamble SH, Sharma A, King TI, et al. Exploration of cytochrome P450 inhibition mediated drug–drug interaction potential of kratom alkaloids. *Toxicol Lett*. 2020;319:148-154. https://doi.org/10.1016/j.toxlet.2019.11.005

21. Hassan Z, Muzaimi M, Navaratnam V, et al. From Kratom to mitragynine and its derivatives: physiological and behavioural effects related to use, abuse, and addiction. *Neurosci Biobehav Rev*. 2013;37(2):138-151. https://doi.org/10.1016/j.neubiorev.2012.11.012
22. Overbeek DL, Abraham J, Munzer BW. Kratom (mitragynine) ingestion requiring naloxone reversal. *Clin Pract Cases Emerg Med*. 2019;3(1):24-26. https://doi.org/10.5811/cpcem.2018.11.40588
23. Holstege CP, Borek HA. Toxidromes. *Crit Care Clin*. 2012;28(4):479-498. https://doi.org/10.1016/j.ccc.2012.07.008
24. Medlej K, Kazzi AA, El Hajj Chehade A, et al. Complications from administration of vasopressors through peripheral venous catheters: an observational study. *J Emerg Med*. 2018;54(1):47-53. https://doi.org/10.1016/j.jemermed.2017.09.007
25. Tian DH, Smyth C, Keijzers G, et al. Safety of peripheral administration of vasopressor medications: a systematic review. *Emerg Med Australas*. 2020;32(2):220-227. https://doi.org/10.1111/1742-6723.13406
26. Tran QK, Mester G, Bzhilyanskaya V, et al. Complication of vasopressor infusion through peripheral venous catheter: a systematic review and meta-analysis. *Am J Emerg Med*. 2020;38(11):2434-2443. https://doi.org/10.1016/j.ajem.2020.09.047
27. Tse L, Barr AM, Scarapicchia V, Vila-Rodriguez F. Neuroleptic malignant syndrome: a review from a clinically oriented perspective. *Curr Neuropharmacol*. 2015;13(3):395-406. https://doi.org/10.2174/1570159x13999150424113345
28. Gordon C, Schmelzer M. Care of the patient in excited delirium. *J Emerg Nurs*. 2013;39(2):190-196. https://doi.org/10.1016/j.jen.2012.03.007
29. Aroni F, Iacovidou N, Dontas I, Pourzitaki C, Xanthos T. Pharmacological aspects and potential new clinical applications of ketamine: reevaluation of an old drug. *J Clin Pharmacol*. 2009;49(8):957-964. https://doi.org/10.1177/0091270009337941
30. Green SM, Roback MG, Kennedy RM, Krauss B. Clinical practice guideline for emergency department ketamine dissociative sedation: 2011 update. *Ann Emerg Med*. 2011;57(5):449-461. https://doi.org/10.1016/j.annemergmed.2010.11.030
31. Abdullah HMA, Haq I, Lamfers R. Cardiac arrest in a young healthy male patient secondary to kratom ingestion: is this 'legal high' substance more dangerous than initially thought? *BMJ Case Rep*. 2019;12(7):e229778. https://doi.org/10.1136/bcr-2019-229778

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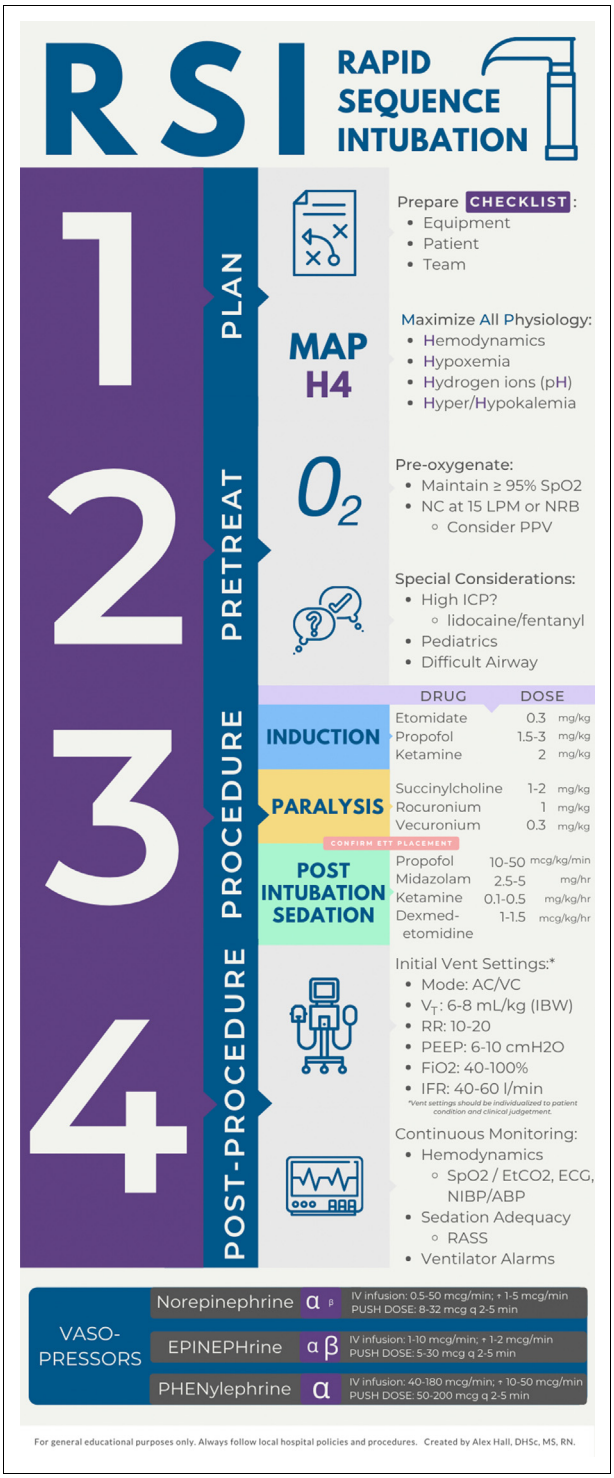
RSI
RAPID SEQUENCE INTUBATION
1 PLAN
2 PRETREAT
3 PROCEDURE
4 POST-PROCEDURE
Prepare CHECKLIST:
• Equipment
• Patient
• Team
MAP H4
Maximize All Physiology:
• Hemodynamics
• Hypoxemia
• Hydrogen ions (pH)
• Hyper/Hypokalemia
O2
Pre-oxygenate:
• Maintain ≥ 95% SpO2
• NC at 15 LPM or NRB
◦ Consider PPV
Special Considerations:
• High ICP?
◦ lidocaine/fentanyl
• Pediatrics
• Difficult Airway
DRUG DOSE
INDUCTION
Etomidate 0.3 mg/kg
Propofol 1.5-3 mg/kg
Ketamine 2 mg/kg
PARALYSIS
Succinylcholine 1-2 mg/kg
Rocuronium 1 mg/kg
Vecuronium 0.3 mg/kg
CONFIRM ETT PLACEMENT
POST INTUBATION SEDATION
Propofol 10-50 mcg/kg/min
Midazolam 2.5-5 mg/hr
Ketamine 0.1-0.5 mg/kg/hr
Dexmedetomidine 1-1.5 mcg/kg/hr
Initial Vent Settings:*
• Mode: AC/VC
• VT: 6-8 mL/kg (IBW)
• RR: 10-20
• PEEP: 6-10 cmH2O
• FiO2: 40-100%
• IFR: 40-60 l/min
*Vent settings should be individualized to patient condition and clinical judgement.
Continuous Monitoring:
• Hemodynamics
◦ SpO2 / EtCO2, ECG, NIBP/ABP
• Sedation Adequacy
◦ RASS
• Ventilator Alarms
VASO-PRESSORS
Norepinephrine α β IV infusion: 0.5-50 mcg/min; + 1-5 mcg/min PUSH DOSE: 8-32 mcg q 2-5 min
EPINEPHrine α β IV infusion: 1-10 mcg/min; + 1-2 mcg/min PUSH DOSE: 5-30 mcg q 2-5 min
PHENylephrine α IV infusion: 40-180 mcg/min; + 10-50 mcg/min PUSH DOSE: 50-200 mcg q 2-5 min
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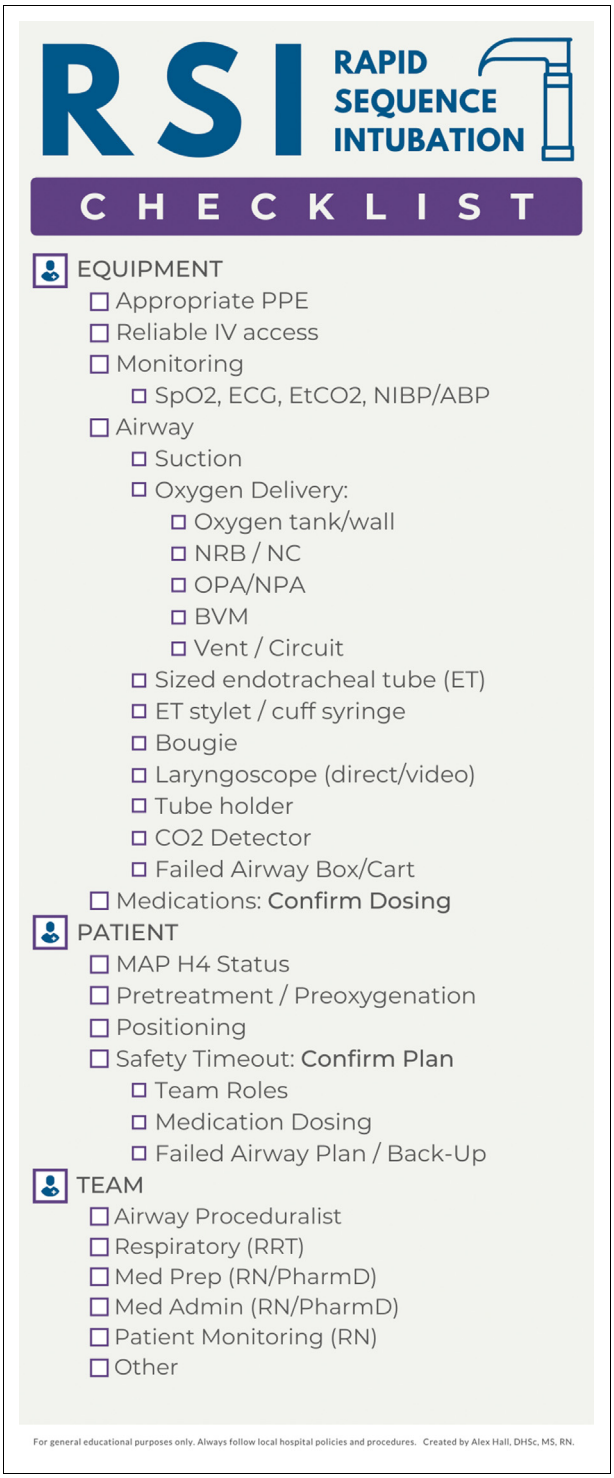
RSI
RAPID SEQUENCE INTUBATION
CHECKLIST
EQUIPMENT
☐ Appropriate PPE
☐ Reliable IV access
☐ Monitoring
☐ SpO2, ECG, EtCO2, NIBP/ABP
☐ Airway
☐ Suction
☐ Oxygen Delivery:
☐ Oxygen tank/wall
☐ NRB / NC
☐ OPA/NPA
☐ BVM
☐ Vent / Circuit
☐ Sized endotracheal tube (ET)
☐ ET stylet / cuff syringe
☐ Bougie
☐ Laryngoscope (direct/video)
☐ Tube holder
☐ CO2 Detector
☐ Failed Airway Box/Cart
☐ Medications: Confirm Dosing
PATIENT
☐ MAP H4 Status
☐ Pretreatment / Preoxygenation
☐ Positioning
☐ Safety Timeout: Confirm Plan
☐ Team Roles
☐ Medication Dosing
☐ Failed Airway Plan / Back-Up
TEAM
☐ Airway Proceduralist
☐ Respiratory (RRT)
☐ Med Prep (RN/PharmD)
☐ Med Admin (RN/PharmD)
☐ Patient Monitoring (RN)
☐ Other
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Case Report Detailing an Inferior Myocardial Infarction, Third-Degree Heart Block, and Cardiogenic Shock

Authors: Daniella James, MSN, APRN, AGCNS-BC, and Leslie London, MSN, APRN, ACNS-BC, CEN, Charlotte, NC

CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

- What is already known: rapid identification of high-risk cardiovascular clinical conditions and subsequent targeted interventions can improve patient outcomes.
- The main finding: cardiac disease processes can evolve over time and complicate patient care.
- Recommendations for translating the findings of this paper into emergency clinical practice include: remaining up to date on American Heart Association recommendations improve the quality and safety of care for complex, critically ill patients.

Abstract

An infarction in the right coronary artery affects the inferior wall of the heart and can also cause impedance to the cardiac conduction system. The right coronary artery perfuses the sinoatrial and atrioventricular nodes, and a loss of blood flow contributes to a breakdown in the communication system within the heart, causing associated bradycardias, heart blocks, and arrhythmias. This case report details the prehospital and emergency care of a middle-aged man who experienced an inferior myocardial infarction, concomitant third-degree heart block, and subsequent cardiogenic shock, with successful revascularization. This case is informative for emergency clinicians to review symptoms of acute coronary syndrome, rapid lifesaving diagnostics and intervention, and the unique treatment and monitoring considerations associated with right ventricular involvement and third-degree heart block.

Key words: Emergency nursing; Myocardial infarction; Heart block; Percutaneous coronary intervention

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J Emerg Nurs 2021;47:557–562.
Available online 9 June 2021
0099-1767

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Introduction

This case report details the prehospital and emergency care of a middle-aged male patient who experienced an inferior myocardial infarction, concomitant third-degree heart block, and subsequent cardiogenic shock, with successful revascularization. Facility institutional review board policy was followed, and patient consent was obtained by electronic communication.

Case Report

A 56-year-old man with a past medical history of hypercholesteremia, no documented family history of cardiac disease, and no home medications had a syncopal event while at an outdoor recreation facility. After completing a leisure-time driving activity (go-kart racing), the patient sat down and immediately became pale and unconscious. Owing to bystander concern for cardiac arrest, cardiopulmonary resuscitation (CPR) without defibrillation was initiated, and emergency medical services (EMS) was called. On EMS arrival, the patient was pale and diaphoretic but alert and oriented; in addition, the patient was experiencing chest pain, nausea, and vomiting. The initial vital signs were as follows: heart rate 38 beats per minute (bpm), blood pressure 65/37 mm Hg, and respiratory rate 20 breaths per minute; the patient's blood glucose level was 30 mg/dL. A 12-lead electrocardiogram (ECG) was obtained. EMS identified a third-degree atrioventricular (AV) heart block as well as an inferior myocardial infarction (MI) with ST elevation in leads II, III, and aVF and reciprocal depression in leads I and aVL (Figure 1).

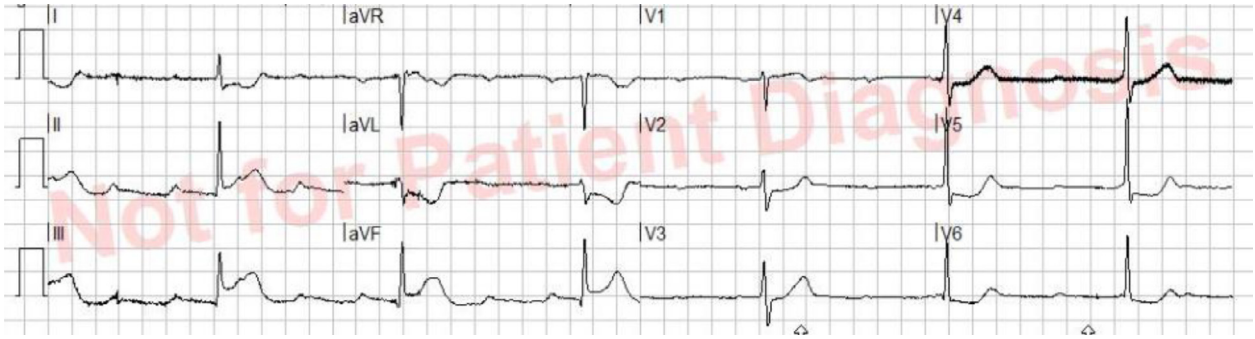

FIGURE 1
Prehospital 12-lead electrocardiogram.

EMS administered a 500-mL normal saline (0.9%) intravenous (IV) bolus and a dose of EPINEPHrine 5 mcg through IV push. After the first dose of EPINEPHrine, the patient's heart rate did not increase, and he became hypertensive to 212/160 mm Hg owing to the vasopressor. Despite an attempt to perform transcutaneous pacing, capture was not achieved, and ultimately pacing was stopped owing to patient intolerance. During transport, repeat vital signs were obtained with a blood pressure reading of 96/68 mm Hg and a heart rate of 38 bpm. Per protocol, EMS administered a second dose of EPINEPHrine 3 mcg IV push for persistent bradycardia and hypotension. Additional medications given by EMS were ondansetron 4 mg IV push, aspirin 324 mg by mouth, fentaNYL 50 mcg IV push, and a dextrose 10% IV infusion for hypoglycemia.

On arrival to the emergency department, the patient complained of left-sided chest pain that radiated to his left arm. His blood pressure was 111/64 mm Hg, and his heart rate was 42 bpm. A second 12-lead ECG was acquired, and the interpretation was unchanged from the initial ECG (Figure 2). Blood laboratory specimens were obtained in the emergency department, and the results outside of normal limits were as follows: potassium 5.9 mmol/L (3.5-5.1 mmol/L), low-density lipoprotein 139 mg/dL (<100 ng/dL), and troponin 684 ng/L (<20 ng/L; high-sensitivity troponin). The patient received heparin 4000 units IV push before transfer to the cardiac catheterization laboratory.

Emergent cardiac catheterization demonstrated mild nonobstructive disease in the left anterior descending system and 100% occlusion of the proximal right coronary artery (RCA). The interventional cardiologist placed a temporary pacing wire and stented the culprit lesion in the RCA with a single drug-eluting stent. Subsequently, the patient's heart block and signs of cardiogenic shock resolved after successful vessel reperfusion of the RCA with restoration of a normal sinus rhythm (Figures 3 and 4).

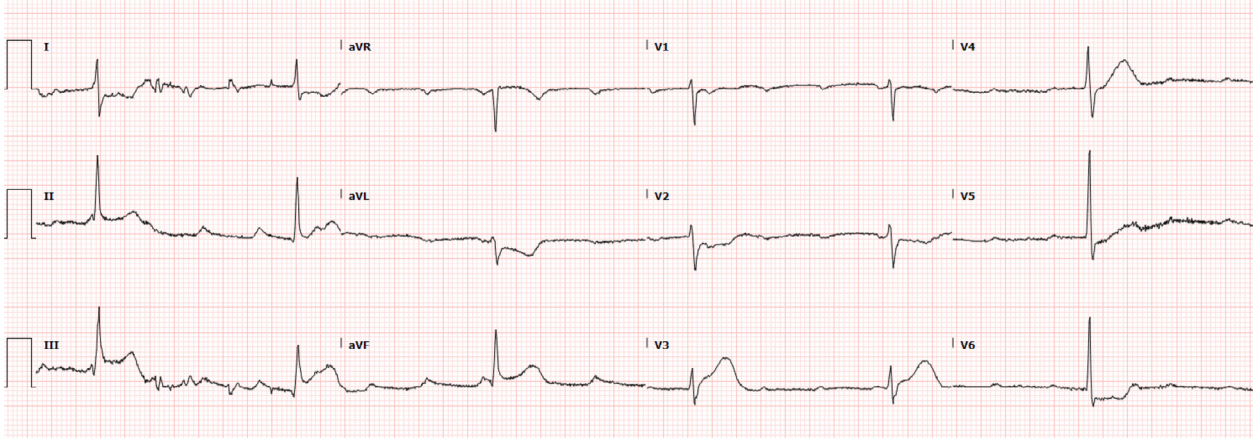

FIGURE 2
ED 12-lead electrocardiogram.

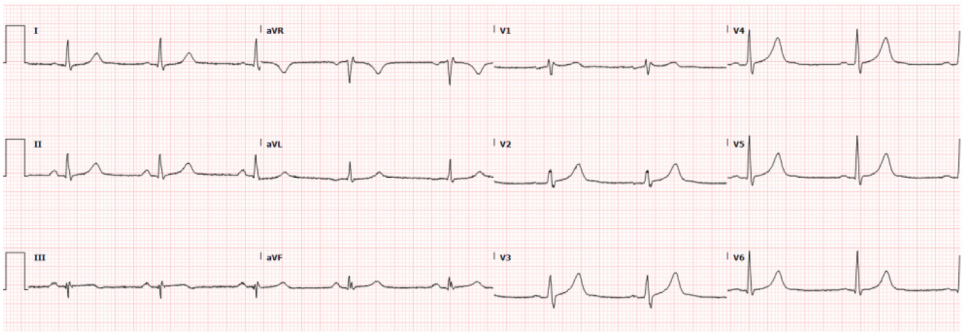

FIGURE 3

Postcardiac catheterization 12-lead electrocardiogram.

Diagnostic Assessment

A 12-lead ECG is one of the most important diagnostic tools for the workup of patients with a suspected MI; however, an ECG is insufficient on its own to diagnose acute myocardial ischemia or MI. Elevation of the ST segment in 2 contiguous leads is required to diagnose an ST-elevated MI (STEMI).[1] To diagnose an inferior MI, the trained clinician would look for an ST-segment elevation in leads II, III, and aVF; reciprocal changes may be seen in lead aVL.[2] See Figure 5 for diagnostic criteria suggestive of an inferior STEMI and third-degree AV block. When an inferior MI is identified, a right-sided 12-lead ECG should also be acquired to examine the right ventricle because studies have demonstrated that up to 40% of the inferior wall MIs have associated right ventricular (RV) involvement that predicts a worse outcome.[3]

Additional criteria to inform a diagnosis of an acute MI can be a rise in the cardiac troponin blood levels above the 99th percentile.[1] The high-sensitivity troponin blood test administered (Beckman Coulter hsTnl) has a 99th percentile cutoff of 19.8 ng/L for males.[4] The patient had a maximum troponin level of 14 492 ng/L 12 hours after symptom onset, which represents a significant rise above the 99th percentile.

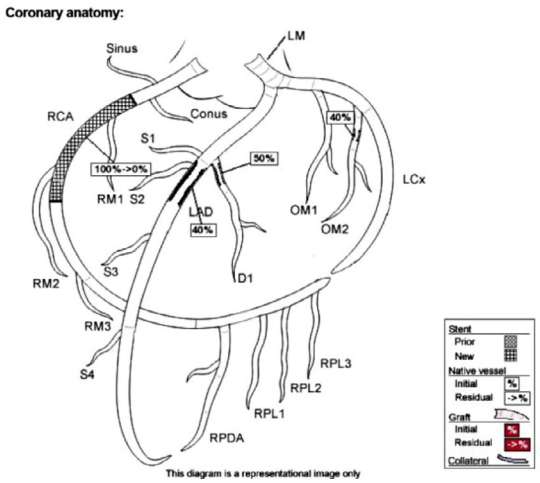

FIGURE 4

Cardiac catheterization laboratory report with depiction of occlusion location and stenting. RCA, right coronary artery; LM, left main; RM1, ramus marginalis 1; RM2, ramus marginalis 2; RM3, ramus marginalis 3; S1, septal perforator 1; S2, septal perforater 2; S3, septal perforater 3; S4, septal perforater 4; LAD, left anterior descending; OM1, left obtuse marginal 1; OM2, left obtuse marginal 2; D1, diagonal artery 1; RPDA, right posterior descending artery; RPL1, posterior left ventricular wall 1; RPL2, posterior left ventricular wall 2; RPL3, posterior left ventricular wall 3; LCx; left circumflex.

Pathophysiology

The blood supply to the heart is provided by the coronary circulatory system. The RCA originates at the anterior aortic sinus and supplies blood to the right atrium, right ventricle, sinoatrial (SA) node, AV node, and posterior aspects of the left ventricle.[5] A blockage in the RCA stops the flow of oxygenated blood to the inferior wall of the heart,[2] leading to myocardial ischemia and eventually MI. When MI occurs, it can also cause impedance to the cardiac conduction system. The RCA perfuses the SA and AV nodes, and a loss of blood flow contributes to a breakdown in the communication system within the heart, causing associated bradycardias, heart blocks, and arrhythmias.[3] With open communication systems and adequate perfusion, the SA node starts an impulse that travels to the AV node. This

ECG Criteria: Diagnosing an Acute Inferior Myocardial Infarction and Third-Degree Heart Block
Inferior ST-segment Elevation MI
- ST-segment elevation of greater than 1 mm (greater than 2 mm in leads V1/V2 in males) in two anatomically contiguous leads: II, III, and aVF. - Reciprocal ST depression is often seen in lead aVL.
Third-Degree Heart Block
- Independent atrial and ventricular activity with no relation between the P wave and the QRS complex. - The atrial rate, demonstrated by the P wave, should be faster than the ventricular rate, as demonstrated by the QRS complex. - *Consideration*: A repeat ECG or rhythm strip may be required to differentiate between second-degree and third degree heart blocks as a second degree heart block may masquerade as a third-degree heart block[7].

FIGURE 5

ECG, electrocardiogram; MI, myocardial infarction; STEMI, ST-elevated MI.

Event	Time	Duration
Call to EMS	6:51 PM	
FMC	7:01 PM	10 minutes Dispatch time
12-lead ECG	7:07 PM	6 minutes FMC to ECG
ED arrival	7:47 PM	40 minutes Transport time
12-lead ECG	7:52 PM	5 minutes ED arrival to ECG
CCL arrival	8:02 PM	10 minutes ED ECG to CCL arrival
Reperfusion	8:20 PM	79 minutes FMC to reperfusion

FIGURE 6

FMC, first medical contact; EMS, emergency medical services; ECG, electrocardiogram; CCL, cardiac catheterization laboratory.
*Total ED length of stay = 15 minutes.

impulse travels through the bundle of His, down the bundle branches, and through the Purkinje fibers causing the ventricles to contract.[6] In the setting of third-degree heart block, the SA node continues to send the impulse, but the AV node does not receive the message. This contributes to a clinical finding of bradycardia where the heart rate may only be 45 to 50 bpm.[7]

Further complicating the patient's clinical course was the cardiogenic shock that was identified in the prehospital setting on the basis of hypotension secondary to the acute MI and third-degree heart block. Cardiogenic shock is the result of a cardiac injury that leads to a decrease in cardiac contractility.[8] This progresses to a cycle of reduced cardiac output and low blood pressure, which further worsens cardiac ischemia.[8] Clinically observed as the inability to maintain a systolic blood pressure of 90 mm Hg or more for 30 minutes or longer, cardiogenic shock may also manifest as altered mental status; oliguria; and cold, clammy skin.[8]

Discussion

REVASCULARIZATION

Treatment of an inferior STEMI and third-degree heart block involves a reperfusion strategy, either mechanical or medicinal, to restore optimal blood flow and cardiac function. The preferred reperfusion strategy is a percutaneous coronary intervention (PCI). Compared with fibrinolytic therapy, PCI has been shown to improve outcomes, including higher rates of vessel patency and lower rates of intracranial hemorrhage and death.[9] In addition, the American College of Cardiologists and the American Heart Association (AHA) recommend a drug-eluting stent with primary PCI so long as the patient is willing to comply with a prolonged course of dual antiplatelet therapy. For a third-degree heart block, initial treatment includes application of transcutaneous or transvenous pacing, which allows for rhythm stabilization; definitive treatment is an implanted pacemaker or PCI if the heart block is caused by an MI.[7]

COMPLICATED BRADYCARDIA

The AHA Advanced Cardiac Life Support 2020 guidelines for the treatment of adult bradycardia recommend atropine 1 mg through IV push every 3 to 5 minutes (maximum dose of 3 mg) as the initial treatment until the desired effect is achieved.[10] However, the guidelines caution clinicians on the use of atropine in bradycardia due to a third-degree heart block because it may not be responsive to the reversal of the cholinergic effects of atropine.[11] Atropine is not recommended as first-line treatment for bradycardia secondary to third-degree heart block because it acts on the AV node, not the SA node, and therefore is rarely effective in raising the heart rate.[12] If a third-degree heart block is identified on an ECG, the clinician should initiate transcutaneous pacing.

For this patient, pacing was not successful; per the EMS report, capture was not achieved, and the patient was unable to tolerate the intervention. In a clinical setting, if pacing is no longer an option for initial treatment, other options for symptomatic bradycardia are treatment of the

underlying medical condition (eg, dialysis), IV medications (either DOPamine or EPINEPHrine), PCI, or pacemaker implantation.[13] Therefore, EMS proceeded to secondary interventions for treatment of third-degree heart block using EPINEPHrine. Because EPINEPHrine is a sympathomimetic catecholamine and acts on both alpha- and beta-adrenergic receptors, it acts on all pacemaker sites of the heart to cause vasoconstriction and can restore hemodynamic stability while awaiting definitive treatment. An additional clinical advantage of the use of EPINEPHrine in this patient's case was the improvement of diastolic blood pressure and coronary artery perfusion pressure

HYPOGLYCEMIA IN MI

The patient had an initial fingerstick blood glucose level of 30 mg/dL per the EMS report. During transport, the EMS personnel administered a 10% dextrose infusion per their protocol. Owing to an increased risk of extravasation, the local EMS agency does not stock 50% dextrose in its ambulances. A possible cause of the patient's initial low blood glucose is "silent hypoglycemia," which is defined as a blood glucose level of less than 70 mg/dL without typical symptoms of hypoglycemia.[14] Hypoglycemia was found to be frequently occurring in patients without diabetes diagnosed with an acute MI.[14] On arrival to the emergency department, the patient's blood glucose level was 285 mg/dL. During hospitalization, the patient's hemoglobin A_{1C} level was evaluated and found to be 5.8% (5.7%-6.5%), which is in the prediabetes range.[15] There was no follow-up on discharge for the patient's hemoglobin A_{1C} level.

BYSTANDER CPR IN SUSPECTED CARDIAC ARREST

It is highly probable that this patient did not lose pulses during his suspected cardiac arrest but instead had a syncopal event caused by low cardiac output and decreased peripheral resistance, resulting in hypotension and cerebral hypoperfusion.[16] The patient did receive bystander CPR. Retrospective cohort reviews have revealed the benefit of bystander CPR on 30-day survival rate and overall mortality rate for out-of-hospital cardiac arrests; it is well known that there is a positive correlation between early CPR and survival rates.[10,17] Furthermore, layperson-initiated CPR is endorsed by the AHA because the risk of harm to the patient is low if the patient is not in cardiac arrest.[10] Ultimately, the patient was taken to the cardiac catheterization laboratory for PCI with stent placement in 61 minutes from first medical contact (goal of 90 minutes).[9] Figure 6 outlines the event timeline.

Implications for Emergency Nursing

For an emergency nurse, it is important to be aware of the symptoms of acute coronary syndrome: typical symptoms include chest pain associated with nausea, dyspnea, diaphoresis, or syncope, and atypical symptoms may include fatigue and upper abdominal pain. This patient group classified as high risk needs rapid assessment and intervention, including an ECG within 10 minutes of arrival.[11] The trained emergency nurse is knowledgeable on evidence-based care of patients experiencing an STEMI and associated progression of disease. When an inferior MI is identified on an ECG by an ED provider or cardiologist, the emergency nurse should perform a right-sided ECG by reversing the precordial leads to the right side of the chest (create a mirror image of the traditional precordial leads) to determine RV involvement.[3] If the right ventricle is involved, the patient's treatment pathway should differ in that vasodilators and nitrates should be avoided to maintain RV preload and adequate cardiac output while awaiting intervention.[18] For patients who arrive with symptoms of acute coronary syndrome without ST elevation on their ECG, the emergency nurse should follow their facility protocols for serial cardiac enzyme testing. The emergency nurse should be aware of the time intervals between repeat ECG tracings and serial troponin levels, as well as hospital processes and protocols for the care of cardiac patients.

When a third-degree heart block is identified, transcutaneous pacing is indicated for initial treatment until the cause of the heart block can be reversed or a permanent pacemaker can be inserted. Because temporary transvenous pacing may be done in the emergency department, the emergency nurse should remain up to date on the procedure steps as well as complications that may occur. In addition, the nurse should observe the patient for expected and adverse outcomes as a patient with bradycardia due to a heart block; the patient will likely experience decreased perfusion and decreased cardiac output. A sedative, if ordered, should be administered before the pacing attempt because the patient may experience discomfort. Vital signs, skin color, level of consciousness, and peripheral pulses should be monitored to evaluate the effectiveness of the paced heart rhythm.[5] Potential adverse events include failure to capture, patient discomfort, arrhythmias, and skin breakdown.[5] Documentation of the procedure should include the date and time of pacer initiation, pacemaker settings, and the patient's response. A 12-lead ECG should be obtained before and after pacing is initiated. Finally, the emergency nurse should be knowledgeable about other treatment modalities for third-degree heart block when pacing is not an option, such as pharmacologic management.

Case Conclusion

The patient was admitted to the cardiac intensive care unit and discharged to home after 2 days. As follow-up, the patient had a virtual visit with the cardiology team in which the patient reported no recurrence of chest discomfort. In addition, the patient was able to return to work. This case demonstrates the importance of prehospital communication and notification protocols, especially in the setting of a complicated MI.

Author Disclosures

Conflicts of interest: none to report.

REFERENCES

1. Thygesen K, Alpert JS, Jaffe AS, et al. Fourth universal definition of myocardial infarction. *J Am Coll Cardiol*. 2018;72(18):2231-2264. Accessed May 25, 2021. https://www.acc.org/latest-in-cardiology/ten-points-to-remember/2018/08/24/00/09/fourth-universal-definition-of-mi-esc-2018
2. Whalen D, Dunne C, Dubrowski A, Mohamed L, Parsons MH. Diagnosis and management of an inferior ST-elevation myocardial infarction: a simulation scenario. *Cureus*. 2019;11(2):e3995. https://doi.org/10.7759/cureus.3995
3. Warner M, Tivakaran V. Inferior myocardial infarction. StatPearls. Published January 1, 2021. Accessed January 18, 2021. https://www.statpearls.com/articlelibrary/viewarticle/23500/
4. Apple FS, Collinson PO, IFCC Task Force on Clinical Applications of Cardiac Biomarkers. Analytical characteristics of high-sensitivity cardiac troponin assays. *Clin Chem*. 2011;58(1):54-61. https://doi.org/10.1373/clinchem.2011.165795. Published correction appears in *Clin Chem*. 2012;58(4):796.
5. Atrium Health. Transcutaneous pacing. Accessed January 27, 2021. https://procedures.lww.com/lnp/view.do?pId=2883136&hits=pacing&a=false&ad=false
6. Metkus TS, Zieve D. Cardiac conduction system. MedlinePlus. U.S. National Library of Medicine; Updated 2020. Accessed May 25, 2021. https://medlineplus.gov/ency/anatomyvideos/000021.htm
7. Knabben V, Chhabra L, Slane M. *Third-Degree Atrioventricular Block. StatPearls [Internet]*. StatPearls Publishing; 2021.
8. Kosaraju A, Pendela VS, Hai O. *Cardiogenic Shock. StatPearls [Internet]*. StatPearls Publishing; 2021.
9. Tamis-Holland JE, O'Gara P. Highlights from the 2013 ACCF/AHA guidelines for the management of ST-elevation myocardial infarction and beyond. *Clin Cardiol*. 2014;37(4):252-259. https://doi.org/10.1002/clc.22258
10. American Heart Association. Highlights of the 2020 AHA guidelines: update for CPR and ECC. Published October 1, 2020. Accessed February 8, 2021. https://www.eccguidelines.heart.org/
11. Craig-Brangan KJ, Day MP. Update 2015 AHA BLS and ACLS guidelines. *Nursing*. 2016;46(2):40-45. https://doi.org/10.1097/01.nurse.0000476229.95631.bf
12. Hasselqvist-Ax I, Riva G, Herlitz J, et al. Early cardiopulmonary resuscitation in out-of-hospital cardiac arrest. *N Engl J Med*. 2015;372(24):2307-2315. https://doi.org/10.1056/NEJMoa1405796
13. Abrich VA, Le RJ, Mulpuru SK, et al. Clinical outcomes of various management strategies for symptomatic bradycardia. *Clin Med Res*. 2020;18(2):75-81. https://doi.org/10.3121/cmr.2019.1507
14. Zhang J-W, Zhou YJ. Association of silent hypoglycemia with cardiac events in non-diabetic subjects with acute myocardial infarction undergoing primary percutaneous coronary interventions. *BMC Cardiovasc Disord*. 2016;16(1):75. https://doi.org/10.1186/s12872-016-0245-z
15. American Diabetes Association. Understanding A1C. Accessed January 18, 2021. https://diabetes.org/a1c
16. El-Hussein MT, Cuncannon A. Syncope in the emergency department: a guide for clinicians. *J Emerg Nurs*. 2021;47(2):342-351. https://doi.org/10.1016/j.jen.2020.11.002
17. Hafeez Y, Grossman S. Sinus bradycardia. *StatPearls*. Published November 21, 2020. Accessed January 18, 2021. https://www.statpearls.com/articlelibrary/viewarticle/29047/
18. Rehman S. Physiology, coronary circulation. Physiology, Coronary Circulation. StatPearls Publishing; 2021. https://www.ncbi.nlm.nih.gov/books/NBK482413/

Submissions to this column are encouraged and may be submitted at jenonline.org where submission instructions can be found in the Author Instructions.

Alignment of Nurse Practitioner Educational Preparation and Scope of Practice in United States Emergency Departments: A Systematic Review of the Literature

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CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

Nurse practitioners (NPs) are increasingly being employed to practice within the emergency department. The main finding of this paper is that there is a lack of high-quality research evaluating if NP education matches current employment in emergency departments. NPs have expressed interest in more specific ED-related education. Recommendations for translating the findings of this paper into emergency clinical practice include the following: If health care systems continue to hire NPs for staffing in emergency departments, more research needs to be conducted to elucidate their preparation for these roles and to understand how to better prepare NPs for ED-related needs.

Abstract

Introduction: National debate persists surrounding the expanded use of nurse practitioners in the emergency department. Current understanding of the alignment of nurse practitioner educational preparation and practice parameters in United States emergency departments is inchoate. The objective of this review was to seek evidence to support that nurse practitioner education and training align with current practices in the emergency department.

Methods: A Preferred Reporting Items for Systematic Reviews and Meta-Analyses guided systematic review of the existing literature was conducted of 4 relevant databases. Level of evidence and quality assignments were made for each article using Grading of Recommendations, Assessment, Development, and Evaluation or Confidence in Evidence from Reviews of Qualitative Research as appropriate.

Results: Nurse practitioners are increasingly staffing emergency departments, providing care to both patients classified as high-acuity and low-acuity. Reports of nurse practitioner scope of practice vary widely. No studies evaluated alignment of educational preparation and training for actual clinical practice.

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J Emerg Nurs 2021;47:563–581.

0099-1767

https://doi.org/10.1016/j.jen.2021.04.005

Discussion: This review of the literature was inconclusive, and the review team we was unable to find evidence that supports the alignment of nurse practitioner educational preparation and training with scope of clinical practice in United States emergency departments. Future research should seek to articulate the landscape of nurse practitioner academic preparation for specialty practice in the emergency department and to specifically examine the alignment of educational preparation with scope of practice and impact on clinical outcomes of patients seen in the emergency department.

Keywords: Nurse practitioner; Emergency department; Scope of practice; Education

Introduction

BACKGROUND

Emergency care requires specialized skills, and emergency departments need a unique and expert workforce.[1,2] As of 2014, the emergency care workforce consisted of approximately 60 000 emergency medicine (EM) clinicians, of whom fewer than 2 out of 3 were emergency physicians.[1] Since then, there has been tremendous growth in the use of nurse practitioners (NPs), with an estimated 47 700 practicing EM physicians working in 2019.[2] NPs are increasingly staffing emergency departments[1-3] as hospitals seek to contain costs while simultaneously expanding services. Although NPs were initially placed in the nonacute or "fast track" areas of emergency departments, their practice parameters have expanded significantly since the origins of the role. They come from diverse backgrounds and have variable levels of clinical experience, education, and training.[4,5]

NPs are but 1 type of advanced practice provider (APP) currently staffing emergency departments, and others include nurse midwives, nurse anesthetists, clinical nurse specialists, and physician assistants (PAs). This investigation focuses exclusively on NPs working in emergency departments.

According to the American Association of Nurse Practitioners, there are approximately 15 000 NPs working in emergency care. More than 60% of the national NP workforce are certified family NPs, and less than 9% are acute care certified.[6] In fact, most of the United States NPs are prepared through family, adult, and pediatric primary care programs. They are nationally certified to address "urgent" and "nonurgent" types of patient conditions, similar to primary or urgent care providers treating patient conditions in nonhospital settings.[6] It is unclear if these NPs are educationally prepared to manage patients presenting with critical and/or unstable conditions commonly encountered in hospital-based ED settings (eg, chest pain/myocardial infarction, pulmonary edema, altered mental status, status epilepticus, severe trauma, acute respiratory failure). In fact, great variability exists in the education and training between physicians, physician assistants (PAs), and NPs in years of training, total number of hours of clinical and didactic learning, and the proportion of clinicians who have specialty training in EM. Whereas there are clear requirements for both physician residencies and PA postgraduate training programs in EM, NPs do not have a standardized curriculum. Some academic programs are online with limited hands-on clinical training. Emergency physicians and PAs are both required to have clinical experience in the emergency department, but NPs can graduate without any EM experience. Very few NPs have fellowship training in EM because it is not required for practice.[7] Those who do vary widely in regard to length and quality of training.

Currently, NPs are providing care to all levels of patients seeking emergency evaluation and management, including those who are acute and critically ill. ED census data reveal that in 2017 there were approximately 139 million patient visits; 44.7% were emergency severity levels 1 to 3 (immediate, emergent, urgent) and 27.9% were levels 4 or 5 (semiurgent, nonurgent), with 22.3% uncoded or unknown.[1] An analysis of 2018 Medicare provider use and payment data substantiates that NPs are increasingly billing emergency services of all levels of severity, independent of physicians.[1,8] Although NPs were typically added to the ED staffing matrix to care for fast-track nonurgent patients, it seems that they have also been asked, or are seeking, to care for patients with higher-acuity. This phenomenon warrants an evaluation to see if their past education prepares them for this and if their role in this care has influenced clinical outcomes.

Previous reviews have investigated the role of NPs in emergency departments with mixed results. Smith and Hodgins[9] conducted a synthesis of articles reporting the educational preparation and practice parameters of emergency NPs across 4 countries (the US, Canada, Australia, and the United Kingdom). Of the 43 articles analyzed, 60% were descriptive or qualitative studies, and 7% were randomized controlled trials, with findings suggesting that no outcomes had been evaluated consistently, and many were not specific to the intervention or actions of NPs.[9]

Woo et al [3]conducted a systematic review to determine the impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings. Fifteen studies were included in their review across 5 countries; however, only 6 of the studies were specific to the ED setting. Their findings did not support that NP performance directly changed or improved patient outcomes.[3] Some of the studies included in this literature review found comparable clinical outcomes between NP and physician care.[3] There were, in fact, very few that had found improved care outcomes from NPs (time to analgesic medications, patient satisfaction score in 1 study) or cost benefits.[10-14]

In a recent review, Fowler et al[11] stated that NPs practicing in ED settings improve a variety of national quality metrics, ultimately improving the timeliness, efficiency, effectiveness, and quality of care.[10] Their methodology for selecting studies for the review was not described, and of the 8 studies included, 3 were not conducted in the emergency department and should have been excluded from the analysis.[11-13]

All of these reviews included studies from countries outside of the US, adding to their generalizability. However, the roles, education, training, practice, costs, and outcomes of NPs will vary greatly in global settings and may not be applicable to the US. Their findings may have little or no relevance to NPs practicing in US emergency departments.

The primary objective of this review was to seek evidence to support that NP education and training align with current practices in the emergency department.

Methods

LITERATURE SEARCH

A systematic review of the literature was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses approach (Supplementary Table).[15] This framework provides for a guided search and review method with prespecified inclusion and exclusion criteria, definition of terms, and documentation of selection decisions.[16]

A detailed systematic search strategy was developed in collaboration with an expert medical librarian at the Johns Hopkins University Welch Medical Library in Baltimore, MD. In total, a series of 4 progressive literature searches with specific search terms were executed between September 2019 and January 2020 to ensure broad coverage of the topic (Table 1 includes all search terms). The databases searched were MEDLINE through the PubMed interface, the Cumulative Index of Nursing and Allied Health Literature through EBSCO, Scopus, and Web of Science. Three topic areas within these concepts were identified and searched: scope of practice, outcomes, and education. All databases were searched using a combination of controlled vocabulary and keywords for optimal retrieval of studies. Medical Subject Headings terms and combinations with Boolean search tools were applied where applicable per database. The references of the identified articles were reviewed for additional primary source material that was not initially identified in the search strategy.

DATA COLLECTION AND EXTRACTION

To be included in this review, the article had to be a publication of a research work describing NP education and training, practice, or patient outcomes as it related to the delivery of emergency health care services. Studies based in the US, written in English, and published between 2010 and October 2019 were included. The web-based database software Covidence (Veritas Health Innovation Ltd) was used to store and organize all citations and develop standardized abstraction forms for the review. Two members of the research team (T.G.V. and R.L.) conducted title and abstract screening, and papers that were marked as irrelevant by either reviewer were excluded. The remaining articles were reviewed in full, and differences of opinion regarding article eligibility were resolved through consensus adjudication among 4 authors (T.G.V., R.L., S.F., and C. P.T.). Data extraction was conducted by 1 of the authors (C.P.T.), and it was cross-checked for accuracy by 2 of the authors (T.G.V. and R.L.).

DATA ABSTRACTION AND QUALITY ASSESSMENT

Each article was assigned a level of evidence and corresponding quality grade as outlined by Dearholt and Dang[17] through discussion and consensus performed by 3 authors (T.G.V., R.L., and C.P.T.) (Table 2). Evidence levels were defined as follows: level I: experimental study or randomized controlled trial; level II: quasi-experimental study; level III: nonexperimental study or systematic review; level IV: opinion of respected authorities and/or nationally recognized expert committees/consensus panels; and level V: case reports or expert commentary based on experiential and nonresearch evidence.[17] To assess the quality of these studies, the Grading of Recommendations, Assessment, Development, and Evaluation and Grading of Recommendations, Assessment, Development, and Evaluation—Confidence in Evidence from Reviews of Qualitative Research tools were used to assess the quality of the

TABLE 1
Search strategies and terms

Search strategies	
Literature searches	1. Nurse Practitioner Terms AND Emergency Health Care Services Terms AND Scope of Practice Terms AND Outcomes Terms 2. Nurse Practitioner Terms AND Emergency Health Care Services Terms AND Outcomes Terms 3. Nurse Practitioner Terms AND Emergency Health Care Services Terms AND Scope of Practice Terms 4. Nurse Practitioner Terms AND Emergency Health Care Services Terms AND Education Terms
Search terminology	
Nurse practitioner terms	Emergency Nurse Practitioners (MeSH), Emergency nursing (MeSH), Advanced Practice Nurses, Nurse Practitioners (MeSH), Nurse Practitioner role (MeSH), Emergency Nurses (MeSH), Nursing (MeSH), Nursing staff (MeSH), Nursing staff, hospital (MeSH), Nursing workforce
Emergency health care services terms	Emergency medical services, Emergency Department, Accident and Emergency department, Emergency care, Emergency nursing (MeSH), Clinical decision making (MeSH), Decision making (MeSH), Delivery of health care (MeSH), Emergency care (MeSH), Emergency health service (MeSH)
Scope of practice terms	Scope of practice, nursing practice, licensure, standards of care, practice parameters
Patient outcomes terms	Patient outcomes (MeSH), health outcomes, ("patients"[MeSH Terms] OR Patient[Text Word]) AND outcomes[All Fields]
Education terms	Education, academic preparation, training, fellowship, nurse residency

quantitative and qualitative studies, respectively.[46,47] Certainty in evidence or quality of evidence was graded as very low, low, moderate, and high. The purpose, characteristics, and quality of included manuscripts are depicted in Table 2. Rationale is reported for the assignment of quality of the evidence. Given the heterogeneity of the interventions and findings in the studies, no meta-analysis was performed. Instead, a narrative synthesis of the studies was carried out, and the thematic analysis was conveyed in prose alongside tables to outline and explain the findings. The thematic analysis was conducted by the entire study team to identify the key findings relevant to the research question.

Results

The initial search strategy identified 4472 published works (Figure), and 3 additional studies were located by reviewing the references of these published works, yielding a total of 4475 articles. After duplicates (1554) were removed, 2921 articles remained for title and abstract screening. Of these, 2783 papers were not relevant to the research question, leaving 138 manuscripts that were reviewed in full. After full-text review, an additional 108 articles that did not meet the inclusion criteria were excluded, leaving 30 articles for analysis.

Most of the articles (n = 22, 73%) were evidence level III, 5 (17%) were evidence level II, 2 were evidence level V (7%), and 1 was evidence level IV (3%). Most of the articles (n = 16, 53%) were of low quality, 13 (43%) were of moderate quality, and 1 (3%) was of very low quality. The findings from each of the included studies are discussed herein within the context of educational preparedness, clinical practice, and clinical outcomes for NPs working in emergency departments.

EDUCATIONAL PREPAREDNESS

Current Training for Practice

Six of the 30 articles included in this review addressed educational preparedness and training for emergency NP practice. These studies suggest that the structure and licensure

TABLE 2
Research report type, data type, study purpose, and sample characteristics of all reviewed studies

Authors, year	Purpose	Design	Setting	Methods	Reliability	Validity	LOE	Quality	GRADE and CERQual	Rationale
Abbot et al[18], 2010	Determine current practice models for staffing of APPs in the emergency department	Descriptive study	ED managers	Web-based survey of ED managers	Reliability not assessed owing to anticipated low response rate of test/retest	Pilot study assessed face and content validity. Attempted to control for response bias. Expert review	III	B	Low	Only focused on 2 states in the Pacific Northwest United States, which may not be fully representative of full US because scope of practice for NPs varies from state to state, and both states have full practice authority for NPs.
Aledhaim et al[19], 2019	Compare resource use in emergency departments with and without APPs	Retrospective secondary data analysis	Nonacademic emergency departments	Outcomes of resource use (CT, admission, radiography, ultrasonography, MRI)	Secondary data analysis of Emergency Department Bench-marking Alliance. Data are self-reported	Original data set contained information from EDs in 44 states and D.C.	III	B	Low	Two groups were compared using secondary data analysis that was voluntarily submitted by participating hospitals. It evaluated the cost-effectiveness of personnel. Secondary data analysis from existing data set.
Bai et al[8] 2019	Examine national trends in billing codes for APPs in the emergency department	Observational, cross-sectional	Emergency departments with unrestricted APP practice	Examined billed acuity through Medicare provider use and payment data from 2012 to 2016	Not reported	Secondary data analysis of Medicare provider use and payment data from 2012 to 2016; thus only included Medicare patients	III	A	Moderate	Data were assessed from only 2 states, both of which have independent practice for NPs. It only looked at number billing and types of billing for specific CPT codes.
Begaz et al[20] 2017	Compare diagnostic test ordering between NPs and physicians as the providers in triage	Retrospective secondary data analysis	Los Angeles county emergency department	Evaluated number of test categories ordered by the provider in triage	Secondary analysis of previous study	RCT	III	A	Low	The original study was an RCT. The current study looked at the ordering patterns of NPs and physicians from 1 group and was specific to the NP role as the provider in triage. Results suggest that physicians are better predictors of what tests are needed in the ED setting. The conclusions reached do not align directly with the data analyzed.
Bowen[21] 2018	Describe a fellowship program for new graduate APRNs working in the emergency department	QI project	Academic pediatric emergency department	Self-evaluation, monthly evaluation by preceptors, and skills competency assessment	Not reported	Not reported	V	C	Very low	This was a DNP scholarly project. A needs assessment that was vaguely described. There was a 360-degree evaluation, but the actual findings were unclear.
Celona et al[22] 2018	Describe the use of NPs in a fast-track triage program	QI project	High-volume emergency department	Medical records review	Not reported	Not reported	III	C	Low	Fast-track QI project. Only 1 factor was considered; it is hard to know if this was the only change and how it relates. There was no statistical analysis.
Eismann et al[23] 2018	Assess availability of providers to recognize sentinel injuries in infants	Cross-sectional study	Pediatric emergency departments and affiliated urgent care centers in 1 state	Survey	Interrater reliability of respondents	Survey pilot tested and adjusted	II	A	Moderate	Adequate sample size and strong statistical analysis.
Evans et al[24] 2017	Describe novel NP education for emergency APPs	Retrospective review	Emory University, Atlanta, GA	Implementation project and survey	Not reported	Not reported	III	C	Low	Vague questions and biased wording in questionnaire; only reported "agree" or "strongly agree." Small sample size at only 1 institution.
Hall et al[1] 2018	Describe current emergency medicine workforce	Cross-sectional study	Emergency department	Secondary data analysis	Not reported	Sensitivity analysis performed with increasingly strict cutoffs	III	B	Moderate	Large, well-designed study with good analysis that drew from Medicare public use files. Limited only to Medicare recipients. All APPs included together.
Hamden et al[25] 2014	Determine productivity differences	Observational study		Medical records review	Not reported	Only 1 site, reducing validity	III	C	Low	The analysis seemed to be biased; did not consider that providers may be

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TABLE 2
Continued

Authors, year	Purpose	Design	Setting	Methods	Reliability	Validity	LOE	Quality	GRADE and CERQual	Rationale
	between residents and APPs		Urban, high-acuity emergency department							upcoding as a possibility rather than having more accurate and thorough documentation. Without a chart review, it is impossible to draw the conclusions reached.
Henderson et al[26] 2010	Assess adequacy of NPs performing ultrasonography in the emergency department	Longitudinal	Emergency department	Clinical skills posttest	Not reported	Not reported	II	B	Low	Sample size for NPs, but large number of ultrasonography were assessed by each NP. Study was limited to only 1 facility and 5 NPs. No power calculation included in the study analysis.
Hoyt et al[27] 2018	Compare assignment of severity between independent APPs and those who consult with physicians for acute abdominal pain in emergency departments	Retrospective review	NPs working in the emergency department	Secondary data analysis	Interrater reliability "high" for discharge diagnoses	Not reported	III	C	Low	Retrospective study. Limited to ED staffing group staffing 4 hospitals, all in the same area. Potential bias in that 3 NPs assigned concordance of ESI/ED discharge diagnoses for 12 440 patients.
Keough et al[28] 2011	Examine NP practice sites compared with licensure	Cross-sectional study	Licensed NPs	Mailed survey	Survey pilot tested and adjusted	Random sample of NPs from ANCC list. Content and face validity assessed	III	A	Moderate	National survey, self-reported responses, but did have a good response rate for this type of study, did not include pediatric ED providers.
Keough et al[29] 2016	Identify unique educational needs of emergency NPs	Cross-sectional study	Licensed NPs	Secondary data analysis	Secondary data analysis from pilot-tested and adjusted survey	Random sample of NPs from ANCC list. Content and face validity assessed	III	A	Moderate	Secondary data analysis of prior study. The original was well designed using a randomized sample. The original survey was validated by a "panel of experts."
Lloyd-Rees[30] 2016	Explore how NPs view their role in the emergency department	Qualitative	NPs in the emergency department	Semistructured interviews	Not reported	Not reported	IV	B	Low	Singe-site study, small sample with purposive sampling method not clearly defined; limited generalizability.
Mafi et al[31] 2017	Compare value of care between APPs and physicians managing high-acuity ED cases	Cross-sectional	Physicians and APPs in the emergency department	Medical records review	Not reported	Large sample size and broad sampling frame	III	B	Moderate	Nationally represented data from the National Hospital Ambulatory Medical Care Survey with a large number of visits. NPs/PAs bundled in analysis, did not evaluate medical relevance of interventions.
Nelson and Hooker[32] 2016	Determine roles, responsibilities, distribution, and characteristics of APPs in rural emergency departments	Cross-sectional	Community access hospital emergency departments	Questionnaire	Not reported	Survey adjusted on the basis of field-testing results	III	C	Moderate	Mixed-methods exploratory study. Included all critical access hospitals in Washington state. Identified the roles of PAs and NPs in rural emergency departments in Washington state, omitted visiting distant hospitals.
Olson[33] 2015	Determine roles, responsibilities, distribution, and characteristics of APPs in rural emergency departments	QI project	APPs in the emergency department	Needs assessment for education needs of APPs in the emergency department	Not reported. Adapted a previously developed survey	Convenience sample	V	B	Moderate	Sample included 6 APPs in hospitals in close proximity to St. Cloud Hospital in Minnesota. Identified current methods and gaps in education for APPs new to rural emergency care through a needs assessment as part of a DNP scholarly project.

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TABLE 2
Continued

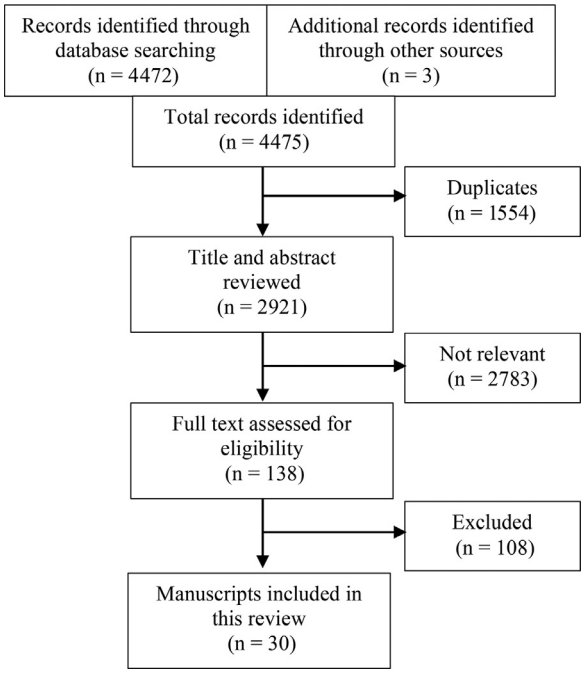
Authors, year	Purpose	Design	Setting	Methods	Reliability	Validity	LOE	Quality	GRADE and CERQual	Rationale
Phillips et al[34] 2018	Establish baseline record of current APP staffing models in the emergency department	Cross-sectional study	Members of the ACEP	Exploratory interviews and survey	t-retest kappa for audience response system survey = 0.895 (95% CI, 0.837-0.953), online survey = 0.873 (95% CI, 0.843-0.903). Interrater reliability = 0.978 (95% CI, 0.965-0.987)	Content validity assessed by PAs, NPs, and physicians. Pilot test. Participants from ACEP considered to be nationally representative sample (90.1% response rate)	III	C	Low	Cross-sectional survey. Identified PA and NP staffing models, practice patterns, and practice scope in emergency departments. Sample did not include NPs or PAs, only physicians who were attending a council meeting of ACEP councilors. Responses were based only on personal memory and/or opinion. Biased sampling patterns.
Pines et al[35] 2020	Examine how APP coverage relates to productivity, patient safety, flow, and experience	Cross-sectional	APPs in the emergency department, nationally	Descriptive analysis	Not reported	Not reported	II	B	Moderate	Did not assess clinical outcomes on the basis of clinician (NP vs PA), RVU use was not consistent across institutions, which limited comparison between sites.
Reuter-Rice et al[36] 2016	Describe current practice of acute care pediatric NPs	Cross-sectional	Practicing acute care NPs	Descriptive analysis	Reliability 0.84 to 1.0 for tasks, 0.92 to 1.00 for knowledge or skills statements	Size was adequate for analysis and representative of the practice of ACPNP in the US	III	B	Moderate	Cross-sectional survey. No response from PNPs in 16 states. Limited owing to gradual nationwide implementation of APRN Consensus Model.
Reuter-Rice[37] 2013	Describe practice of acute care pediatric NP	Cross-sectional	Practicing acute care NPs	Descriptive analysis	Reliability coefficient α and interrater correlation. Coefficient α ranged from .93 to .97. Interrater reliability was .99 across items	Advisory committee developed survey. Invitation to participate sent to all CPNP-ACs and dually certified PNPs in PNCB database	III	B	Moderate	No response from PNPs in one-third of the states. Study did not control for ACPNP practice foci.
Rudy and Wilbeck[38], 2017	Assess current educational content within existing emergency NP fellowships	Cross-sectional	Emergency NP fellowships	Survey	Not discussed	Not discussed	III	B	Moderate	Discussion did not include descriptive statistics or comparative statistics for included programs.
Sterling et al[39] 2017	Examine implementation of a virtual physician consulting program	Pretest, posttest	Rural emergency departments	Survey pretest/posttest	Before and after addition of NP	Nine hospitals eligible for participation, 100% participation rate	II	B	Moderate	Study design did not account for other process interventions that may have occurred between pre- and poststudy surveys. Small sample size with only 9 hospitals. Interpretations not particularly insightful.
Tsai et al[40] 2010	Evaluate quality of asthma care provided by APPs compared with that provided by physicians	Retrospective review	Emergency departments with APPs or physicians	Secondary data analysis	Not stated	ED visits randomly selected from National Emergency Department Safety Study. Predominately urban and academic-affiliated emergency departments may mean less generalizability	III	C	Low	Small sample size of patients cared for by APPs. Quality of care by APPs may have been confounded by unmeasured variables. Author states that the quality of retrospective chart review may be affected by underdocumentation based on a 1999 study.
Tucker and Bernard[41] 2015	Examine outcomes of NPs in the triage and fast-track ED programs	Pretest, posttest	Emergency department	Medical records review pre/post APP use	Not reported	Not reported	II	B	Low	Adequate evaluation of data, appropriate metrics for evaluation, no statistical analysis for significance in the differences between 2 means or proportions. Only 1 emergency department evaluated.

(*continued on next page*)

TABLE 2
Continued

Authors, year	Purpose	Design	Setting	Methods	Reliability	Validity	LOE	Quality	GRADE and CERQual	Rationale
Tyler et al[42] 2018	Practice analysis of NPs working in the emergency department	Cross-sectional	Emergency departments	Online survey	Survey pilot tested and adjusted. Final survey had internal consistency with Cronbach α 0.86 to 0.95 across scales	Sample demographics consistent with NHAMCS data, considered to be representative of population	III	C	Low	Large sample size for survey, broad distribution, response rate not calculated; 4% of the respondents did not specify nursing degree; it is possible that non-NPs completed the survey.
Wiler et al[43] 2012	Evaluate the use and visit acuity for APPs in the emergency department	Retrospective review	Emergency departments	Retrospective medical records review	Not reported	Secondary data analysis of 2006-2009 NHAMCS. Probability sampling. Tracking methods similar throughout survey years, limits potential for bias over time	III	B	Low	Large data set, but only analyzed trends over a 3-year course, did not address practice laws or states with restricted practice authority. NPs and PAs were grouped in analysis. Data set may not have been adequate to fully answer research question.
Wolf et al[44] 2017	Identify skills being performed by APRNs in the emergency department, explore training and competency validation	Exploratory study	Emergency departments	Qualitative interviews and focus groups	Not reported	Purposive convenience sampling. Used survey developed from Delphi study and pilot tested, assessed for content validity	III	C	Low	Low response rate (3%), unaddressed high concentration of doctoral-prepared nurses in qualitative portion of study, quantitative findings not explored thoroughly; high sampling bias of recruiting from ENA members and conference attendees not addressed. Qualitative arm included focus group interviews. Small sample size in quantitative arm (n = 147).
Wood et al[45] 2010	Determine prevalence of NPs in pediatric emergency departments and fast-track areas; identify common procedures performed by NPs in the emergency department	Cross-sectional	Emergency departments	Telephone interview	Not reported	Phase 1: sample from list of hospitals on National Association of Children's Hospitals and Related Institutions website. Phase 2: convenience sample of NPs identified from phase 1 who were working on the day of the telephone interview	III	C	Low	Two-part study. Sample in first phase included 198 hospitals in 41 states (97% response rate) to identify NPs. Phase 2 included interviews with NPs (53% response rate). Survey limited to 1 NP from each hospital and only examined hospitals in the National Association of Children's Hospitals and Related Institutions. Administered surveys while working. Not all answered surveys included in analysis.

LOE, level of evidence; APP, advanced practice provider; NP, nurse practitioner; GRADE, Grading of Recommendations, Assessment, Development, and Evaluation; CERQual, Confidence in Evidence from Reviews of Qualitative Research; CT, computed tomography; MRI, magnetic resonance imaging; CPT, Current Procedural Terminology; RCT, randomized controlled trial; APRN, Advanced Practice Registered Nurse; QI, quality improvement; DNP, Doctor of Nursing Practice; ESI, Emergency Severity Index; ANCC, American Nurses Credentialing Center; PA, Physician Assistant; CI, confidence interval; ACEP, American College of Emergency Physicians; RVU, relative value unit; ACPNP, Acute Care Pediatric Nurse Practitioner; PNP, Pediatric Nurse Practitioner; PNCB, Pediatric Nursing Certification Board; NHAMCS, National Hospital Ambulatory Medical Care Survey; ENA, Emergency Nurses Association



FIGURE

Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram for included articles

of ED staffing varies geographically and among institutions. Keough et al[28] report that 65% of the family NPs who were practicing in nontraditional environments were working in high-acuity emergency departments. Most NPs reported high-priority learning needs that were met through continuing education and on-the-job training. In a follow-up analysis, Keough et al[29] reported that NPs practicing in the emergency department identified additional educational needs, including managing patients who were critically ill; pharmacology; interpretation of laboratory test results/electrocardiograms (ECGs)/radiographs/computed tomography (CT) scans; suturing; and mentoring by physicians and senior NPs.

Some NPs reported that after being hired by an emergency department, they received on-the-job training, including some form of orientation or training specific to emergency care, shadowing with a physician, or training under an APP preceptor, whereas other respondents reported having no ED-specific training.[33] Some stated that they prepared for their role with self-directed training (ECG interpretation books, UpToDate [Wolters Kluwer] referencing, and online boot camps) and felt least confident in lumbar puntures, continuous positive airway pressure/bilevel positive airway pressure therapy, thoracostomy, thoracentesis, sexual assault evaluation, and CT scan interpretation.[33] One study found that NPs have high success with module-type instruction for specialized training, such as the performance of ultrasonography in the emergency department; however, the study involved only 5 NPs in 1 setting.[26]

Three publications describe specialized EM educational opportunities for NPs. ED fellowship programs for NPs vary widely and range in duration from 275 hours of EM clinical care during schooling[24] to 12- to 18-month programs with 2000 to 3000 clinical hours, and some incorporate training that is provided to EM resident physicians.[38] Fellowship programs enroll NPs with varied clinical backgrounds and years of experience before beginning the specialized training.[21] Graduates of 1 of these programs reported that the EM content and rotations were beneficial, improved clinical skills, and increased confidence in communicating with physicians,[24] but most of those surveyed after EM training wanted more training in splinting, orthopedics, and suturing.[21] Most (91.6%) of the practicing NPs would take an EM fellowship and would want to learn from both a physician and NP preceptor.[21]

CLINICAL PRACTICE

Fifteen studies included in this review have attempted to ascertain the proportion of NPs working in emergency departments in the US, many of which evaluated the roles of NPs and PAs together.

As acknowledged earlier, NPs have several specialties and are licensed accordingly; EM departments currently hire NPs with training in adult/gerontology acute care, adult/gerontology primary care, pediatric acute care, and pediatric primary care, with most NPs having received training in family primary care.

National surveys found that APPs account for between 24.5% and 79% of the providers in the emergency department, and national surveys have identified a growth of emergency departments that staff with NPs, increasing from 58% to 79% between 2010 and 2019.[18,19,43] An evaluation of the 2014 Medicare public use files that included 58 641 providers in the US found that APPs accounted for 24.5% of the reimbursements for ED billing, 14.3% of which came directly from NPs.[1] Other analyses on large national data sets have found that NPs account for approximately 5.4% of the independent billing in the emergency department.[35]

In a survey of 163 practicing physician members of the American College of Emergency Physicians, 72.2% of the respondents said that the emergency department that they worked at employed NPs and PAs, 10.4% of whom stated they only hired NPs (and not PAs).[34] Fifty-

TABLE 3
Key findings in included articles in chronological order

Year	Author	Key findings in chronological order
2010	Abbot et al[18]	Fifty-eight percent of hospital emergency departments used NPs or PAs (58.1% of the emergency departments in Washington state and 73% of the emergency departments in Oregon). Hospitals using NPs/PAs were more likely to be large urban centers; 59.3% of the emergency departments had nonemergent tracts, but there was no assertion between this and use of NP/PAs. Half of the respondents said that NP/PA providers saw both emergent and nonemergent cases. In Oregon, 81.8% of the patients cared for by NP/PA were nonemergent; 42% in Washington. Sixty percent of the managers used NPs/PAs to care for nonemergent cases only; 14.8% of the respondents said that NPs/PAs cared for more than 50% of the patients in the emergency department.
2010	Henderson et al[26]	A total of 229 ultrasonography were performed; 2 were nondiagnostic. A total of 32 images were inadequate, 27 positive findings (all correct). Of the 32 inadequate images, 18 were for focused assessment with sonography for trauma and were negative for free fluid. The overall adequacy of the images were 86% for the entire sample. The NPs achieved a sensitivity level of 93% and specificity level of 98% for ultrasonography images. Positive predictive value for NP ultrasonography was 89%, and the negative predictive value was 99%.
2010	Tsai et al[40]	Ninety percent of the patients were seen by physicians only, 8% by APPs supervised by physicians, and 2% by APPs alone. APPs were less likely to administer beta-agonists within 15 min of arrival (OR 0.2; 95% CI, 0.1-0.7), less likely to prescribe systemic corticosteroids (OR 0.4; 95% CI, 0.20.9), and more likely to prescribe antibiotics at discharge (OR 2.1; 95% CI, 1.1-4.1). NPs/PAs were bundled in the analysis, and thus it was impossible to determine NP practice.
2010	Wood et al[45]	Fifty-one percent of the respondents reported using NPs in the pediatric emergency department, and 36% reported using PAs ($P < .01$); NPs were evenly distributed across the country, and PAs tended to work in the Northeast and Midwest regions ($P < .01$). Freestanding children's hospitals were more likely to use NPs than children's hospitals associated with a general hospital ($P < .01$). Of the NPs, 97.6% had a master's degree, 2.4% had a doctorate, 61.9% had completed a pediatric NP program, 23.8% had completed a family NP program, 11.9% had completed an emergency NP program, and 2.4% had an acute care NP degree. All NPs reported performing fluorescein dye studies in the eye, more than 90% had attended to dog bites, nursemaid elbows, splinting, packed wounds, and first/second-degree burns. At least 80% of the respondents would perform scalp stapling, treat dog bites to the face, I&D, extremity suture, and nailbed repair. At least 70% would tend to finger dislocation or suture the face. And less than 70% would perform shoulder dislocation procedures, lumbar punctures, gastrostomy tube issues, patella dislocation, or repair fingertip amputation.
2011	Keough et al[28]	Sixty-five percent of the family NP respondents were practicing in high-acuity emergency departments; the most additional education received was in pharmacology, laboratory test results interpretation, and diagnostic test ordering
2013	Reuter-Rice[37]	More than 40% of the acute care PNPs were practicing in the Midwest, and 86.2% of the respondents practiced in urban settings. Seventy-one percent of the respondents practiced in inpatient settings in critical care (27.5%) and the emergency department (10.7%).
2012	Wiler et al[43]	Almost 6% of the patients were seen by APPs alone, and 7.4% were seen by APPs in consultation with physicians. Compared with data from the 1993-2005 span, acuity of APP-only visits did not change; APPs saw 6.5% of the patients who arrived by ambulance (compared with 6%) and 33% of the high-acuity visits (compared with 37%); 64% of the emergency departments used APPs, with higher use in urban settings (74%) than in rural settings. In nonurban emergency departments, APPs saw a median 27% of all visits compared with 7.5% for urban emergency departments. Since 1993, the proportion of ED visits seen by APPs has increased from 3% to 14%.

(*continued*)

TABLE 3
Continued

Year	Author	Key findings in chronological order
2014	Hamden et al[25]	APPs saw 1.56 patients per hour, and residents saw 1.23 patients hourly ($P < .001$); the APPs generated 3.19 RVUs/h, whereas the residents generated 3.33 RVUs/h ($P = .43$). The residents generated 2.73 RVUs per-patient, whereas the APPs generated 2.05 RVUs per-patient ($P < .001$). When examining higher-level residents (third year), the APPs saw more patients hourly (1.3 vs. 1.56, $P = .003$), but the residents generated the same number of RVUs/h (3.58 vs 3.19, $P = .06$) because they generated more RVUs/patient than APPS (2.79 vs 2.05, $P < .001$).
2015	Olson[33]	Three out of 5 respondents were PAs hired into the emergency department as their first position; the NP participant had 18 years of experience as an RN/NP before working in the emergency department. Five of the 6 APPs had some form of orientation or training specific to emergency care; the sixth APP had urgent care orientation. Two of the APPs shadowed with a physician, others had a preceptor; one PA had no ED-specific orientation or training. The APPs stated that they prepared for their role with self-directed training (ECG interpretation books, UpToDate [Wolters Kluwer] referencing, and online boot camps). The APPs stated that they felt least confident in LP, CPAP/BIPAP, thoracotomy, thoracentesis, sexual assault evaluation, and CT interpretation. The APPs requested improved education in anaphylaxis, burn care, cardiopulmonary disorders, EMTALA, endocrine disorders, GI issues, palliative care, shock, sexual assault, and trauma care. A module for adult and pediatric care in the emergency department was well received; the participants liked the mixed delivery method (videos, modules, reading, in-class) and felt it was helpful.
2015	Tucker and Bernard[41]	Door-to-provider time decreased from 59.2 minutes to 32.08 minutes, bed-to-provider time decreased by 9.17 minutes, with 22.9 minutes average time being seen. The percentage of patients who left-without-being-seen decreased by 3.7%, along with an increase in the number of patients seen by 2.25 patients daily without change in patient acuity over time. Patient satisfaction remained above 90% consistently before and after the program started.
2016	Keough et al[28]	Thirty percent were FNPs, 18% were adult NPs, 40% were acute care NPs, and 12% had at least 2 certifications. The identified educational needs (in order) were managing critically ill patients; pharmacology; interpretation of laboratory test results/ECG/radiograph/CT scan; suturing, and mentoring by physicians and senior NPs.
2016	Lloyd-Rees[30]	The themes identified included interprofessional working, role development, education, and motivation. There was overall positive discussion on the interprofessional models in the emergency department and on the belief that physicians often do not understand the NP role until they work with one, and there is some hesitation when the NP makes a referral to a physician if the NP has not consulted with a physician within their specialty. Ongoing education is valued and positively contributes to their practice and satisfaction.
2016	Nelson and Hooker[32]	Eighteen of the 39 CAH emergency departments employed APPs; 75% of the APPs were employed by hospitals, and the remaining were part of a contracted physician group. Fifty-six percent of the respondents were trauma centers designated as level IV, and the remaining were level V. All of the APP-staffed facilities were in more remote areas of the state. There were 42 full-time APPs; most (74%) were PAs hired full-time, and many of the NPs worked part time and worked as backup staff. Thirty-one stated that autonomy was a benefit to their role, 31% were satisfied with their job, and 69% were very satisfied with their job.
2016	Reuter-Rice et al[37]	Practice analysis of 319 certified acute care PNPs; most were practicing in the Southeast (28%) and Midwest US (27%). Most worked in critical care (36%) or in the emergency department (9%); 4.4% worked in high-acuity emergency departments, and 4.7% worked in low-acuity emergency departments.
2017	Begaz et al[20]	Physicians ordered more diagnostic test categories than NPs (1.75 vs 1.54, $P < .001$); physicians ordered more urine tests (77.8% vs 71.4%, $P = .04$), ultrasonography (12.3% vs 4.1%, $P < .001$), blood tests (82.6% vs 77.3%, not significant), and CT scans (0.6% vs 0%, not significant). Provider type remained a significant predictor of test ordering when other variables stayed constant in logistic regression. At the end of the stay, there was no difference in the

(*continued*)

TABLE 3
Continued

Year	Author	Key findings in chronological order
		number of tests ordered by provider type; only when they were in triage. NPs ordered fewer test categories in aggregate and specifically ordered fewer of each individual test category. Despite this difference, by the end of the ED stay, there was no significant difference in total test categories ordered between the groups (eg, urine, blood, x-ray, ultrasonography, CT scan). Thus, the total number of, for example, ultrasonography, was similar between the groups, although fewer were ordered by NPs in triage. This suggests that some necessary studies that were not ordered by the provider in triage were subsequently ordered in the emergency department by the patient's definitive provider and that attending physicians were better able to "predict" what studies would be required by the definitive team in working up their patients. By the end of their ED stay, there was no significant time difference in patient time spent in an ED bed between the provider groups.
2017	Evans et al[24]	This article described an emergency nurse practitioner program. The emergency specific curriculum was designed to adhere to national accreditation and certification standards for FNPs. Emergency medicine content was spread over 4 semesters, and students were required to have 500 clinical hours of primary care and 275 hours of emergency specific clinical care during the program. Emergency NP students learned suturing, splinting, FB removal, I&D, ECG interpretation, emergency childbirth, radiograph interpretation, thoracotomy, and airway management/intubation. Emergency simulation and procedure laboratory tests were added. Ninety percent of the graduates worked in the emergency department or in urgent care. NP participants reported that the emergency medicine content and rotations were beneficial and reported improving clinical skills and confidence in communicating with physicians.
2017	Mafi et al[31]	Thirty-nine percent of the NPs/PAs saw patients without physician collaboration; NP/PA patients were younger and had lower triage scores, and NPs/PAs used similar hospital resources with the exception of medication. NPs/PAs used more medications than physicians (83.9% vs 81.5%; OR 1.18; 95% CI, 1.04-1.33). NPs/PAs were bundled in the analysis; therefore, unable to determine with any degree of accuracy what NP practice was.
2017	Rudy and Wilbeck[38]	This study was specific to NPs. Each offered ED-specific training to board-certified NPs through high-intensity learning to promote critical thinking and proficiency in ED skills and procedures. Programs were 12 to 18 months in duration and had 2000 to 3000 hours of clinical programs with 40 to 65 hours weekly. Some ENP programs were adapted so that newly hired NPs could attend events already existent for medical ED residents. Competency was evaluated with individual performance reviews after each clinical rotation or every 3 months; evaluation within skills and simulation laboratories were also used.
2017	Sterling et al[39]	ED volume did not change with intervention, but ED admission to the same rural hospital did increase (from 6.7% to 8.1%, $P = .02$), and discharge rates decreased (from 87.1 to 80%, $P = .003$). Patient death rates and transfer rates had no change, and instances of patient discharge against medical advice increased after TelEmergency use (from 0.3% to 1.1%, $P = .004$). Of the NPs, 54% used the consulting services for every shift, and more than 91% collaborated with an emergency medicine physician multiple times per shift through telephone. Eighty-six percent of the NPs reported that having a physician constantly available for consultation led to a change in the frequency of consultations.
2017	Wolf et al[35]	APRNs in the emergency department discussed the use of direct and indirect care skills (triage, assessment, documentation). The proportions of APRNs who reported providing interventions in the emergency department were as follows: partner violence, 44%; suicide, 33%; palliative care, 48%; wound care, 52%; and gynecologic/rectal procedures, 45%. Of the APRNs, 100% reported ordering/interpreting ECGs on a daily basis. The APRNs reported gaining skills through brief seminars in their education programs, one-on-one training with preceptors, or through independent learning. Most reported that necessary skills were learned on-the-job. The scope of practice and roles within the emergency department varied greatly among the

(*continued*)

TABLE 3
Continued

Year	Author	Key findings in chronological order
		respondents: some only worked in fast-track roles, some performed procedures, some performed wound repair, and some only performed tasks as delegated by a physician. Most of them reported barriers and restrictions to full practice based on the scope of the NP, including lack of administrative support, state laws, and practice restrictions. The presence of supportive nursing leadership and good physician−NP relationships facilitated improvement in the practice scope. The participants endorsed a lack of uniform consensus on competencies for the role and position, leading to challenges in defining the expectations and roles for NPs.
2018	Bowen[21]	A 12-month fellowship for new graduate APRNs was designed. A needs assessment found that 25% of the practicing APRNs (n = 4) had <1 year's experience, half (n = 7) were emergency RNs before assuming the APRN role, 33% had exposure to surgery before working in the emergency department, and half had orthopedic training. Practicing NPs (10 of 12) wanted more than 4 months of training in splinting, half felt that it was appropriate to provide orthopedic care with 4 months of experience, 33% of the practicing APRNs wanted more education on suturing and felt comfortable after 6 months of practice. It took an average of 6 months to feel comfortable with time management skills in the emergency department. Of the practicing APRNs, 91.6% stated that they would take an emergency medicine fellowship. Of the respondents, 100% stated that they want to learn from physician and APRN preceptors.
2018	Celona et al[22]	Adding NPs to the fast-track program improved timeliness of care and reduced the rates of patients leaving without being seen. Door-to-provider time decreased from 68 minutes to 48 minutes, treat-and-release time reduced from 216 min to 162 min, left-without-being-seen rates decreased from 5.8% to 4.7%. In addition, the average patient visits per year increased at the same time; therefore, these findings are likely underestimating the true effect.
2018	Eismann et al[23]	In a survey to identify symptoms of sentinel injuries in children, all respondents had a moderate agreement with kappa of 0.57, whereas residents and NPs had the least agreement (κ = 0.51 and 0.48, respectively). Attending physicians with more years of experience and emergency medicine fellowship had higher agreement. Responses on a scale evaluating the factors influencing the decision to perform a physical abuse assessment or report to Child Protection Services were not different between NPs and attending physicians and nearly the same as medical residents/fellows.
2018	Hall et al[1]	There were 58 641 emergency medicine clinicians: 35 856 (61.1%) were emergency physicians, 8397 (14.3%) were nonemergency physicians, and 14 360 (24.5%) were APPs. Among the APPs, PAs accounted for 68.4%, and NPs accounted for 31.5%. Urban areas had a higher proportion of physicians. Fewer than two-thirds of the clinician workforce were not emergency medicine physicians.
2018	Hoyt et al[27]	NPs/PAs working alone had the lowest rate of consistent diagnosis between admission and discharge (92.9%), those working in collaboration had the highest rate (97.1%), and physicians working alone had a rate of 95.3%; the groups were all significantly different, with the chi-square statistic at 46.01 ($P < .001$). There were significantly different rates in consistent diagnoses between hospitals as well, accounting for some variability.
2018	Phillips et al[34]	Of the hospitals that employed APPs, 72.4% had both NPs and PAs on staff, 17.2% had only PAs, and 10.4% had only NPs; 59.4% of the hospitals that staffed with NPs had NPs without prior NP experience; 63.6% for PAs. Fifty-one percent regarded APPs as subordinate to physicians, 12% had equivalent relationships, 0.92% regarded NP/PA roles as the same as medical students, 22.9% stated that they liked working with a resident, and 13.2% had no reported relationships with APPs. Thirty percent of the hospitals had APPs who saw patients classified as level I, and more than 90% saw patients classified as levels 3 to 5. There was no difference in the rate of hiring of PAs and NPs (χ^2 = 6.01, P = .11). The ED setting (rural vs urban) did not affect the rate of NP vs PA hiring. Less experienced APPs were thought to use more resources than experienced APPs, and NPs were thought to use more resources than physicians or PAs.

(*continued*)

TABLE 3
Continued

Year	Author	Key findings in chronological order
		The respondents thought that NPs required more education than PAs, 41% thought that a new graduate residency was needed for NPs, 36.8% thought that PAs needed residency training, 17.9% thought that residency training was not needed for NPs, 23.2% thought that residency training was not needed for PAs; 59.3% said that the scope of practice for APPs was not changing at their institution, 31.6% stated that it was increasing, and 3.3% stated that it was decreasing.
2018	Tyler et al[42]	The chief complaints seen by NPs were respiratory (15%), GI (14%), cardio (12%), musculoskeletal/HEENT/rash/GU/trauma (8% each), and neuro/behavioral (1%). The most time was spent in patient management (30%); followed by medical decision making/differential diagnoses (25%); medical screening (21%); patient disposition (14%); and professional, legal, and ethical practices (10%). The average frequency ratings of knowledge use ranged from a low of 2.3 (forensics) to a high of 4.9 (chief complaint, signs and symptoms, focused physical examination, and medical decision making). Potential for harm ratings ranged from a low of 2.5 (biopsychosocial principles/theories) to a high of 3.7 (medical decision making, diagnostic studies, and pharmacologic therapies). The frequency ratings for the procedures performed varied greatly. For example, surgical airway (M = 1.3) was almost never performed; in comparison, local anesthesia (M = 4.1) was administered frequently. Perimortem cesarean section (M = 1.0) was virtually never performed. Harm ratings ranged from a low of 2.8 (tooth stabilization) to a high of 3.9 (for intubation as well as for cardiopulmonary, neonatal, and pediatric resuscitation). The potential for harm was extremely high for certain groupings of procedures such as airway techniques, resuscitation, cardiovascular, and thoracic (M = 3.8).
2019	Aledhaim et al[19]	Seventy-nine of the emergency departments used APPs; emergency departments with APPs had higher crude resource use rates in all measures. but emergency departments with APPs had a higher prevalence of high-acuity visits and more average attending hours. Emergency departments with APPs had higher per-patient rates of admissions, CT scans, radiography, ultrasonography, and MRI use. They also had more acute visits and attending hours, as well as larger volumes.
2019	Bai et al[8]	Over the time of the study, the number of NP and PA providers billing independently for severe ED visits increased by 30%, and the number of billings for low-severity visits decreased. The proportion of services billed by NPs increased from 11% to 18%, with a drop in the proportion of billings by physicians. For ED visits with the highest severity, the number of services billed by NPs nearly doubled (from 5% to 9%). The size and average service volume for APPs increased dramatically in only 4 years across nearly all levels of acuity in the emergency department, with the fastest increase in the populations comprising patients with the most complex conditions.
2020	Pines et al[35]	NPs managed 5.4% of the 13.02 million ED visits from 2014 to 2018 (PAs managed 18.6%, physicians managed 74.6% alone, and 1.4% jointly with APPs). APP visits had lower RVUs per visit (2.8 vs 3.7), and APPs saw fewer patients per hour (1.1 vs 2.2) than physicians. More APP coverage during the day shift decreased patients/clinician hour by 0.12 (95% CI, −0.15 to −0.1). APP staffing in the emergency department had no impact on flow, safety, or patient experience.

NP, Nurse Practitioner; PA, Physician Assistant; APP, advanced practice provider; OR, odds ratio; CI, confidence interval; RVU, relative value unit; RN, Registered Nurse; ECG, electrocardiogram; LP, lumbar puncture; CPAP/BIPAP, continuous positive airway pressure/bilevel positive airway pressure therapy; CT, computed tomography; EMTALA, Emergency Medical Treatment and Active Labor Act; GI, gastrointestinal; FNP, Family Nurse Practitioner; CAH, community-access hospital; FB, foreign body; I&D, incision and drainage; ENP, Emergency Nurse Practitioner; APRN, Advanced Practice Registered Nurse; HEENT, head, eyes, ears, nose, and throat; GU, genitourinary.

one percent of pediatric emergency charge nurses who worked at hospitals participating in the National Association of Children's Hospitals reported using NPs, with only 36% reporting using PAs.[45] The rates of APP use in the emergency department are also likely increasing. One study found that since 1993, the proportion of ED visits seen by APPs alone increased from 3% to 14%.[43] One study evaluated the use of APPs in critical access hospitals in Washington state and found that 46.1% of the hospitals employed APPs.[32] Freestanding children's hospitals were more likely to use pediatric NPs than pediatric emergency departments associated with general hospitals.[45] A survey of acute care certified pediatric NPs found that 9% of all acute care pediatric NPs worked in pediatric emergency departments, of whom 4.4% worked in high-acuity emergency departments.[37]

The roles and functions of NPs, along with billing patterns in the emergency department, vary by region and facility.[25] Half of the ED managers surveyed in Washington and Oregon reported that APPs in the emergency department see both emergent and nonemergent cases and evaluate more than half of all cases that present to the emergency department.[18] In a survey of 163 practicing physician members of the American College of Emergency Physicians, 30% of the respondents reported that they work at a facility where NPs and PAs are involved with the care of patients classified as level I.[34] In an evaluation of 55 NP and PA and 98 emergency resident shifts at an urban high-acuity hospital emergency department, Hampden et al found that APPs saw an average of 1.56 patients hourly, whereas residents saw 1.23 patients hourly ($P < .0001$).[25]

Restriction of Practice and Physician Collaboration

The NP scope of practice is defined nationally by the credentialing bodies, but state governments have the ability to enact restrictive laws that limit the legal abilities of NPs to practice independently. The rates at which NPs see patients without required physician oversight and endorsement range widely; between 2% and 39% of the emergency departments reported staffing with NPs who saw patients independently.[43,31,40]

Many of the studies reviewed addressed APPs, with NPs included in the analysis. The proportion of NPs who see patients in the emergency department without physician collaboration is increasing. An examination of Medicare provider use between 2012 and 2016 showed that the number of APPs (including NPs) billing for highly acute ED visits independently increased by 30%.[8] Furthermore, the number of services billed by NPs working independently increased from 11% to 18%, with a decrease in the proportion of visits billed by physicians.[8] In an evaluation of a virtual physician consulting service, Sterling et al[39] found that providing NPs in the emergency department with virtual access to an EM physician for consultation did not change ED volume, but admission to the same rural hospital did increase (6.7% to 8.1%, $P = .02$), and discharge rates decreased from 87.1% to 80.0% ($P = .003$). When seen by APPs and physicians together, admission and discharge diagnoses for patients with acute abdominal pain were high (97.1% consistently) but were lower if seen by a physician alone (95.3%) or an APP alone (92.9%).[27]

In a survey of APPs that included NPs working in critical access hospitals in Washington state, 31% of the respondents stated that autonomy was a benefit to their role,[32] and most of the NPs working in the emergency department reported that the largest barriers to their ability to practice to their full scope was a lack of administrative support, state laws, and practice restriction.[44] The presence of supporting nurse leadership and strong physician–NP relationships facilitated improvements in practice scope.[44]

Clinical Practice and Tasks

The clinical privileges granted to NPs in the emergency department vary greatly, and they see patients presenting with chief complaints that span a wide range of medical specialties and subspecialties.[42] In a cross-sectional survey of 198 pediatric emergency departments,[45] at least 80% of the respondents reported that they regularly performed scalp stapling, treated dog bites to the face, performed incision and drainage, placed extremity sutures, and tended to nailbed repair. Seventy percent reported that they would tend to finger dislocation or suture the face.[45] In another national survey, all the responding APPs reported that they regularly ordered and interpreted ECGs on a daily basis.[44] In qualitative studies of NPs, it was found that physicians often did not understand the roles of NPs until they worked with one.[30]

CLINICAL OUTCOMES

Seven studies in this review were conducted to elucidate whether or not NPs in the emergency department were clinically competent to evaluate and treat patients independently. When NPs were added to ED staffing, patients were more frequently discharged directly from triage instead of being admitted to an ED bed, and the number

of patients who left-without-being-seen by a provider decreased.[22,41] In some instances, the time from entering the emergency department and being evaluated by a provider was cut nearly in half after NPs joined the practice, from 59.2 minutes to 32.08 minutes[41]; another emergency department saw door-to-provider time decrease from 68 minutes to 48 minutes after staffing with NPs.[22] After addition of NPs to the triage role, patient satisfaction scores were unchanged.[41]

Other studies suggested that physicians in triage tend to order more diagnostic test categories than NPs in triage and that attending physicians were better able to "predict" what studies would be required by the definitive team in working up their patients.[20] Pines et al found that PAs and NPs treated fewer complex visits and half as many patients/hour compared with physicians. Higher PA/NP coverage allowed physicians to treat higher-acuity cases. The authors found no economies of scale for PA/NP coverage, suggesting that increasing PA/NP staffing may not lower staffing costs.[35]

Other studies found that APPs use similar hospital resources, with the exception of medications where APPs used medication in 83.9% of the cases compared with 81.5% for physicians (odds ratio 1.18; 95% confidence interval, 1.04−1.33).[31] Emergency departments that staffed with APPs had higher rates of crude resource use in general, such as higher rates of admissions, CT scans, radiography, ultrasonography, and magnetic resonance imaging use in emergency departments with NPs.[19]

Two studies in this review attempted to determine the differences in care between physicians and NPs in emergency departments. In a study to determine if there were differences in the factors that influence the decision to perform a physical abuse assessment in a pediatric emergency department, researchers found that although all respondents had a moderate agreement with kappa of 0.57, residents and NPs had the least agreement (κ = 0.51 and 0.48, respectively). Attending physicians with more years of experience and EM fellowship had higher agreement.[23] In a retrospective medical records review, it was found that APPs in the emergency department were less likely to administer beta-agonists to patients with asthma within 15 minutes of arrival and less likely to prescribe systemic corticosteroids.[40]

Discussion

The role of NPs in increasing access to health care while maintaining quality and safety in the US is documented in the existing literature.[48−50] NPs, most of whom are prepared in academic programs for primary care, can provide high-quality care to populations of all ages across many clinical settings. Yet, as NP employment in specialty practice areas continues to grow, the nursing community has recognized that little is known regarding the scope and scale of NP misalignment.[51] Because NPs come from diverse backgrounds and educational paths, efforts to align knowledge, emergency medical experience, and scope of practice should match individual capabilities.[52] Our research team sought to answer the question "Does the educational preparation of NPs align with scope of practice in US emergency departments?" None of the studies we identified addressed this question directly (Table 3). The results did suggest that NPs make up a significant component of staffing in emergency departments. Although most of the NPs are educated in primary care academic programs, NPs in emergency departments are seeing both patients classified as high-acuity and low-acuity. Clinical outcomes for these patients were difficult to ascertain owing to the limitations in the quality of the individual studies. Many studies aggregated NP and PA data so that it was impossible to determine what findings were attributable specifically to NP practice. NP practice varied widely depending on geographical location, and NPs reported either having to self-educate (beyond their academic preparation) to work in the emergency department or expressing the need for more education.

None of the studies we identified compared emergency NP practice and clinical outcomes in NPs with advanced EM training and certification with those NPs without such education and training. Although some studies attempted to evaluate whether or not NPs in the emergency department had the clinical competency to evaluate and treat patients independently, none of these studies addressed the care of patients classified as high-acuity.

The studies generally considered to be landmark in the development of the emergency NP specialty scope, standards, and competencies for NPs in emergency care were based on self-report and were generally low to moderate in quality. Paradoxically, current challenges to the validity of NP practice in emergency care are occurring simultaneously with a new population focus in emergency being considered for addition to the Advanced Practice Registered Nurse Consensus Model. At a minimum, the findings of this review call for more objective and high-quality studies to be conducted. Auerbach et al[53] reported that in the past decade the NP workforce doubled from 91 000 to 190 000, and current projections anticipate that these numbers will continue to grow by 6.3%. The number of NP academic programs has increased dramatically, whereas the total time required for a registered nurse to become an NP has decreased. New NPs are entering the workforce

with less registered nurse experience from shorter and more consolidated academic NP programs, most of which are primary care focused.[53] The findings of this review suggest that at a minimum we need a rapid and robust evaluation of the academic preparation of NPs currently working in emergency departments.

Limitations

The primary limitations of this systematic review of the literature involve study design. Systematic analysis of the 30 manuscripts included in this review revealed a range of levels of evidence from levels II to V, with most of the studies being level III, IV, or V. The studies varied widely in their focus of inquiry and addressed themes related to NP educational preparation, scope of practice, and patient outcomes but did not measure the alignment of these variables overall. Some studies included PAs and NPs in the same cohort (APPs); therefore, elucidating the role of the NP specifically was challenging.

Implications for Emergency Clinical Care

Misalignment of NP education and training and scope of practice in the ED setting is a public health concern and potentially puts both patients and NP providers at risk.

Conclusions

The growing burden of care in US emergency departments that are simultaneously facing cost constraints has resulted in an increased reliance on NPs for staffing. Although NPs clearly continue to play a major role in the US health care workforce, optimization of their contribution will occur when they are employed in clinical settings that align completely with their academic preparation and clinical training. The complexity of the ED setting includes the care of patients with a wide range of chief complaints from a simple laceration to hemodynamic instability and respiratory failure. We sought to evaluate evidence that supported that the NPs currently working in US emergency departments have the specific knowledge, competencies, and abilities to care for a broad range of patient presentations. Our review of the literature was inconclusive, and we were unable to find evidence of this alignment. Future research should seek to articulate the landscape of NP academic preparation for specialty practice in the emergency department and to specifically examine the alignment of educational preparation, scope of practice, and its impact on clinical outcomes of patients seen by NPs in the emergency department.

Author Disclosures

Conflicts of interest: none to report.

REFERENCES

1. Hall MK, Burns K, Carius M, Erickson M, Hall J, Venkatesh A. State of the national emergency department workforce: who provides care where? *Ann Emerg Med*. 2018;72(3):302-307. https://doi.org/10.1016/j.annemergmed.2018.03.032
2. Reiter M, Allen BW. The emergency medicine workforce: shortage resolving, future surplus expected. *J Emerg Med*. 2020;58(2):198-202. https://doi.org/10.1016/j.jemermed.2020.01.004
3. Woo BFY, Lee JXY, Tam WWS. The impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings: a systematic review. *Hum Resour Health*. 2017;15(1):63. https://doi.org/10.1186/s12960-017-0237-9
4. National Council of State Boards of Nursing. Nursing regulation. Accessed February 2, 2021. https://www.ncsbn.org/boards.htm
5. American Association of Physician Assistants. Accessed February 2, 2021. https://www.aapa.org/
6. American Association of Nurse Practitioners. Accessed February 2, 2021. https://www.aanp.org/
7. American Academy of Emergency Nurse Practitioners. Fellowship programs. Accessed March 14, 2021. https://www.aaenp-natl.org/fellowship-programs
8. Bai G, Kelen GD, Frick KD, Anderson GF. Nurse practitioners and physician assistants in emergency medical services who billed independently, 2012-2016. *Am J Emerg Med*. 2019;37(5):928-932. https://doi.org/10.1016/j.ajem.2019.01.052
9. Smith GI, Hodgins MJ. Synthesis of research articles to examine reporting of the educational preparation and practice parameters of emergency nurse practitioners. *Adv Emerg Nurs J*. 2018;40(3):226-237. https://doi.org/10.1097/TME.0000000000000202
10. Carter AJE, Chochinov AH. A systematic review of the impact of nurse practitioners on cost, quality of care, satisfaction and wait times in the emergency department. *CJEM*. 2007;9(4):286-295. https://doi.org/10.1017/s1481803500015189
11. Fowler LH, Landry J, Nunn MF. Nurse practitioners improving emergency department quality and patient outcomes. *Crit Care Nurs Clin North Am*. 2019;31(2):237-247. https://doi.org/10.1016/j.cnc.2019.02.010
12. Martin-Misener R, Harbman P, Donald F, et al. Cost-effectiveness of nurse practitioners in primary and specialised ambulatory care: systematic review. *BMJ Open*. 2015;5(6):e007167. https://doi.org/10.1136/bmjopen-2014-007167
13. Mcdevitt J, Melby V. An evaluation of the quality of emergency nurse practitioner services for patients presenting with minor injuries to one rural urgent care centre in the UK: a descriptive study. *J Clin Nurs*. 2015;24(3-4):523-535. https://doi.org/10.1111/jocn.12639

14. Stanik-Hutt J, Newhouse RP, White KM, et al. The quality and effectiveness of care provided by nurse practitioners. *J Nurse Pract*. 2013;9(8):492-500.e13. http://doi.org/10.1016/j.nurpra.2013.07.004
15. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6:(7) e1000097. https://doi.org/10.1371/journal.pmed.1000097
16. PRISMA. Welcome to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) website! Updated 2015. Accessed June 6, 2020. http://www.prisma-statement.org/
17. Dang D, Dearholt SL. *Johns Hopkins Nursing Evidence-Based Practice*. 3rd ed. Sigma Theta Tau International; 2017.
18. Abbott PD, Schepp KG, Zierler BK, Ward D. The use of nurse practitioners and physician assistants in Washington and Oregon emergency departments: a descriptive study of current practice. *Adv Emerg Nurs J*. 2010;32(4):338-345. https://doi.org/10.1097/TME.0b013e3181f91aed
19. Aledhaim A, Walker A, Vesselinov R, Hirshon JM, Pimentel L. Resource utilization in non-academic emergency departments with advanced practice providers. *West J Emerg Med*. 2019;20(4):541-548. https://doi.org/10.5811/westjem.2019.5.42465
20. Begaz T, Elashoff D, Grogan TR, Talan D, Taira BR. Differences in test ordering between nurse practitioners and attending emergency physicians when acting as provider in triage. *Am J Emerg Med*. 2017;35(10):1426-1429. https://doi.org/10.1016/j.ajem.2017.04.027
21. Bowen M. *Development of a Pediatric Emergency Medicine Fellowship for Advanced Practice Registered Nurses: A Case Study*. North Dakota State University Repository: Dissertation; 2018.
22. Celona C, Amaranto A, Ferrer R, et al. Interdisciplinary design to improve fast track in the emergency department. *Adv Emerg Nurs J*. 2018;40(3):198-203. https://doi.org/10.1097/TME.0000000000000199
23. Eismann EA, Shapiro RA, Thackeray J, et al. Providers' ability to identify sentinel injuries concerning for physical abuse in infants. *Pediatr Emerg Care*. 2021;37(5):e230-e235. https://doi.org/10.1097/PEC.0000000000001574
24. Evans D, Ashooh M, Kimble L, Heilpern K. An exemplar interprofessional academic emergency nurse practitioner program: a blueprint for success. *Adv Emerg Nurs J*. 2017;39(1):59-67. https://doi.org/10.1097/TME.0000000000000132
25. Hamden K, Jeanmonod D, Gualtieri D, Jeanmonod R. Comparison of resident and mid-level provider productivity in a high-acuity emergency department setting. *Emerg Med J*. 2014;31(3):216-219. http://doi.org/10.1136/emermed-2012-201904
26. Henderson SO, Ahern T, Williams D, Mailhot T, Mandavia D. Emergency department ultrasound by nurse practitioners. *J Am Acad Nurse Pract*. 2010;22(7):352-355. https://doi.org/10.1111/j.1745-7599.2010.00518.x
27. Hoyt KS, Evans DD, Wilbeck J, et al. Appraisal of the emergency nurse practitioner specialty role. *J Am Assoc Nurse Pract*. 2018;30(10):551-559. https://doi.org/10.1097/JXX.0000000000000134
28. Keough VA, Stevenson A, Martinovich Z, Young R, Tanabe P. Nurse practitioner certification and practice settings: implications for education and practice. *J Nurs Scholarsh*. 2011;43(2):195-202. https://doi.org/10.1111/j.1547-5069.2011.01395.x
29. Keough VA, Tell D, Andreoni C, Young R, Tanabe P. Unique educational needs of emergency nurse practitioners. *Adv Emerg Nurs J*. 2016;38(4):300-307. https://doi.org/10.1097/TME.0000000000000120
30. Lloyd-Rees J. How emergency nurse practitioners view their role within the emergency department: a qualitative study. *Int Emerg Nurs*. 2016;24:46-53. http://doi.org/10.1016/j.ienj.2015.06.002
31. Mafi J. Comparing the value of care delivered by U.S. nurse practitioners, physician assistants, and physicians in the emergency department. Paper presented at: Academy Health Annual Research Meeting; June 25–27, 2017; Hyatt Regency, New Orleans. Accessed May 31, 2021. https://academyhealth.confex.com/academyhealth/2017arm/meetingapp.cgi/Paper/17063
32. Nelson SC, Hooker RS. Physician assistants and nurse practitioners in rural Washington emergency departments. *J Physician Assist Educ*. 2016;27(2):56-62. https://doi.org/10.1097/JPA.0000000000000074
33. Olson CM. *Emergency Care Education for Advanced Practice Providers in Rural Critical Access Hospitals*. ProQuest Dissertations Publishing; 2015.
34. Phillips A, Klauer K, Kessler C. Emergency physician evaluation of PA and NP practice patterns. *JAAPA*. 2018;31(5):38-43. https://doi.org/10.1097/01.JAA.0000532118.98379.f1
35. Pines JM, Zocchi MS, Ritsema T, et al. The impact of advanced practice provider staffing on emergency department care: productivity, flow, safety, and experience. *Acad Emerg Med*. 2020;27(11):1089-1099. https://doi.org/10.1111/acem.14077
36. Reuter-Rice K, Madden MA, Gutknecht S, Foerster A. Acute care pediatric nurse practitioner: the 2014 practice analysis. *J Pediatr Health Care*. 2016;30(3):241-251. https://doi.org/10.1016/j.pedhc.2016.01.009
37. Reuter-Rice K. Acute care pediatric nurse practitioner: a practice analysis study. *J Pediatr Health Care*. 2013;27(6):410-418. https://doi.org/10.1016/j.pedhc.2012.04.005
38. Rudy S, Wilbeck J. Postgraduate emergency nurse practitioner fellowships: opportunities for specialty education. *Adv Emerg Nurs J*. 2017;39(3):224-230. https://doi.org/10.1097/TME.0000000000000155
39. Sterling SA, Seals SR, Jones AE, et al. The impact of the TelEmergency program on rural emergency care: an implementation study. *J Telemed Telecare*. 2017;23(6):588-594. https://doi.org/10.1177/1357633X16657499
40. Tsai CL, Sullivan AF, Ginde AA, Camargo Jr. CA. Quality of emergency care provided by physician assistants and nurse practitioners in acute asthma. *Am J Emerg Med*. 2010;28(4):485-491. https://doi.org/10.1016/j.ajem.2009.01.041
41. Tucker A, Bernard M. Making the case for nurse practitioners in the emergency department: a clinical case study. *Adv Emerg Nurs J*. 2015;37(4):308-312. https://doi.org/10.1097/TME.0000000000000081
42. Tyler DO, Hoyt KS, Evans DD, et al. Emergency nurse practitioner practice analysis: report and implications of the findings. *J Am Assoc Nurse Pract*. 2018;30(10):560-569. https://doi.org/10.1097/jxx.0000000000000118
43. Wiler JL, Rooks SP, Ginde AA. Update on midlevel provider utilization in U.S. emergency departments, 2006 to 2009. *Acad Emerg Med*. 2012;19(8):986-989. https://doi.org/10.1111/j.1553-2712.2012.01409.x
44. Wolf LA, Delao AM, Perhats C, Moon MD, Carman MJ. The experience of advanced practice nurses in US emergency care settings. *J Emerg Nurs*. 2017;43(5):426-434.e16. http://doi.org/10.1016/j.jen.2017.04.007
45. Wood C, Wettlaufer J, Shaha SH, Lillis K. Nurse practitioner roles in pediatric emergency departments: a national survey. *Pediatr Emerg Care*. 2010;26(6):406-407. https://doi.org/10.1097/PEC.0b013e3181e057b8
46. Guyatt G, Oxman AD, Akl EA, et al. GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol*. 2011;64(4):383-394. https://doi.org/10.1016/j.jclinepi.2010.04.026

47. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336(7650):924-926. http://doi.org/10.1136/bmj.39489.470347.AD
48. Kurtzman ET, Barnow BS, Johnson JE, Simmens SJ, Infeld DL, Mullan F. Does the regulatory environment affect nurse practitioners' patterns of practice or quality of care in health centers? *Health Serv Res*. 2017;52(suppl 1): 437-458. https://doi.org/10.1111/1475-6773.12643
49. Traczynski J, Udalova V. Nurse practitioner independence, health care utilization, and health outcomes. *J Health Econ*. 2018;58:90-109. https://doi.org/10.1016/j.jhealeco.2018.01.001
50. Xue Y, Ye Z, Brewer C, Spetz J. Impact of state nurse practitioner scope-of-practice regulation on health care delivery: systematic review. *Nurs Outlook*. 2016;64(1):71-85. https://doi.org/10.1016/j.outlook.2015.08.005
51. Martsolf GR, Gigli KH, Reynolds BR, McCorkle M. Misalignment of specialty nurse practitioners and the consensus model. *Nurs Outlook*. 2020;68(4):385-387. https://doi.org/10.1016/j.outlook.2020.03.001
52. American College of Emergency Physicians. Policy statements. Updated 2021. Accessed February 2, 2021. https://www.acep.org/patient-care/policy-statements/
53. Auerbach DI, Buerhaus PI, Staiger DO. Implications of the rapid growth of the nurse practitioner workforce in the US. *Health Aff (Millwood)*. 2020;39(2):273-279.

Patient Characteristics of Persons Dead on Arrival Received in a Danish Emergency Department: A Retrospective Review of Health Records

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Contribution to Emergency Nursing Practice

- It is known that emergency nurses have the responsibility of caring for persons dead on arrival, or DOA, and their relatives in Denmark, however, the characteristics and size of the population are unknown.
- The main finding of this research was that the care of persons DOA is a daily event in the emergency department and a daily task for emergency nurses. The population of persons DOA is characterized by a mean age of 71 years, most being male and found dead or dying by near family.
- The size and characteristics of the DOA population and the subsequent impact on emergency nurses' daily practice warrant priority attention to further the development of care practices for persons DOA and their bereaved in the emergency department.

Abstract

Introduction: In addition to treating living patients, emergency nurses are also responsible for receiving and caring for persons who are dead on arrival and their relatives. There is limited knowledge about the dead on arrival patient and family population as well as care practice for the dead and their relatives. The first step in improving care for dead on arrival persons is to know the size and characteristics of the population. Therefore, the aim of this study was to describe the size and characteristics of the dead on arrival population in a Danish emergency department.

Methods: A retrospective review of health records was undertaken for all consecutive dead on arrival persons received in 1 Danish emergency department between January 2018 and December 2019.

Results: A total of 719 dead on arrival persons were included, 350 in 2018 and 369 in 2019. Males accounted for 64%. The mean age was 71 years with a range from 18 to 102 years. The place of death was 80% at home, and more than half (54%) were found either dead or dying by a spouse, cohabitant, or son/daughter. In most cases, the cause of death was described as unknown (92%), whereas suicide and accidents accounted for 8%.

Discussion: The population of dead on arrival persons in a Danish emergency department were mainly men, found dying or dead by relatives and brought in from home. Additional research and development are warranted regarding care practices for dead on arrival and their families in the emergency department.

Key words: Emergency nurse; Brought in dead; Dead on arrival; Bereavement; Emergency department; Grief

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J Emerg Nurs 2021;47:582-589.
Available online 26 February 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.01.007

Introduction

Emergency departments are gateways to hospitals treating patients with all kind of conditions and states of acute illness. Alongside treating living patients, the bodies of patients who are dead are also received and cared for in the emergency department. Dead on arrival (DOA) or brought in dead (BID) are terms used when a person is found dead unexpectedly outside a hospital. Persons can also be defined as DOA or BID after unsuccessful resuscitation in the ambulance or in the trauma room. There is no difference between the terms "dead on arrival" and "brought in dead." We use the term DOA to cover dead persons brought into an emergency department with or without resuscitation attempt.

COUNTRY CONTEXT

In Denmark, it is a criminal offense to not initiate resuscitation or call for help if there is any doubt as to whether a person is dying or dead. Only a physician can declare a person dead, unless the onset of death is obvious or expected (eg, in a patient who was terminally ill). Obvious death can involve decay, injury, or trauma inconsistent with life.[1] The bodies of people declared "dead in the field" may be brought directly to a morgue or a forensic institute. The police are expected to be involved and conduct a forensic inquest when there is any suspicion the death was caused by criminal offenses, suicide, or accidents, or if the person is found dead or death occurred suddenly and without obvious medical reasons.[1] According to Danish law, the police decide whether or not to transfer the dead person to a forensic institute.[2]

Pursuant to the Danish Health Care Act, a person is dead by irreversible cessation of breathing and cardiac activity (the cardiac death criterion) or by irreversible cessation of all brain function (the brain death criterion). Inquest is performed by a physician at arrival at the emergency department or in the field to confirm signs of death and, if possible, the manner and cause of death. Confirmed signs of death are either stiffness of death (rigor mortis), corpses (livores), or decay (cadaveresitas). When confirmed signs of death are present a death certificate can be made by a physician. The death certificate is a legal document that serves as documentation that a person is dead.

LOCAL EMERGENCY NURSING CARE OF DOA

North Zealand Hospital is a university hospital located in the capital region of Denmark. When a DOA person is received in the emergency department, and if the police permit, the emergency nurse assumes care of the body. Emergency nursing care includes preparing the deceased for the viewing of their relatives and providing support during the initial family viewing of the DOA person's body and the initial family bereavement. Preparing a DOA person can involve grooming and positioning so that the DOA person appears dignified and as presentable as possible.[3] The condition of DOA persons can vary greatly depending on how death occurred, and death can range from expected to suddenly traumatic depending on the circumstances surrounding the death. The incidence of DOA persons may vary across time and contexts; pandemics, such as coronavirus disease 2019, or catastrophic situations can be expected to increase the number of DOA persons significantly.

AVAILABLE KNOWLEDGE

Our systematic literature search did not identify any relevant studies describing the adult DOA population. The few identified studies focused on how to predict or prevent patients from dying on the way to the emergency department,[4] DOA in low-income countries,[5-7] or perinatal loss or loss of children[8,9] or patients <45 years.[10] No identified studies described the characteristics of an adult DOA population received and cared for in emergency departments in high-income countries. Furthermore, studies reported that some emergency nurses and physicians find it difficult and unsatisfying to provide end-of-life or postmortem care in an emergency department. This occupational difficulty was due to both the lack of knowledge and resources and the association of end-of-life and postmortem care with an increased level of work-related stress and low job satisfaction.[11-17]

The grieving process can be painful and stressful, though most individuals have sufficient internal resources and external support to adequately cope with their grief and slowly adjust to a life without the deceased. Situational factors such as place of death, lack of preparation for death, or violent or traumatic death were associated with an increased risk of prolonged grief disorder (PGD).[18-21] Factors associated with a favorable bereavement response included perceiving the death as peaceful and nondistressing, and the ability to give the loss a sense of meaning.[3,18,19] Little is known about emergency nursing care interventions for the DOA population and the impact on PGD.

PURPOSE AND RATIONALE

To our knowledge, DOA is not systematically registered in Denmark nor elsewhere. There is a knowledge gap about the characteristics of the adult DOA population and the

care for their relatives to support the process of grieving in the emergency setting. The DOA population and their families may be unnoticed and overlooked. It is timely and important to know more about the DOA population to take proper care of the DOA persons' bodies, their relatives, and the health care professionals delivering this care. Therefore, the purpose of this study was to describe the size and characteristics of the DOA population in a Danish emergency department.

Methods

This study was a retrospective review of health records of all DOA persons received in the emergency department at North Zealand Hospital within a 2-year period. North Zealand Hospital is a university hospital located in the capital region of Denmark, which serves a population of 310 000 urban and rural residents. The emergency department employed approximately 120 nurses and received more than 100 000 patients each year, corresponding to 3000 patients each day. DOA persons are among the patients arriving for acute illness, trauma, or injury care in the emergency department. This study was reported according to the Reporting of Studies Conducted Using Observational Routinely Collected Health Data statement, a checklist extended from the Strengthening the Reporting of Observational Studies in Epidemiology statement.[22]

PARTICIPANTS

All adult persons (≥18 years) classified as DOA persons and received in the emergency department at North Zealand Hospital between January 1, 2018, and December 31, 2019, were identified and included. Children and young people aged <18 years classified as DOA are not received in the emergency department. They are received and cared for in the pediatric ward by pediatric nurses and physicians and therefore were not included in this study.

DATA COLLECTION AND DATA MANAGEMENT

Based on a pilot test of 10 randomly selected cases from 2019, a standardized audit scheme was designed (Supplementary Material). All variables that could be extracted from the health records and were related to death were registered. The health record was electronic and covered the persons' past and present contact with hospitals. If the DOA persons had no such contacts, the health record was empty, except for recent data related to death. Data on resuscitation were sparse and only recorded as attempted cardiopulmonary resuscitation (CPR), yes or no. By whom and why CPR was or was not initiated was not systematically registered in the health records. Patients who received CPR on their way to the emergency department or in the trauma room of the emergency department were also classified as DOA because they died before being labeled "hospitalized" and were therefore recorded as an unexpected death outside a hospital.

The cause of death was divided into 3 broad categories as recorded in the health record. The cause of death was not determined by the conclusion of an autopsy or a medical examination but by the ED physician who filled out the death certificate. In cases of accidents and suicide, the cause of death was established. The remaining cases were categorized as unknown cause of death (eg, in which the cause of death could not be determined for certain). In some cases, based on the patient's medical history, the ED physician estimated a cause of death (eg, chronic obstructive pulmonary disease, cancer). However, because of the validity and misspecifications for these estimates, they were not included in our study.

The first and second author reviewed the DOA persons' health records, and all data were entered into a REDCap database. Data were anonymized for analysis. All variables were analyzed using descriptive statistics and presented as means (SD) and ranges (parametric continuous data) or frequencies with percentages (categorical and binary data). SPSS Statistics, version 22.0 (IBM Corp) was used for the statistical analysis.

ETHICS

As the study design was retrospective, informed consent was not relevant and, according to the Danish Committee Act, not required for registry-based studies.[23] The project was approved by the hospital executive board and the chief nurse and physician of the emergency department. All data were handled and stored in accordance with the Danish Data Protection Agency, and the Regional Data Protection Agency approved the project (VD-20019-03).

Results

A total of 719 DOA persons were included. The results are presented in Table 1. However, the number does not equal 719 because data are missing randomly owing to the lack of chart registration (Table 1).

TABLE 1
Characteristics of the DOA persons and circumstances related to their death (n = 719)

Characteristics	2018, n = 350		2019, n = 369		2018/2019, n = 719	
	n	%	n	%	n	%
Sex and age						
Male	230	66	231	63	461	64
Female	120	34	138	37	258	36
Age, y, mean (SD)/median (range)	350	71 (15)/74 (18-102)	369	70 (14)/73 (18-100)	719	71 (15)/73 (18-102)
Resuscitation						
Initiated CPR*	132	38	142	43	274	43
No CPR	178	62	186	57	364	57
Missing	40		41		81	
Place of death						
Home	206	82	214	79	420	80
Outside home	46	18	58	21	104	20
Missing	98		97		195	
The DOA person was found by						
Spouse, cohabitants, or children	93	53	122	56	215	54
Neighbors or friends	17	10	21	10	38	10
Home care service	32	18	35	16	67	17
Police	10	5	10	5	20	5
Others, often random bystanders	25	14	31	14	56	14
Missing	173		150		323	
Forensic inquest						
Forensic inquest, yes	143	55	150	56	293	56
Forensic inquest, no	119	45	116	44	235	44
Missing	88		103		191	
Cause of death*						
Suicide	18	5	25	7	43	6
Traffic or other accidents	10	3	7	2	17	2
Unknown cause of death	322	92	337	91	659	92

All data are presented as numbers and percent except for age.
CPR, cardiopulmonary resuscitation; DOA, dead on arrival.
* Cause of death estimated by time of death by a physician.

Men accounted for nearly two-thirds of the DOA persons (64%, n = 461). The mean age of DOA was 71 years (SD = 15), and the median was 73 years with a range from 18 to 102 years. Most (80%) were found dead or died in their home. In 54% of the cases, relatives had been present when the person died or called the Danish emergency number 112 (equivalent to 911 in the United States) as the person was found dead or dying. Home care service was involved in 17% of the events and friends and neighbors in 10%. In 14%, the DOA person was found by bystanders with no relation to the DOA person.

In total, 274 DOA persons received unsuccessful CPR corresponding to 43%. Among these were 183 patients ≥70 years and of these were 22 patients ≥90 years. In total, CPR was initiated on patients ≥70 years in 67% of the cases.

Discussion

This study described the characteristics of DOA persons in a Danish emergency department during a 2-year period. The emergency department received in average 1 DOA person

every day. The DOA population was characterized by a median age of 73 years, and nearly two-thirds were males. However, the age ranges from 18 to 102 years and the different causes of death illustrate a heterogeneous population. As expected, the elderly constituted the largest proportion of the DOA population. Why males constituted most of the DOA persons is unknown. The same pattern was seen in autopsy studies that found that sudden death was more frequent in men than women.[24]

Our data showed that 67% (n = 183) of those receiving unsuccessful CPR were older than 70 years, and of these, 22 were patients older than 90 years. It is debatable whether the death of a 90-year-old person is unexpected and if it is always commendable to start resuscitation. Here, advanced care planning (ACP) is an important consideration. If there is no CPR opt-out on the health record, the person who finds the patient dead or dying will be obliged to start resuscitation regardless of the patient's age and general state of health. To opt-out of CPR, the person has to discuss CPR with a physician in advance. Previous studies have shown that older people frequently attend the emergency department in their last year of life,[25,26] giving emergency nurses and physicians a chance to address issues related to end-of-life care and dignified death. This is a new way of thinking about emergency care as emergency nurses and physicians are often focused on solving acute clinical problems and saving lives rather than on ACP. However, an emergency care encounter may be the only chance we get to discuss ACP with some of the patients, and we know that ACP is important for both the patients (in risk of becoming a DOA person) and their relatives and for the way we use the resources in our health care system.[27,28]

The DOA persons are received and cared for by the emergency nurses but can be neither "treated" nor "saved." On average, each dead person leaves 4 close relatives,[29,30] corresponding to more than 1400 relatives per year in our setting. This indicates that DOA persons and their relatives nationally and globally constitute a substantial population in an emergency department; a population that can be expected to increase significantly during pandemics such as coronavirus disease 2019. The DOA population has not been previously studied in Western countries, despite the population's size and impact on daily nursing practice in an emergency department.

Immediate family found the person either dead or dying in more than half of the cases in our study. In 8%, the cause of death was an accident or suicide. Finding a loved one dead or dying and being the one who initiates CPR and/or is present during unsuccessful CPR may become a traumatic experience for the relatives. Our literature review did not identify any studies that investigated the perspectives of the bereaved relatives. The findings of our study lead to additional initial research questions that may be refined, such as "Do you, on behalf of your spouse, regret their being subjected to resuscitation? If your spouse had the opportunity, would they have opted out of CPR? Would your grieving process have been different if you and your spouse had taken a stand in advance and discussed it with a physician?" In summary, we need knowledge and insight from the relatives of DOA persons and recommend further research about this topic.

The prevalence of PGD is higher when death is caused by traumatic events compared with nontraumatic events (9.8% vs 13%-78%),[20,31,32] however, sparse knowledge of grief interventions aimed at bereaved adults exists. We have not identified any intervention aimed at relatives of DOA, thus a systematic review investigated the effectiveness of interventions for people bereaved through suicide and found only scant and weak evidence—and a need for further research.[33] PGD is a painful condition and associated with elevated rates of suicidal ideation and attempts, cancer, immunologic dysfunction, hypertension, cardiac events, functional impairments, depression, anxiety, hospitalizations, adverse health behaviors, and reduced quality of life.[29,30,34,35] No studies seem to have investigated the prevalence of PGD among DOA relatives nor their need for support. However, relatives of DOA persons can be considered a vulnerable population as the circumstances surrounding death will often be traumatic.

The relatives of DOA patients will often be in contact with emergency nurses in the first hours/day after the death as they arrive to the emergency department to see and say goodbye to the deceased. Care that potentially prevents or relieves symptoms of PDG among relatives is described as an integrated part of palliative care, but in an illness trajectory in which patients, relatives, and health care professionals already have an established relationship.[11,36-38] This article reports the finding from the first of 3 studies with the overall aim to improve care for the BID and their relatives. The other studies are ongoing and described in detail in a qualitative study protocol.[39]

LIMITATIONS

This study had some limitations. First, it was a single-center study. It would be interesting to include DOA persons from all Danish hospitals with an emergency department (n = 14) in a future study. Second, the retrospective design made it impossible for us to retrieve missing data by collecting supplementary information about prehospital care, CPR, cause of death, and so on. Finally, more characteristics of the DOA relatives would have been relevant but were

impossible to identify owing to the retrospective design. Nonetheless, this study did provide new data describing the DOA population, knowledge that can lead to further research needed to improve the care for DOA persons and their bereaved relatives.

Implications for Emergency Nurses

Knowledge about end-of-life and postmortem care for DOA patients and their families is relevant to emergency clinical practice. There are challenges to obtaining competencies and skills for postmortem care and bereavement support as the priority focus in the specialty is often on life-saving competences and skills. Care for DOA persons and their relatives requires other competences and interests than those generally demanded and valued in the emergency specialty. However, what competencies are required for care for DOA persons and how care is best organized are unknown. More research, innovation, and development are warranted if we want to improve nursing care for this population. The size of the population and the complexity of care needs imply that care for DOA persons and their relatives must affect the daily practice and the work environment of emergency nurses and physicians. More information is needed about the added workload and staffing capacity for emergency nurses to dedicate and provide care for DOA persons and their relatives.

Conclusions

The purpose of this study was to describe the size and characteristics of the DOA population in a Danish emergency department. There were 360 DOA persons per year in our setting. The population of DOA persons in our Danish emergency department were mainly men, found dying or dead by relatives and brought in from home. Our findings justify the need for further research in this population and development of better end-of-life, postmortem, and bereavement care practices for the dead and their relatives in the ED setting.

Author Disclosures

The authors would like to acknowledge that this work was supported by a research grant to the first author (D.G.B.) from North Zealand Hospital's Research Council.

Conflicts of interest

None to report.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2021.01.007.

REFERENCES

1. The Ministry of Health. Danish Health Care Act (LBK nr. 903 af 26/08/2019). Section XIII. (In Danish) Updated 2019. Accessed February 4, 2021. https://www.retsinformation.dk/eli/lta/2019/903
2. The Ministry of Health, Danish Health Care Act (LBK nr. 903 af 26/08/2019), chapter 56; §187. (In Danish) Updated 2019. Accessed February 4, 2021. https://www.retsinformation.dk/Forms/R0710.aspx?id=210110#id87a06e16-7416-42ba-8382-33bfc22354c0
3. Olausson J, Ferrell B. Care of the body after death: nurses' perspectives of the meaning of post-death patient care. *Clin J Oncol Nurs*. 2013;17(6):647-651. https://doi.org/10.1188/13.CJON.647-651
4. Lin JN, Lin TJ, Kuo MC, Chou JJ, Lin CK, Tsai MS. Analysis of factors associated with successful cardiopulmonary resuscitation in non-traumatic dead-on-arrival patients in emergency department. *Kaohsiung J Med Sci*. 2002;18(2):84-90.
5. Khursheed M, Bhatti J, Parukh F, et al. Dead on arrival in a low-income country: results from a multicenter study in Pakistan. *BMC Emerg Med*. 2015;15(suppl 2):S8. https://doi.org/10.1186/1471-227X-15-S2-S8
6. Chiang TC, Wang CY. Dead-on-arrival patients in Panchiao, Taipei. *Zhonghua Yi Xue Za Zhi (Taipei)*. 1999;62(8):509-513.
7. Janeway H, O'Reilly G, Schmachtenberg F, Kharva N, Wachira B. Characterizing injury at a tertiary referral hospital in Kenya. *PLoS ONE*. 2019;14(7):e0220179. https://doi.org/10.1371/journal.pone.0220179
8. Ovstedal LR, Moe D, Dyregrov A, Dyregrov K. Young road fatalities: consequences for life quality and the role of transport authorities. *Omega (Westport)*. 2017;75(1):69-91. https://doi.org/10.1177/0030222817698992
9. Kersting A, Wagner B. Complicated grief after perinatal loss. *Dial Clin Neurosci*. 2012;14(2):187-194. https://doi.org/10.31887/DCNS.2012.14.2
10. Cooper JJ, Stock RC, Wilson SJ. Emergency department grief support: a multidisciplinary intervention to provide bereavement support after death in the emergency department. *J Emerg Med*. 2019;58(1):P141-P147. https://doi.org/10.1016/j.jemermed.2019.09.034
11. Diaz-Cortes MDM, Granero-Molina J, Hernandez-Padilla JM, Perez Rodriguez R, Correa Casado M, Fernandez-Sola C. Promoting dignified end-of-life care in the emergency department: A qualitative study. *Int Emerg Nurs*. 2018;37:23-28. https://doi.org/10.1016/j.ienj.2017.05.004
12. Smith AK, Fisher J, Schonberg MA, et al. Am I doing the right thing? Provider perspectives on improving palliative care in the emergency

department. *Ann Emerg Med*. 2009;54(1):86-93.e1. https://doi.org/10.1016/j.annemergmed.2008.08.022

13. Decker K, Lee S, Morphet J. The experiences of emergency nurses in providing end-of-life care to patients in the emergency department. *Australas Emerg Nurs J*. 2015;18(2):68-74. https://doi.org/10.1016/j.aenj.2014.11.001
14. Hogan KA, Fothergill-Bourbonnais F, Brajtman S, Phillips S, Wilson KG. When someone dies in the emergency department: perspectives of emergency nurses. *J Emerg Nurs*. 2016;42(3):207-212. https://doi.org/10.1016/j.jen.2015.09.003
15. Gagnon J, Duggleby W. The provision of end-of-life care by medical-surgical nurses working in acute care: a literature review. *Palliat Support Care*. 2014;12(5):393-408. https://doi.org/10.1017/S1478951513000965
16. Maslach C, Leiter MP. Early predictors of job burnout and engagement. *J Appl Psychol*. 2008;93(3):498-512. https://doi.org/10.1037/0021-9010.93.3.498
17. Parola V, Coelho A, Cardoso D, Sandgren A, Apostolo J. Prevalence of burnout in health professionals working in palliative care: a systematic review. *JBI Database System Rev Implement Rep*. 2017;15(7):1905-1933. https://doi.org/10.11124/JBISRIR-2016-003309
18. Stroebe M, Schut H, Stroebe W. Health outcomes of bereavement. *Lancet*. 2007;370(9603):1960-1973. https://doi.org/10.1016/S0140-6736(07)61816-9
19. Lobb EA, Kristjanson LJ, Aoun SM, Monterosso L, Halkett GK, Davies A. Predictors of complicated grief: a systematic review of empirical studies. *Death Stud*. 2010;34(8):673-698. https://doi.org/10.1080/07481187.2010.496686
20. Nakajima S, Ito M, Shirai A, Konishi T. Complicated grief in those bereaved by violent death: the effects of post-traumatic stress disorder on complicated grief. *Dialogues Clin Neurosci*. 2012;14(2):210-214. https://doi.org/10.31887/DCNS.2012.14.2
21. Comtesse H, Vogel A, Kersting A, Rief W, Steil R, Rosner R. When does grief become pathological? Evaluation of the ICD-11 diagnostic proposal for prolonged grief in a treatment-seeking sample. *Eur J Psychotraumatol*. 2020;11(1):1694348. https://doi.org/10.1080/20008198.2019.1694348
22. Benchimol EI, Smeeth L, Guttmann A, et al. The REporting of studies Conducted using Observational Routinely collected health Data (RECORD) statement. *PLoS Med*. 2015;12(10), e1001885. https://doi.org/10.1371/journal.pmed.1001885
23. The Ministry of Health. The National Committee on Health Research Ethics (The Committee Act). (In Danish) Updated 2017. Accessed February 4, 2021. https://www.retsinformation.dk/Forms/r0710.aspx?id=192671
24. Naneix AL, Perier MC, Beganton F, Jouven X, Lorin de la Grandmaison G. Sudden adult death: an autopsy series of 534 cases with gender and control comparison. *J Forensic Leg Med*. 2015;32:10-15. https://doi.org/10.1016/j.jflm.2015.02.005
25. Preston L, Chambers D, Campbell F, Cantrell A, Turner J, Goyder E. What evidence is there for the identification and management of frail older people in the emergency department? A systematic mapping review. *Health Serv Deliv Res*. 2018;6(16):1-142. https://doi.org/10.3310/hsdr06160
26. Gruneir A, Silver MJ, Rochon PA. Emergency department use by older adults: a literature review on trends, appropriateness, and consequences of unmet health care needs. *Med Care Res Rev*. 2011;68(2):131-155. https://doi.org/10.1177/1077558710379422
27. Skorstengaard MH, Jensen AB, Andreassen P, et al. Advance care planning and place of death, hospitalisation and actual place of death in lung, heart and cancer disease: a randomised controlled trial. *BMJ Support Palliat Care*. 2019;10(4):e37. https://doi.org/10.1136/bmjspcare-2018-001677
28. Seamark D, Blake S, Seamark C, et al. Is hospitalisation for COPD an opportunity for advance care planning? A qualitative study. *Prim Care Respir J*. 2012;21(3):261-266. https://doi.org/10.4104/pcrj.2012.00032
29. Det nationale sorgcenter [The Danish National Center for Grief]. Kortlægningsrapport - ældres sorg (report - the elderly's grief). En kortlægning af sundhedprofessionelles viden og kompetencebehov indenfor ældre og sorg i Danmark. (In Danish) Accessed February 4, 2021. 2018. https://sorgcenter.dk/wp-content/uploads/2020/06/Kortl%C3%A6gningsrapport-%C3%86ldre-og-sorg-final.pdf
30. Shear MK, Ghesquiere A, Glickman K. Bereavement and complicated grief. *Curr Psychiatry Rep*. 2013;15(11):406. https://doi.org/10.1007/s11920-013-0406-z
31. Lundorff M, Holmgren H, Zachariae R, Farver-Vestergaard I, O'Connor M. Prevalence of prolonged grief disorder in adult bereavement: a systematic review and meta-analysis. *J Affect Disord*. 2017;212:138-149. https://doi.org/10.1016/j.jad.2017.01.030
32. Djelantik A, Smid GE, Mroz A, Kleber RJ, Boelen PA. The prevalence of prolonged grief disorder in bereaved individuals following unnatural losses: systematic review and meta regression analysis. *J Affect Disord*. 2020;265:146-156. https://doi.org/10.1016/j.jad.2020.01.034
33. Andriessen K, Krysinska K, Hill NTM, et al. Effectiveness of interventions for people bereaved through suicide: a systematic review of controlled studies of grief, psychosocial and suicide-related outcomes. *BMC Psychiatry*. 2019;19(1):49. https://doi.org/10.1186/s12888-019-2020-z
34. Prigerson HG, Horowitz MJ, Jacobs SC, et al. Prolonged grief disorder: psychometric validation of criteria proposed for DSM-V and ICD-11. *PLoS Med*. 2009;6(8):e1000121. https://doi.org/10.1371/journal.pmed.1000121
35. Stroebe MS, Folkman S, Hansson RO, Schut H. The prediction of bereavement outcome: development of an integrative risk factor framework. *Soc Sci Med*. 2006;63(9):2440-2451. https://doi.org/10.1016/j.socscimed.2006.06.012
36. Fernandez-Sola C, Cortes MM, Hernandez-Padilla JM, Torres CJ, Terron JM, Granero-Molina J. Defining dignity in end-of-life care in the emergency department. *Nurs Eth*. 2017;24(1):20-32. https://doi.org/10.1177/0969733015604685

37. Sealey M, Breen LJ, O'Connor M, Aoun SM. A scoping review of bereavement risk assessment measures: implications for palliative care. *Palliat Med*. 2015;29(7):577-589. https://doi.org/10.1177/0269216315576262

38. Sundhedsstyrelsen [Danish Health Authority]. Anbefalinger for den palliative indsats [recommendations for palliative care]. (In Danish) (1.0);2017. Accessed February 4, 2021. https://www.sst.dk/da/udgivelser/2017/anbefalinger-for-den-palliative-indsats

39. Bove DG, Rosted E, Prip A, Jellington MO, Timm H, Herling SF. How to care for the brought in dead and their relatives. A qualitative study protocol based on interpretive description. *J Adv Nurs*. 2020;76(7):1794-1802. https://doi.org/10.1111/jan.14353

Appendix

Danish social security number	
Date of death	
Sex (Køn)	☐ Male
	☐ Female
Age at time of death	
Attempted cardiopulmonary resuscitation (CPR)	☐ No
	☐ yes, prehospital
	☐ yes, trauma room
Place of death	☐ Death at home
	☐ Death outside home
Found dead or dying by	☐ Spouse, cohabitants, children
	☐ Homecare service
	☐ Neighbours or friends
	☐ Police
	☐ Random bystanders
	☐ Others
Forensic inquest	☐ yes
	☐ no
Cause of death	☐ Traffic or other accidents
	☐ Suicide
	☐ Unknown cause of death
	☐ Cause of death estimated in the health record describes_____

Emergency Nurses' Knowledge, Attitudes, and Practices Related to Blood Sample Hemolysis Prevention: An Exploratory Descriptive Study

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CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

- Blood sample analysis is a common emergency medicine practice, and hemolysis is a common occurrence leading to inaccurate results, repeated phlebotomy, delays in patient care, and increased costs. Evidence exists that certain practices decrease hemolysis rates.
- Emergency nurses' knowledge related to blood sample hemolysis prevention is incomplete; attitudes toward prevention may be incongruent with attitudes of key stakeholders; and responsibility for hemolysis prevention and correction falls primarily on nursing.
- Further investigation is needed in the extent of blood sample hemolysis, and national benchmarks are needed to address sequelae of hemolyzed blood samples. Those charged with decreasing the rate of blood sample hemolysis should use certified emergency nurses.

Abstract

Introduction: The aim of the study was to identify emergency nurses' knowledge, attitudes, and practices related to blood sample hemolysis prevention and explore associations between these factors and demographic characteristics. The current state is unknown. Understanding baseline knowledge, attitudes, and practices addresses a gap in the literature.

Method: An exploratory, descriptive design with cross-sectional survey methodology employing a study-specific instrument was used.

Results: Request for participation email was sent to a random sample of 5000 Emergency Nurses Association members, and 427 usable surveys were returned (response rate = 8.5%). Mean years in nursing was 13.85 (standard deviation = 10.78), and 226 (52.9%) were certified emergency nurses. Only 85 participants (19.9%) answered all 3 knowledge questions correctly. Answering the 3 knowledge questions correctly was significantly associated with being a certified emergency nurse ($\chi^2 = 7.15$, $P < .01$). Participant responses to attitude items about the sequelae of blood sample hemolysis were skewed toward agreement, and most attitude items were associated with whom participants reported as being primarily responsible for phlebotomy. Emergency nurses remain primarily responsible for phlebotomy as well as addressing hemolyzed samples, but few reported that blood sample hemolysis was addressed at a departmental level.

Discussion: Findings suggest that emergency nurses lack some knowledge related to blood sample hemolysis prevention

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J Emerg Nurs 2021;47:590-598.
Available online 26 February 2021
0099-1767

https://doi.org/10.1016/j.jen.2020.12.015

best practices. Attitudes toward phlebotomy practices may be 1 reason practice has not changed. Every effort should be made to prevent hemolyzed blood samples to decrease delays and costs in emergency care.

Key words: Hemolysis; Phlebotomy; Emergency nursing; Knowledge; Attitude; Clinical practice nursing research

Introduction

According to the 2017 National Hospital Ambulatory Medical Care Survey, 44.6% of patients who present to the emergency department have blood samples analyzed as part of their visit, with 37.8% having either a basic or comprehensive metabolic panel test completed.[1] Although there are no recently published national or international standardized data on hemolysis incidence for blood samples specifically in the emergency department, a review of available studies published in the past 5 years in which hemolysis incidence of blood samples was reported revealed a range of 4.4% to 19% for hemolyzed samples.[2-13] A meta-analysis identified a number of practices that are effective in reducing ED blood sample hemolysis: use of a steel straight needle for phlebotomy, use of an antecubital site for phlebotomy with intravenous (IV) cannulation, and use of low-vacuum tubes.[14] Blood sample hemolysis causes delays in patient care for the patient involved and other patients waiting for care while a new sample is drawn and the laboratory test repeated. Delays have been reported to be up to 1 hour independent of other variables such as patient disposition or triage categorization.[15] Improving phlebotomy processes in emergency departments has the potential to lead to substantial savings in personnel time, patient discomfort, and delays in care.[10,16] Emergency nurses are generally responsible for phlebotomy in the emergency department, so they are the group most responsible for implementing best practices to reduce blood sample hemolysis.

BLOOD SAMPLE HEMOLYSIS PREVENTION

The Emergency Nurses Association (ENA) Clinical Practice Guideline (CPG) on Prevention of Blood Sample Hemolysis in Peripherally-Collected Specimens established the strength of evidence for interventions tested to reduce hemolysis.[17] None of the evidence presented in the CPG was judged to reach the highest level of evidence. The 5 blood sample hemolysis prevention practices that received moderate ratings (rated as having minor inconsistencies in the quality of evidence) were educating staff performing phlebotomy, using low-vacuum tubes, using a steel straight needle for phlebotomy, using a vein in the antecubital fossa for phlebotomy, and using a needleless connector does not increase hemolysis risk. Subsequent research confirms that use of a steel straight needle for phlebotomy,[3,8] use of a vein in the antecubital fossa,[8] and use of low-vacuum tubes[9,12,18] decrease hemolysis incidence in the emergency department. Some emergency departments have adopted these recommendations by making phlebotomists responsible for obtaining specimens, as phlebotomists typically use a steel straight needle in an antecubital vein to prevent blood sample hemolysis. Emergency nurses' knowledge and other noncognitive factors that support current practice have yet to be explored.

CHALLENGES IN IMPLEMENTING EVIDENCE-BASED PRACTICES

Implementing a change from current practice to an evidence-driven practice requires more than presenting an educational intervention. Indeed, those charged with helping people change their behavior to improve health outcomes have found that education alone is often not enough.[19,20] For that reason, researchers, theorists, and practitioners have explored the relationship among knowledge, attitude, and behavior, or practice, to explain why an expected behavior occurs or does not occur.[21]

Ajzen's[22] Theory of Planned Behavior provides a theoretical model in which knowledge, attitude, and behavioral control (practices) are drivers of behavioral intention and, ultimately, the behavior itself. The 3 conceptually independent drivers of behavioral intention are *perceived behavioral control*, *attitude toward behavior*, and *subjective norms*. Perceived behavioral control relates to knowledge about the intended behavior and its perceived ease or difficulty. Attitude toward behavior refers to an affective appraisal, positive or negative emotion or belief, about the behavior. Subjective norms relate to the current practices of one's work group and the pressures to conform to those practices. Results of meta-analyses examining studies in which Theory of Planned Behavior interventions were tested for an effect on behavioral outcomes support this theoretical model.[23,24] To understand how best to implement evidence-based interventions that reduce blood sample hemolysis in the emergency department, it is imperative to know emergency nurses' current state of knowledge related to hemolysis prevention interventions, attitudes toward phlebotomy and

TABLE 1
Blood sample hemolysis prevention knowledge items

When drawing blood from a patient presenting to your emergency department, the best practice to reduce risk of lab sample hemolysis is by using a:

a. Large bore steel straight needle in a prominent hand vein
b. Large bore intravenous catheter in the antecubital vein
c. Large bore intravenous catheter in a prominent hand vein
d. Large bore steel straight needle in the antecubital vein

There is evidence that the risk for hemolysis of lab samples drawn in the emergency department is reduced when the tubes are:

a. High volume and high vacuum
b. Low volume and low vacuum
c. High volume and low vacuum
d. Low volume and high vacuum

The most common reason for lab sample hemolysis in the emergency department is:

a. Red cell membrane disruption due to turbulence
b. Potassium gradient shift due to renal insufficiency
c. Change in intracellular osmotic force due to dehydration
d. Exposure to air that exists within the sample tube

Correct answers: d, b, a.

blood sample hemolysis, and practices that help to maintain the status quo.

SPECIFIC AIMS

The aims of this study were (1) to describe emergency nurses' knowledge, attitudes, and practices (KAP) related to blood sample hemolysis prevention and (2) to explore associations between nurse demographic characteristics and KAP related to blood sample hemolysis prevention.

Methods

An exploratory, hypothesis-generating approach was taken using a descriptive, correlational design.

DEVELOPMENT AND TESTING OF THE KAP SURVEY

The survey was developed by the investigators informed by recommendations for KAP surveys.[21] The survey contained 3 multiple choice knowledge items, a series of 5 attitude items each answered on a 1 (*totally disagree*) to 5 (*totally agree*) Likert scale, 7 multiple choice practice items, and 8 personal and departmental demographic items (Supplementary Table). Knowledge items were based on 4 of the 5 highest level of evidence recommendations from the ENA CPG to create a parsimonious test. Attitude items were based on themes derived from discussions about blood sample hemolysis with practicing emergency nurses. Practice items were developed on the basis of both best practice recommendations and common blood sample hemolysis practices that may influence nurses' hemolysis prevention practices. Content validity of the survey was confirmed by sending the survey to 10 published nursing and medical experts on blood sample hemolysis prevention, with 7 returning responses. All agreed that the questions were relevant to the topic, and the suggested edits to items were accepted to improve item clarity. No additional items were suggested. Table 1 presents the knowledge questions used in this survey.

PROCEDURES

The investigators' institutional review board approved the protocol with a waiver of written consent owing to limited risk for participants, using an information letter in the text of the recruitment email in its place (Cleveland Clinic Institutional Review Board #17-505). Participation implied consent. The ENA's Institute for Emergency Nursing Research distributed the recruitment email to a random sample of its members ($n = 5000$). We used a convenience sample of those who completed the survey by following the link in the email to the anonymous, online version of the survey in the final analysis. Participation was limited to registered nurses currently practicing in emergency departments in the United States by use of a screening question aimed at identifying only practicing emergency nurses.

DATA ANALYSIS

Frequencies and percentages were used to summarize categorical data, and means and standard deviations were used to summarize continuous data. Missing data were replaced with item mean or mode as appropriate, and surveys were considered complete if the knowledge and attitude items were completed. Knowledge items were scored as either pass (answering all 3 correctly) or fail, converting knowledge to a dichotomous categorical item. Attitude items were heavily skewed toward *agree* and *totally agree*, so categories were combined into *disagree*, a neutral *neither agree nor disagree*, and *agree*. Independent samples *t* tests for normally distributed continuous data, or Mann-Whitney U test for

TABLE 2
Participant characteristics in a study of ED nurses' knowledge, attitudes, perceptions of blood sample hemolysis (n = 427)

Variable	Mean	SD
Years as an emergency nurse	13.86	10.75
Emergency department yearly volume	53 353	27 914
	n	%
Current role		
Clinical staff nurse	314	73.53
Other*	113	26.50
Highest level of nursing education		
Diploma/associate degree	68	15.92
Bachelor degree	255	59.71
Graduate degree	104	24.35
Holds certification as†		
Certified emergency nurse	226	52.93
Certified flight registered nurse	9	2.11
Certified pediatric emergency nurse	38	8.90
Certified transport registered nurse	2	0.47
Trauma certified registered nurse	43	17.41
Certification through another nursing specialty organization	71	16.63
Emergency Nurses Association *Clinical Practice Guideline: Prevention of Blood Sample Hemolysis*		
Aware of it and have accessed it	31	7.26
Aware of it and have not accessed it	82	19.20
Not aware of it	314	73.54
Employed in a teaching emergency department	235	55.03
ED patient population		
Adults only	41	9.60
Pediatrics only	12	2.81
Adults and pediatrics	374	87.59
Reported a blood sample hemolysis prevention initiative occurred in their emergency department	118	27.63

* Other roles include clinical nurse specialist, educator, advanced practice nurse, manager/administrator, other.
† Participants could choose all that apply.

non-normally distributed continuous data, and chi-square tests for categorical data were used to determine associations between KAP items and demographic data based on normality and level of data. Analyses were performed using IBM SPSS Statistics version 26 (Armonk, NY) assuming a .05 significance level. Alpha was adjusted using a Bonferroni correction when multiple analyses of demographic characteristics were conducted with 1 dependent variable. For example, years in emergency nursing, highest educational level, being a certified emergency nurse (CEN), and practicing in a teaching emergency department were assumed by the study team to be theoretically linked to knowledge about blood sample hemolysis prevention. Therefore, the significance level was adjusted down to .0125 for that family of analyses. A similar adjustment was made for analyses related to attitude items that also included who was primarily responsible for phlebotomy in the emergency department, with P adjusted to .01 for 5 analyses per item.

Results

There were 461 surveys initiated out of 524 unique views yielding a participation rate of 88.17%. A total of 427 respondents completed most of the survey items yielding a completion rate of 92.62%, and a completeness rate of 96.25% (16 surveys missing data from the 8 practice items). Participants were primarily clinical staff nurses (n = 314; 73.53%) with a bachelor's degree in nursing (n = 255; 59.71%) employed in a teaching emergency department (n = 234; 55.03%) that served both adults and children (n = 374; 87.59%). A slight majority held CEN (n = 226; 52.92%). Few (n = 31; 7.26%) had read the ENA CPG on blood sample hemolysis prevention. Most (n = 309; 72.37%) reported that no blood sample hemolysis prevention initiative had taken place in their emergency department or were unsure if one had taken place. Table 2 presents detailed participant characteristics.

Knowledge related to evidence-based practices that were shown to reduce blood sample hemolysis was inconsistent. Only 19.91% of the participants (n = 85) answered all 3 knowledge test questions correctly, the predetermined passing score. Most (n = 386, 90.40%) knew that the most common reason for blood sample hemolysis is red cell destruction caused by turbulence. Most (n = 254, 59.48%) knew that phlebotomy using a steel needle in the antecubital vein was the most effective technique to reduce the risk of hemolysis but a little more than one-third (n = 162, 37.94%) answered incorrectly that an IV

TABLE 3
Emergency nurse respondents choosing *agree* or *totally agree* to items related to attitudes about phlebotomy and blood sample hemolysis

Attitude statement	*n*	%
Patients expect to be stuck only once for both blood and intravenous catheter placement when presenting to an emergency department.	369	86.42
Sticking patients more than once will impact patient satisfaction scores for nursing care.	354	82.90
The number of times that I have to repeat phlebotomy on a patient due to hemolyzed samples interferes with my care for other patients.	355	83.14
Hemolyzed lab samples contribute to delays in care for emergency department patients.	409	95.78
Sometimes the lab reports a hemolyzed sample when they have mishandled the sample.	256	59.95

catheter in the antecubital vein was most effective. Only 34.19% ($n = 146$) of the participants knew that low-volume/low-vacuum tubes were shown to reduce hemolysis.

Participants generally agreed on the effect of blood sample hemolysis on their practice. Most *agreed* or *totally agreed* with the attitude items. Most of the participants ($n = 256$, 59.95%) believed that sometimes the laboratory reports a hemolyzed sample when the laboratory has mishandled the sample, with 29.97% ($n = 128$) choosing the neutral option. Table 3 presents results for attitude items.

As for the current state of blood sample hemolysis prevention practices, phlebotomy in the emergency department remains primarily a nursing task ($n = 301$, 70.49%) with only 11.00% ($n = 47$) reporting phlebotomists as primarily responsible for obtaining samples in their department. Nurses are also primarily responsible for being notified about a hemolyzed sample ($n = 317$, 74.24%). Most ($n = 372$, 87.12%) reported that phlebotomy was most commonly performed with IV insertion, and approximately half ($n = 222$, 51.99%) reported using low-volume tubes. Only 2.57% ($n = 11$) reported a policy supporting exclusive use of steel straight needles for phlebotomy. Table 4 provides details of practice items.

There were several significant associations between demographic factors and knowledge or attitude items. Holding CEN was significantly associated with answering all 3 knowledge questions correctly, $\chi^2 = 7.15$, $P = .008$. Table 5 presents results of the Kruskal-Wallis test showing that there was a significant association between participants'

TABLE 4
Emergency nurses' responses to questions about phlebotomy and blood sample hemolysis remediation practices

Item	*n*	%
What is the most common way blood samples are drawn in your emergency department?		
During peripheral IV insertion	372	87.12
Using a steel straight needle	55	12.88
Who is the person who usually performs phlebotomy for lab samples in your emergency department?		
Phlebotomist	47	11.01
ED technician	79	18.50
Nurse	301	70.49
What size tube do you use to draw comprehensive metabolic panel samples in the emergency department?		
Small	222	51.99
Large	161	37.70
Not sure	44	10.30
Does your hospital or emergency department have a specific policy or standard of practice for the method by which basic laboratory blood samples, such as a metabolic panel, are to be drawn?		
No policy or procedure	18	4.21
Yes, steel straight needle only	11	2.58
Yes, either steel straight needle or IV catheter	147	34.43
Not sure	80	18.73
"Yes" to having a policy or procedure for the order in which lab tubes are filled?	348	81.5
Which of the methods listed below does the lab use to notify the emergency department that a lab sample is hemolyzed? (Choose all that apply.)		
Phone call to the nurse	317	74.24
Phone call to unit clerk/secretary	152	35.60
Notification via electronic medical record	91	21.31
Phone call to provider	47	11.01

IV, intravenous.

TABLE 5
Results of Kruskal-Wallis test examining association between emergency nurses' report of who is primarily responsible for phlebotomy in their emergency department and phlebotomy and blood sample hemolysis attitude items*

Attitude statement	Phlebotomist ($n = 47$)	ED technician ($n = 79$)	Nurse ($n = 301$)	*P*
Patients expect to be stuck only once for both blood and intravenous catheter placement when presenting to an emergency department.	116.89	235.59	223.55	< .001
Sticking patients more than once will impact patient satisfaction scores for nursing care.	163.65	216.65	221.17	.006
The number of times that I have to repeat phlebotomy on a patient due to hemolyzed samples interferes with my care for other patients.	159.12	245.20	214.38	< .001
Hemolyzed lab samples contribute to delays in care for emergency department patients.	157.36	227.18	219.38	<.001
Sometimes the lab reports a hemolyzed sample when they have mishandled the sample.	198.61	222.00	214.30	.56

Values are given as mean rank.
* Bonferroni corrected alpha $P < .01$ for 5 analyses conducted per item.

report of who has primary responsibility for phlebotomy in the emergency department (phlebotomists, technicians, or emergency nurses) and 4 of the 5 attitude items. A post hoc analysis of the association between answering all 3 knowledge questions correctly (pass vs fail) and holding CEN (yes vs no) was conducted to determine the probability of not making a type II error (false negative). Considering a moderate effect size of .3, $P = .0125$ after the Bonferroni correction for multiple analyses, the sample size of 427 participants, and 1 degree of freedom for a 2×2 chi-square contingency table, the probability of not making a type II error was calculated to be 99.99%.

Discussion

This is the first study to describe emergency nurses' KAP related to prevention of blood sample hemolysis. Results showed that some emergency nurses have knowledge deficits about best practices to prevent blood sample hemolysis. Emergency nurses in this study strongly agreed that phlebotomy practices and blood sample hemolysis affects patient care. In addition, they maintain primary responsibility for ED phlebotomy and remediation of hemolyzed samples, but implementation of evidence-based best practices is limited. The results were perhaps not surprising considering that few respondents had accessed and read the ENA CPG on the topic, and the large number of ENA members who reported being unaware of it. In addition, few participants reported that initiatives to address hemolysis incidence in their department had occurred.

Only recently has there been an interest from key stakeholders in addressing the issue of blood sample hemolysis in the emergency department. Currently, there are no national benchmarks for ED blood sample hemolysis incidence and no published data on ED hemolysis from a national survey of emergency departments, only estimates from published literature that hemolysis incidence may range from a little more than 4% to just less than 19%.[14] Blood sample hemolysis incidence in the emergency department is just starting to be recognized as a meaningful patient quality indicator by clinical pathologists in the Quality Payment Program administered by Centers for Medicare & Medicaid Services, a voluntary program in which clinical pathology laboratories are financially incentivized to improve quality metrics.[25] Results from 1 published quality improvement initiative indicated that a collaborative effort that included participation by emergency physicians, emergency nurses, and clinical pathology laboratory colleagues reduced ED blood sample hemolysis incidence and improved relations between departments.[26] It remains to be seen if incentivizing laboratories to address this problem affects blood

sample hemolysis incidence, especially considering that our results demonstrated that emergency nurses remain responsible for phlebotomy practices in the emergency department.

In addition to being primarily responsible for phlebotomy, emergency nurses in our study were also responsible to receive notification about hemolyzed samples and rectify the situation, which they believe led to delays in patient care. Researchers demonstrated that the use of trained phlebotomists in the emergency department reduced blood culture contamination incidences such that the cost savings paid for the phlebotomist.[27] There may be a similar effect after instituting trained phlebotomists for obtaining all laboratory blood samples in the emergency department. Researchers estimated the financial cost of hemolyzed blood samples from the emergency department to be quite substantial.[28,29] One researcher estimated the average cost per hemolyzed sample in US hospital emergency departments in 2013 to be $337.05.[29] With almost 50% of patients in the emergency department having blood samples collected,[1] the cost savings to hospitals may cover the cost of phlebotomists in the emergency department. Research is needed to determine a more current cost-benefit analysis of blood sample hemolysis and the use of phlebotomists in the emergency department. The participants in this study who reported that phlebotomists were primarily responsible for obtaining blood samples in their emergency department had significantly lower attitude item scores than others. Nurses who practice in departments in which phlebotomists are primarily responsible for obtaining blood samples may understand that patients are not aware of anything different about this practice. Patients who have never been to an emergency department may not know that blood can be drawn through an IV catheter and so would not have an expectation of such. Likewise, those same nurses who reported that phlebotomists were responsible for obtaining blood samples may not be experiencing delays in patient care because of hemolyzed samples.

Respondents in this survey generally agreed that hemolyzed blood samples lead to delays in patient care and interfere with the care of other patients. Researchers showed that duration of stay was significantly longer for patients who were admitted and patients who were discharged who had a hemolyzed sample regardless of initial Emergency Severity Index triage level and final disposition.[15] Despite participants' concern with the impact on care, they also agreed that phlebotomy practices play a part in patient expectation and satisfaction, which may be a stronger motivator inhibiting practice change. Strongly held beliefs about a behavior may be a driver that enhances or prohibits a change in behavior.[22] Emergency nurses' concerns about patient experience and satisfaction related to phlebotomy and IV insertion are generally congruent with findings from an international survey examining patient experience with peripheral IV catheter insertion that demonstrated an association between peripheral IV catheter insertion and overall inpatient experience.[30] The beliefs and experiences of emergency nurses and their patients related to peripheral IV catheter insertion and phlebotomy has yet to be the subject of in-depth research needed to fully understand the experience.

Emergency nurses who held CEN were more likely to know all of the correct responses to the knowledge questions. This is congruent with research results in which certified emergency nurses held more evidence-based beliefs and practices related to vital sign assessment.[31] The relationship between holding CEN and other demographic factors needs further exploration as well.

Limitations

There were several limitations of this study that need to be addressed. Selection bias may have occurred by using self-reported data from ENA members who responded to an email requesting participation. Overall response rate was low (10.48% of those emailed opened the survey) despite weekly reminders requesting participation, and experts agree that this is a potential problem in recruiting study participants by an email request.[32,33] Consequently, generalizing the understanding of all emergency nurses' KAP is limited. No valid and reliable survey instrument exists that was suitable for this study, and we strove to create a concise survey instrument that limited burden on participants yet still captured key elements of blood sample hemolysis prevention KAP that might be relevant for those interested in changing practices. Although content validity was provided by published experts on this topic, no further psychometric testing of the survey instrument was completed for feasibility reasons.

Implications for Emergency Clinical Care

In today's emergency care environment, all efforts should be made to reduce delays in patient care as well as patient discomfort and cost. Research results showed that specimen transport has little effect on blood sample hemolysis incidence,[10,34] and laboratory-specific issues related to hemolysis are out of nurses' control. One way for emergency nurses to address delays and dissatisfaction related to blood sample hemolysis is to facilitate interdisciplinary practice improvement processes. Emergency nurses who wish to make this happen need to begin to track ED blood sample hemolysis incidence and examine current nursing practices. Those charged with reducing hemolysis should engage emergency nurses with CEN because they will most likely know best practices.

Trustworthy evidence must be generated from rigorous research studies to combat strongly held beliefs that prevent nurses from adopting best practices. Further research needs to be conducted to determine which patients would be best served by each type of phlebotomy option. Those responsible for developing and disseminating CPGs should investigate their use by clinical nurses as well as methods that would improve uptake of this important patient care information. Studies that consider the time spent by staff on repeating hemolyzed samples on delays in patient care need to be conducted in which best practices aimed at reducing ED hemolysis are implemented. Understanding emergency nurses' KAP may be the first step in developing a program that will increase emergency nurses' interest in changing their practice. Researchers can use our findings related to emergency nurses' knowledge related to blood sample hemolysis prevention practices knowing that a much smaller sample size is necessary to achieve an acceptable level of power.

Conclusion

Blood sample hemolysis leads to delays in care that may lead to increased costs and patient and nurse dissatisfaction. Every effort should be made to reduce all delays in care and improve patient and provider satisfaction. Blood sample hemolysis needs to be addressed with the same alacrity that other delays in care have received. Best practices for emergency nurses to decrease the risk for blood sample hemolysis are well established, and our results indicate that emergency nurses are knowledgeable about most blood sample hemolysis prevention evidence-based practices. Emergency nurses believe that phlebotomy practices and blood sample hemolysis negatively affect patient care and satisfaction, yet practice remains unchanged. It is time for multidisciplinary efforts to address this patient care issue from practice and research perspectives, and emergency nurses are primed to lead these efforts.

Acknowledgments

The authors thank Altair Delao, MPH, Senior Associate, Institute for Emergency Nursing Research, Emergency Nurses Association, for assistance with distribution of the survey and emergency nurses in the Cleveland Clinic Health System for critiquing the survey. Partial funding for this study was provided by a Society of Academic Emergency Medicine Foundation/Resident and Medical Students Research Grant award number RF2019-008 to Spencer Seballos for unrestricted use.

Author Disclosures

Conflicts of interest: none to report.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2020.12.015.

REFERENCES

1. Rui P, Kang K. National Hospital Ambulatory Medical Care Survey: 2017 emergency department summary tables. *National Center for Health Statistics*. Department of Health and Human Services. Accessed November 5, 2020. https://www.cdc.gov/nchs/data/nhamcs/web_tables/2017_ed_web_tables-508.pdf
2. Barnaby DP, Wollowitz A, White D, et al. Generalizability and effectiveness of butterfly phlebotomy in reducing hemolysis. *Acad Emerg Med*. 2016;23(2):204-207. https://doi.org/10.1111/acem.12858
3. Barnard EB, Potter DL, Ayling RM, Higginson I, Bailey AG, Smith JE. Factors affecting blood sample haemolysis: a cross-sectional study. *Eur J Emerg Med*. 2016;23(2):143-146. https://doi.org/10.1097/MEJ.0000000000000195
4. Duhalde H, Skogö J, Karlsson M. Point-of-care hemolysis detection in blood gas specimens directly at the emergency department. *Scand J Clin Lab Invest*. 2019;79(5):283-287. https://doi.org/10.1080/00365513.2019.1612089
5. Heireman L, Van Geel P, Musger L, Heylen E, Uyttenbroeck W, Mahieu B. Causes, consequences and management of sample hemolysis in the clinical laboratory. *Clin Biochem*. 2017;50(18):1317-1322. https://doi.org/10.1016/j.clinbiochem.2017.09.013
6. Kazezoglu C, Serin E. The effect of different blood drawing methods on hemolysis and test results from intravenous catheters used in emergency departments. *Clin Lab*. 2019;65(1):63-68. https://doi.org/10.7754/Clin.Lab.2018.180614
7. Lippi G, Bonelli P, Bonfanti L, Cervellin G. The use of S-Monovette is effective to reduce the burden of hemolysis in a large urban emergency department. *Biochem Med (Zagreb)*. 2015;25(1):69-72. https://doi.org/10.11613/BM.2015.008
8. Phelan MP, Reineks EZ, Schold JD, Hustey FM, Chamberlin J, Procop GW. Preanalytic factors associated with hemolysis in emergency department blood samples. *Arch Pathol Lab Med*. 2018;142(2):229-235. https://doi.org/10.5858/arpa.2016-0400-OA
9. Phelan MP, Reineks EZ, Berriochoa JP, et al. Impact of use of smaller volume, smaller vacuum blood collection tubes on hemolysis in emergency department blood samples. *Am J Clin Pathol*. 2017;148(4):330-335. https://doi.org/10.1093/ajcp/aqx082
10. Phelan MP, Reineks EZ, Hustey FM, et al. Does pneumatic tube system transport contribute to hemolysis in ED blood samples? *West J Emerg Med*. 2016;17(5):557-560. https://doi.org/10.5811/westjem.2016.6.29948
11. Puelacher C, Twerenbold R, Mosimann T, et al. Effects of hemolysis on the diagnostic accuracy of cardiac troponin I for the diagnosis of myocardial infarction. *Int J Cardiol*. 2015;187:313-315. https://doi.org/10.1016/j.ijcard.2015.03.378

12. Ramakers C. BD Vacutainer® Barricor tube in the emergency department: reduced hemolysis rates using partial draw tubes with reduced vacuum. *Clin Chem Lab Med*. 2018;56(2):e31-e32. https://doi.org/10.1515/cclm-2017-0411
13. Ryan JB, Stuart LA, Southby SJ, et al. Comparison of BD Vacutainer rapid serum tube and plasma for haemolysis markers in the emergency department. *Ann Clin Biochem*. 2015;52(Pt 2):293-296. https://doi.org/10.1177/0004563214533317
14. Heyer NJ, Derzon JH, Winges L, et al. Effectiveness of practices to reduce blood sample hemolysis in EDs: a laboratory medicine best practices systematic review and meta-analysis. *Clin Biochem*. 2012;45(13-14):1012-1032. https://doi.org/10.1016/j.clinbiochem.2012.08.002
15. Phelan MP, Hustey FM, Good DM, Reineks EZ. Seeing red: blood sample hemolysis is associated with prolonged emergency department throughput. *J Appl Lab Med*. 2020;5(4):732-737. Published correction appears in *J Appl Lab Med*. 2020;5(6):1423. https://doi.org/10.1093/jalm/jfaa160
16. Sheppard C, Franks N, Nolte F, Fantz C. Improving quality of patient care in an emergency department: a laboratory perspective. *Am J Clin Pathol*. 2008;130(4):573-577. https://doi.org/10.1309/DGXYTH0VNTTQRQHD
17. Bradford JY, Reeve NE, Killian M, et al. Clinical practice guideline: prevention of blood specimen hemolysis in peripherally-collected venous specimens. *J Emerg Nurs*. 2018;44(4):402.e1-402.e22. https://doi.org/10.1016/j.jen.2018.05.017
18. Mrazek C, Simundic AM, Wiedemann H, et al. The relationship between vacuum and hemolysis during catheter blood collection: a retrospective analysis of six large cohorts. *Clin Chem Lab Med*. 2017;55(8):1129-1134. https://doi.org/10.1515/cclm-2016-0940
19. Feldman DB, Sills JR. Hope and cardiovascular health-promoting behaviour: education alone is not enough. *Psychol Health*. 2013;28(7):727-745. https://doi.org/10.1080/08870446.2012.754025
20. Minsky-Kelly D, Hamberger LK, Pape DA, Wolff M. We've had training, now what? Qualitative analysis of barriers to domestic violence screening and referral in a health care setting. *J Interpers Violence*. 2005;20(10):1288-1309. https://doi.org/10.1177/0886260505278861
21. Schrader PG, Lawless KA. The knowledge, attitudes, & behaviors approach: how to evaluate performance in complex environments. *Perform Improvement*. 2004;43(9):8-15. https://doi.org/10.1002/pfi.4140430905
22. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179-211.
23. Steinmetz H, Knappstein M, Ajzen I, Schmidt P, Kabst R. How effective are behavior change interventions based on the Theory of Planned Behavior? A three-level meta-analysis. *Zeitschrift für Psychologie*. 2016;224(3):216-233. https://doi.org/10.1027/2151-2604/a000255
24. Webb TL, Sheeran P. Does changing behavioral intentions engender behavior change? A meta-analysis of experimental evidence. *Psychol Bull*. 2006;132(2):249-268. https://doi.org/10.1037/0033-2909.132.2.249
25. Kelly J, Patil P, Kennedy A, Singh L, Peditto S, Cardona DM. Developing pathology measures for the quality payment program-part II: overcoming challenges with data capture to maximize reimbursement. *Arch Pathol Lab Med*. 2020;144(6):697-705. https://doi.org/10.5858/arpa.2019-0378-OA
26. Pretlow L, Gandy T, Leibach EK, Russell B, Kraj B. A quality improvement cycle: hemolyzed specimens in the emergency department. *Clin Lab Sci*. 2008;21(4):219-224. https://doi.org/10.29074/ascls.21.4.219
27. Norberg A, Christopher NC, Ramundo ML, Bower JR, Berman SA. Contamination rates of blood cultures obtained by dedicated phlebotomy vs intravenous catheter. *JAMA*. 2003;289(6):726-729. https://doi.org/10.1001/jama.289.6.726
28. Lippi G, Bonelli P, Cervellin G. Prevalence and cost of hemolyzed samples in a large urban emergency department. *Int J Lab Hematol*. 2014;36(1):e24-e26. https://doi.org/10.1111/ijlh.12135
29. Greene SF. The cost of poor blood specimen quality and errors in preanalytic processes. *Clin Biochem*. 2013;46(13-14):1175-1179. https://doi.org/10.1016/j.clinbiochem.2013.06.001
30. Cooke M, Ullman AJ, Ray-Barruel G, Wallis M, Corley A, Rickard CM. Not "just" an intravenous line: consumer perspectives on peripheral intravenous cannulation (PIVC). An international cross-sectional survey of 25 countries. *PLoS One*. 2018;13(2), e0193436. https://doi.org/10.1371/journal.pone.0193436
31. Burchill CN, Polomano R. Certification in emergency nursing associated with vital signs attitudes and practices. *Int Emerg Nurs*. 2016;27:17-23. https://doi.org/10.1016/j.ienj.2015.12.003
32. Surdam J, Daly B, Fulton S, et al. Recruitment strategies for nurse enrollment in an online study. *Nurs Res*. 2020;69(1):69-73. https://doi.org/10.1097/NNR.0000000000000393
33. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet e-surveys (CHERRIES). *J Med Internet Res*. 2004;6(3):e34. https://doi.org/10.2196/jmir.6.3.e34 Published correction appears in *J Med Internet Res*. 2012;14(1):e8. https://doi.org/10.2196/jmir.2042
34. Cakirca G, Erdal H. The effect of pneumatic tube systems on the hemolysis of biochemistry blood samples. *J Emerg Nurs*. 2017;43(3):255-258. https://doi.org/10.1016/j.jen.2016.09.007

Supplementary Table: Lab sample hemolysis survey

Item	Response options
Are you currently working in an emergency department as a staff nurse, educator, advanced practice nurse (CNS and/or NP), or manager/administrator?	Yes No
What is your current role?	Clinical staff nurse Clinical Nurse Specialist/Clinical Educator Direct Care Advanced Practice Nurse Manager/Director/Administrator Other
Approximately how many patients does your emergency department see on a daily basis?	Free text number
Do you have medical trainees (interns and residents) seeing patients in your emergency department?	Yes No
Does your emergency department see	Exclusively adults? Exclusively children? Both children and adults?
Over the course of your nursing career, how many years in total have you been working as an emergency nurse?	Free text whole number
What is your highest level of nursing education?	Diploma/Associate's degree Bachelor's degree Graduate degree
Which certifications do you have? (Choose all that apply)	Certified Emergency Nurse (CEN) Certified Flight Registered Nurse (CFRN) Certified Pediatric Emergency Nurse (CPEN) Certified Transport Registered Nurse (CTRN) Trauma Certified Registered Nurse (TCRN) I have certification through another nursing specialty organization, such as ANCC or AACN I do not have a nursing specialty certification
When drawing blood from a patient presenting to your emergency department, the best practice to reduce risk of lab sample hemolysis is by using a:	Large bore steel straight needle in a prominent hand vein Large bore intravenous catheter in the antecubital vein Large bore intravenous catheter in a prominent hand vein Large bore steel straight needle in the antecubital vein
There is evidence that the risk for hemolysis of lab samples drawn in the emergency department is reduced when the tubes are:	High volume and high vacuum Low volume and low vacuum High volume and low vacuum Low volume and high vacuum
The most common reason for lab sample hemolysis in the emergency department is:	Red cell membrane disruption due to turbulence Potassium gradient shift due to renal insufficiency Change in intracellular osmotic force due to dehydration Exposure to air that exists within the sample tube

continued

Continued

Item	Response options
Patients expect to be stuck only once for both blood and intravenous catheter placement when presenting to an emergency department	Totally disagree Disagree Neutral Agree Totally agree
Sticking patients more than once will impact patient satisfaction scores for nursing care	Totally disagree Disagree Neutral Agree Totally agree
The number of times that I have to repeat phlebotomy on a patient due to hemolyzed samples interferes with my care for other patients	Totally disagree Disagree Neutral Agree Totally agree
Hemolyzed lab samples contribute to delays in care for emergency department patients	Totally disagree Disagree Neutral Agree Totally agree
Sometimes the lab reports a hemolyzed sample when they have mishandled the sample	Totally disagree Disagree Neutral Agree Totally agree
What is the most common way that lab samples are drawn in your emergency department?	Using the intravenous catheter Using a steel straight needle (e.g. butterfly or Vacutainer)
Who is the person who usually performs phlebotomy for lab samples in your emergency department?	Phlebotomist ED tech/paramedic/EMT Nurse Advanced practice provider (NP or PA) Physician
What size tube do you use to draw comprehensive metabolic panel (CMP) samples in the emergency department?	Small (3 ml) Large (6 ml) Not sure
Does your hospital or emergency department have a specific policy or standard of practice for the method by which laboratory blood samples, such as a metabolic panel, are to be drawn?	Yes No Not sure

continued

Continued

Item	Response options
Which of the methods listed below does the lab use to notify the emergency department that a lab sample is hemolyzed? (Please choose all that apply.)	Lab results in the electronic medical record Phone call to the physician/advanced practice nurse/ physician assistant Phone call to the nurse Phone call to the clerk/secretary Lab slip returned to ED with note Other
Has anyone in your emergency department conducted any quality improvement initiatives aimed at reducing lab sample hemolysis?	Yes, nursing Yes, emergency medicine physicians Yes, emergency nursing and medicine collaboratively Yes, laboratory medicine/pathology/phlebotomy No, there has not been a quality improvement initiative aimed at reducing lab sample Hemolysis Not sure
Are you aware of ENA's Clinical Practice Guideline Prevention of Blood Specimen Hemolysis in Peripherally-Collected Venous Specimens?	Yes, I have accessed this content Yes, but have not yet accessed this content No, I have not heard of this

CNS, clinical nurse specialist; ENA, Emergency Nurses Association; EMT, emergency medical technician; NP, nurse practitioner; PA, physician assistant; ANCC, American Nurses Credentialing Center; AACN, American Association of Critical-Care Nurses.

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EMERGENCY NURSING

Implanted Port Access in the Emergency Department: A Unit-Level Feasibility Study of a Nurse-Led Port Access Algorithm

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J Emerg Nurs 2021;47:599-608.0099-1767
https://doi.org/10.1016/j.jen.2021.01.010

Implanted Port Access in the Emergency Department: A Unit-Level Feasibility Study of a Nurse-Led Port Access Algorithm

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CE Earn Up to 12.0 Hours. See page 675.

Contribution to Emergency Nursing Practice

- Current research has not addressed the emergency nurses' role in managing patients with implanted ports to reduce the risk for central line-associated bloodstream infection, such as determining the route for obtaining diagnostic venous sampling as well as administration of medications and intravenous fluids.
- This article contributes evidence-based practice recommendations to guide an emergency nurse's use of implanted ports for ED patients admitted to the hospital.
- Recommendations for translating the findings of this paper into clinical practice include the provision of an implanted port access algorithm used to guide the care of patients in the emergency department on the basis of condition and treatment plan.

Abstract

Introduction: The objective of this study was to determine the impact of an emergency nurse-led implanted port access algorithm for ED patients with implanted ports admitted to the hospital.

Methods: A feasibility study evaluated the implementation of a central line-associated bloodstream infection algorithm in the emergency department over a 1-month study period. Emergency nurses received central line-associated bloodstream infection education and training for port access algorithm implementation. Pre- and postimplementation surveys measured the nurses' knowledge, attitudes, and behaviors regarding central line-associated bloodstream infections. The nurses' perceptions of the algorithm were assessed pre- and postimplementation. ED patient port access and central line-associated bloodstream infection rates were compared with preimplementation rates.

Results: Emergency nurses (N = 32) received central line-associated bloodstream infection education and algorithm training. Pre- and postimplementation as well as knowledge, attitude, and behavior surveys were completed by 59% (n = 19) of the nursing staff. Knowledge regarding central line-associated bloodstream infections significantly improved, $t_{(19)} = -4.8$, $P < .001$. The nurses' pre- and postimplementation attitude and behavior scores did not differ significantly. They expressed no concerns regarding implementation of the algorithm; 89% (n = 17) reported that the algorithm "fit well" with the ED workflow, and 21% (n = 4) integrated the patient's decision regarding venous access into their shift report. The ED port access incidence during the study period was 17.6% (n = 3), compared with 83.3% (n = 15) in the month before the study.

Discussion: The emergency nurse-led port access algorithm decreased ED port access rates. The nurses' pre- and postimplementation knowledge of central line-associated bloodstream infections increased. The emergency nurse-led port access algorithm empowered emergency nurses to educate their patients on implanted port access and decreased central line use.

Key words: Implanted port; Central venous access; Emergency department; Central line-associated bloodstream infection

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J Emerg Nurs 2021;47:599-608.
Available online 10 March 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.01.010

Introduction

A central line-associated bloodstream infection (CLABSI) is described by the Centers for Disease Control and Prevention as a preventable infection that results in thousands of deaths and billions of dollars in cost to the United States health care system each year.[1] Despite the availability of CLABSI prevention bundles and commercially available products to prevent such infections,[2,3] an estimated 30 100 CLABSIs occur in intensive care units and acute care facilities each year.[4] Prior CLABSI prevention research has not addressed the frequency or rationale for the use of an implanted port as a mechanism to reduce the incidence of CLABSI. Current research on CLABSI prevention predominantly addresses central venous catheters broadly, not specifically by the type of central catheter included in the study.

Implanted ports pose a unique risk of CLABSI. Although implanted ports are convenient to access, their permanent status increases their interval CLABSI risk. Nurses often access implanted ports for routine health care. Examples of such care may include diagnostic venous sampling as well as administration of medications and intravenous (IV) fluids. Other central venous catheters require an indication for placement and use in the hospital setting. Interestingly, nurses can access an implanted port at any time; yet, the implanted ports carry the same risk of CLABSI.

A CLABSI is diagnosed when a laboratory confirms a bloodstream infection in a patient with a central line in place within 48 hours preceding the onset of infectious symptoms. The diagnosis of CLABSI is confirmed when a licensed independent provider cannot attribute the BSI to a source other than the central line.[4] The National Health Safety Network (NHSN) definition of CLABSI states that implanted ports, once accessed during a hospital encounter, remain the attributable infection source throughout the remainder of that hospitalization.[4] This criterion varies in comparison with other central lines because of the permanent state of an implanted port's reservoir and cannula, which allows bacterial contamination to proliferate within the device even when it is no longer in use. Consequently, an implanted port that is accessed on the first day of a hospital encounter will remain the designated source of any BSI that develops throughout the remainder of the hospitalization.[4]

Implanted ports are marketed as a necessary device for vesicant chemotherapy. They also provide a convenient venous access route for routine infusions and blood draws.[4] The convenience of implanted ports for both nurse and patient can lead to a culture that minimizes the risks associated with this type of central venous access. Nurses use their clinical judgment when determining the type of venous access needed to care for their patients, and there are no published guidelines to direct the use of implanted ports in the acute care setting.

The current literature focuses on infection prevention (IP) specialists' view of CLABSI prevention initiatives in the context of a quality improvement process, specifically, learning from past mistakes.[5] The views of IP specialists contrast with those of bedside nurses interested in recurring education, procedure repetition, and the ease of integrating new strategies into their daily workflow.[5-9] Special attention is necessary to educate emergency nurses and providers regarding new or unfamiliar vascular access devices to reduce the risk of device misidentification and adverse events.[10]

Emergency nurses more readily adopt CLABSI reduction initiatives when the workflow steps are convenient, and nurses are accountable for reporting their use of the CLABSI reduction measures in the nurse-to-nurse report.[8] The recommended strategies for successful CLABSI prevention initiatives include providing nursing staff with a clear understanding of their role in practice change and outcome measurement.[5,8] Research also identified support from peer leaders, hospital administration, and prescribing providers as a pathway to success.[5,6,8]

Past research studies have discussed central venous catheters as a group. They have not distinguished an implanted port as a unique device. Still, the NHSN describes how an implanted port's permanent cannula prolongs the interval risk of CLABSI.[4] Two systematic review articles described the risk factors for CLABSI in people receiving chemotherapy.[11,12] These studies did not define the types of central lines in their sample. Instead, they concluded that all intravascular devices pose a risk of CLABSI and reported that neutropenia dramatically increases this risk.[11,12]

An expert committee developed the Michigan Appropriateness Guide for Intravenous Catheters to guide decisions regarding central venous catheters.[13] This guideline did not address the routine use of implanted ports after surgical placement, but it discouraged the placement of implanted ports for patients who require frequent phlebotomy. Only 1 published research study addressed the possibility of using central lines in the hospital only for a required indication.[14] This study demonstrated how 1 hospital's policy to obtain blood cultures by peripheral venipuncture, as opposed to the routine practice of sampling from central lines, had a statistically significant impact on blood culture contamination rates and reduced reportable CLABSIs.[14] The study is very relevant and supports the need to integrate this practice for all hospitalized patients, including those patients with implanted ports admitted to the hospital from the emergency department.

TABLE 1
Emergency nurse demographics

Demographics	n	Percentage
Profession		
Full-time	26	81.2
Part-time	6	18.8
Nursing experience, y		
0-5	7	36.9
6-10	4	21
11-15	2	10.5
>16	6	31.6

The purpose of this feasibility study was to determine the impact of an emergency nurse-led port access algorithm on the rate of implanted port access during the hospital encounter. This study built on current evidence-based practices and vascular access research to mitigate CLABSI[5,7-9,11-16] by applying the principles to those patients with implanted ports admitted to the hospital through the emergency department. The emergency nurse-led port access algorithm guides emergency nurses through the process of determining whether peripheral or central venous access is necessary for a given clinical situation. The aims of this feasibility study were to (1) evaluate the use of the emergency nurse-led port access clinical algorithm and (2) examine emergency nurses' perceived knowledge, attitudes, and behaviors (KAB) related to CLABSI. The Standards for QUality Improvement Reporting Excellence (SQUIRE), REporting of studies Conducted using Observational Routinely collected health Data (RECORD), and Template for Intervention Description and Replication (TIDieR) guidelines were used to guide the methodology and data reporting for this study.[17-19]

Methods

DESIGN

A feasibility study of a unit-level education and implementation science intervention was carried out in the emergency department with no contemporaneous control or comparison group. Medical records were reviewed retrospectively.

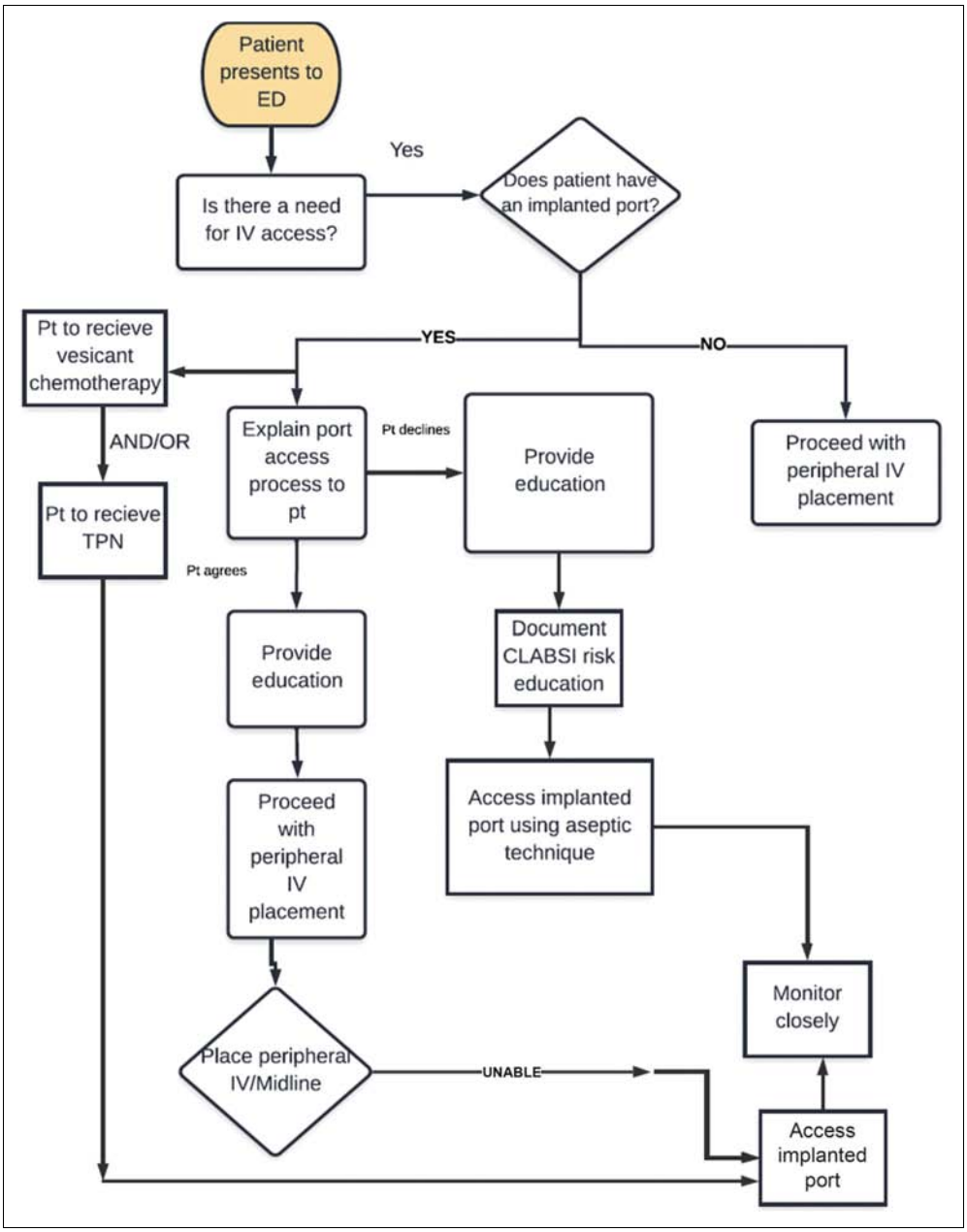
SETTING

The study was conducted at a 156-bed, urban Midwestern, nontrauma-designated hospital with an 18-bed emergency department. The department's 32 emergency nurses had 0.5 to 30 years of nursing experience (mean = 10.97 [SD = 8.96]) (Table 1). The emergency department had an 87.5% 3-month mean implanted port access rate before this unit-level intervention, and the hospital's last CLABSI diagnosis was more than 2 years ago. This study was approved by the university institutional review board (The University of Nebraska Medical Center Instutional Review Board 236-20-EP) as minimal-risk research.

INTERVENTION

An emergency nurse-led port access algorithm was used to guide the appropriate use of implanted ports in the ED setting (Figure). A similar port access algorithm that focused on enhanced patient CLABSI education and guided clinical decision-making regarding the use of implanted ports was implemented on all hospital inpatient units several years before this feasibility study in the emergency department. Inpatients who were directly admitted to the hospital (not passing through the emergency department) were already receiving CLABSI education by nursing staff and a discussion regarding peripheral IV access, rather than implanted port access, when indicated per the inpatient algorithm. The emergency department had not been included in the hospital's original port access algorithm initiative, given concerns regarding the feasibility of implementing the algorithm in the ED setting. A 1-month study period was intentionally used to evaluate the outcomes associated with port access and, more importantly, to assess the feasibility of integrating the port access algorithm into the ED workflow.

All emergency nurses received CLABSI education and port access algorithm training before the study implementation. Baseline staff perceptions of the port access algorithm were obtained to identify concerns and assess barriers to integrating the algorithm into the ED workflow (Table 2). The KAB survey was also administered before the study implementation. This tool was an adaptation of the knowledge, attitudes, and evidence-based practices questionnaire used in a 2013 European nursing study.[9] The original tool had 37 items, and the adapted version used in this study had 41 items. Four questions about central line care guidelines were added to the knowledge section to reflect current CLABSI guidelines in the US. The additional questions assessed the nurses' understanding of the scrub time necessary to disinfect an access lumen, the frequency of dressing changes, the frequency of implanted port needle changes, and the duration of time during which an implanted port can result in CLABSI after it is accessed during a hospitalization. All 6 questions to measure nurse attitudes and 22



FIGURE

Nurse-led port access clinical algorithm. ED, emergency department; IV, intravenous; Pt, patient; TPN, total parenteral nutrition; CLABSI, A central line-associated bloodstream infection.

questions to measure behaviors were retained in their original form.

Education and training related to the port access clinical algorithm and recommendations to guide nurses' discussion of port access with patients and families were conducted by the researchers at either a staff meeting or through one-on-one instruction. Lead emergency nurses championed bedside nurses throughout the study period. The department manager and hospital administration placed an expectation of thorough conversations with ED patients. Lead emergency nurses, IP specialists, and study investigators were available as needed to provide complete education, with a subsequent discussion that satisfied the patient's desire for inclusion and understanding of their treatment process.

TABLE 2
Perceptions of port access algorithm: Pre- and poststudy implementation

Survey	Questions
Preimplementation survey of nurses' perceptions of the port access algorithm	• Is the nurse-led port access algorithm easy to understand? • Do you believe that the nurse-led port access algorithm will fit into your clinical workflow? • What recommendations do you have to prevent disruptions in your workflow while adhering to the nurse-led port access algorithm?
Postimplementation survey of nurses' perceptions of the port access algorithm	• Did you care for a patient with an implanted port since introduction of the nurse-led port access algorithm? ○ If yes, did you use the algorithm when caring for your patient? • Do you believe that the nurse-led port access algorithm fits into your clinical workflow? • Have you encountered any difficulties with the nurse-led port access algorithm?

A medical record review was performed within 24 hours of each patient's ED visit to capture data related to the port access clinical algorithm's fidelity. Data collection from the medical record included the need for the implanted port, patient mode of transportation to the emergency department, Emergency Severity Index (version 4) level,[20] platelet count, white blood cell count, the emergency nurse's clinical decision to access the port vs placement of a peripheral venous catheter, and the emergency nurse's documentation of verbal and written CLABSI education. White blood cell and platelet count data points were only collected if this laboratory testing was performed as part of routine medical care, and no laboratory testing was performed exclusively for the purposes of this study. A daily medical record review was performed on the ED patients admitted to the hospital until their discharge to assess the incidence of implanted port access and incidence of CLABSI diagnosis during hospitalization. A single research investigator conducted a retrospective medical record review to capture data to assess the port access algorithm's implementation fidelity. When there was a lack of medical record documentation, the research nurse contacted the emergency nurse providing care for the patient to ascertain the steps of the algorithm implemented by the emergency nurse.

After the study, the emergency nurses' perceptions of the port access algorithm were collected with an open-ended questionnaire (Table 2). This postperception tool requested information about the use of the algorithm, barriers to integration into the ED workflow, and recommendations to improve the algorithm's functionality. The

TABLE 3
Port-access: Comparison 510 of ED implanted port access rates

Month	Implanted port present	Implanted ports accessed	Proportion of implanted ports accessed
Pre-implementation			
May 2020	22	20	90.90%
June 2020	16	14	87.50%
July 2020	18	15	83.30%
Total	56	49	87.50%
Postimplementation			
August 2020	17	3	17.60%

TABLE 4
Patient demographics and clinical characteristics

Characteristic	n	% of sample
Gender		
Male	8	47
Female	9	53
Age, y		
45-54	3	17.7
55-64	5	29.4
65-74	4	23.5
75-84	5	29.4
Reason for implanted port		
Anticancer therapy	17	100
Reason for ED visit		
Fatigue	5	29.4
Pain	4	23.5
Weakness/fall	3	17.6
Electrolyte imbalance	2	11.8
Fever	2	11.8
Accidental injury	1	5.9
ESI		
ESI-2	3	17.6
ESI-3	11	64.8
ESI-4	3	17.6
Mode of transport to ED		
Private vehicle	16	94.1
Emergency medical transport	1	5.9

ESI, emergency severity index.

KAB questionnaire was also readministered after the study, and the results were compared with the preimplementation scores.

DATA ANALYSIS

Descriptive statistics were used to summarize the outcome variables, including the preimplementation and postimplementation port access rates, CLABSI rates, and the nurses' KAB scores. A paired-samples *t* test was conducted to compare the emergency nurses' pre- and postimplementation KAB scores.

Results

USE OF THE EMERGENCY NURSE –LED PORT ACCESS ALGORITHM

All emergency nurses (N = 32) received preimplementation study CLABSI education and algorithm training. Implanted port access rates were collected for the 3 months preceding implementation of the nurse-led port access clinical algorithm in the emergency department (see Table 3). Twenty of the 22 ports were accessed in the first month (90.0%), 14 of 16 in the second month (87.5%), and 15 of 18 in the third month (83.3%). The total 3-month preimplementation port access rate was 87.5% (49 of the 56 adult patients). Seventeen adult patients with implanted ports presented to the emergency department during the 31-day algorithm implementation period, and all were included in the study (Table 4). This sample size (n = 17) was comparable to the number of patients with implanted ports who presented to the emergency department in the preceding 3 months.

During the study period (31 days), 3 of the 17 patients (17.6%) who presented to the emergency department with an implanted port had their port accessed during the ED encounter. The port access algorithm was used correctly in all patient situations, with appropriate nursing documentation to support deviations from the algorithm, such as a patient's decision to have their port accessed when a peripheral IV was indicated. The nurses providing care for the 3 patients who declined peripheral IV access reported that the patients chose to have their ports accessed owing to their perception that their oncologist wanted their port used for all venous access.

Peripheral IVs were placed on 82.3% (n = 14) of the patients who presented to the emergency department with an implanted port. Peripheral venous access was achieved in 1 attempt in 85.7% (n = 12) of the patients or after 2 attempts in 14.2% (n = 2) of the patients. One patient was treated and discharged from the emergency department. The remaining 16 patients (13 with peripheral IVs and 3 with accessed implanted ports) were admitted to the inpatient unit for ongoing treatment. These patients were followed through the remainder of their hospital encounter. Those with peripheral IVs did not require port access during their hospitalization, and those with accessed implanted ports did not develop a CLABSI, under NHSN criteria, during their hospitalization.

NURSES' PERCEPTIONS AND CLABSI KAB

Baseline and postimplementation KAB questionnaires were completed by 59% (n = 19) of the emergency nurses who received preimplementation study education. The knowledge portion of the KAB questionnaire had a maximum score of 15 points, and a comparison of the preimplementation (mean = 10.84 [SD = 1.72]) and postimplementation (mean =11.68 [SD = 1.41]) scores demonstrated a significant improvement in the emergency nurses' knowledge regarding CLABSI, t (19) = –4.8, $P < .001$. There were no significant differences in the subscales of the KAB measuring attitude and behavior scores.

The baseline nursing staff (n = 19) perceptions of the port access algorithm were that it was easy to understand. Seventy-nine percent (n = 15) reported that the algorithm "fit" into their clinical workflow, and 21% (n = 4) were not sure. An electronic version of the algorithm, integrated into the electronic medical record (EMR), was recommended by 26% (n = 5) of the staff nurses at baseline.

Postimplementation, 17 of the nursing staff (89%) reported that the port access algorithm "fit very well" into their workflow and gave them increased confidence when making decisions about whether to access an implanted port. Two nurses who noted that they did not think that the algorithm "fit" into their workflow also indicated that they had never accessed an implanted port. A preference for integration of the algorithm into the hospital's EMR was expressed by 63% (n = 12) of the staff nurses during the postimplementation assessment. Twenty-one percent (n = 4) of the staff nurses described how they integrated the patient's decision for venous access into their nurse-to-nurse shift report.

During the month preceding this implementation study, no ED nursing documentation was identified to indicate that emergency nurses were providing CLABSI education to ED patients as part of their workflow. The nurse-led port access algorithm includes steps to cue the nurse to provide patient-focused CLABSI education. When the emergency nurses were educated regarding the algorithm, they were provided with written educational resources and scripting examples to facilitate their conversations about port access in the emergency department. During the algorithm implementation period, CLABSI education was documented on 94% (n = 16) of the patients with an implanted port.

Discussion

The implementation of an emergency nurse-led port access algorithm was a unique endeavor undertaken on the basis of prior research that supports using central venous catheters for medications and treatments that require central venous access.[13,14] No prior research has focused exclusively on implanted ports or discussed their use in contrast with nonpermanent central venous catheters. This study implemented a port access clinical algorithm in the emergency department to increase CLABSI patient education and initiate a conversation about the necessity of accessing an implanted port for routine medical care.

Before the implementation of this feasibility study, the hospital already had a well-established CLABSI prevention plan in place for inpatients with implanted ports that included addressing the need for port access. All nurses, including emergency nurses, are required to complete a hands-on and written competency assessment of their central line access and maintenance skills, per Infusion Nursing Society guidelines,[3] every 6 months. The current practice for inpatients with implanted ports includes providing the option of peripheral IV placement, rather than implanted port access, when clinically appropriate. The laboratory also obtains all blood draws peripherally to reduce the risk of central line contamination, unless directed otherwise by the nursing staff or the patient.

We recognize that implanted ports are different from the temporary central venous catheters commonly seen in an acute care setting such as the emergency department. In response, the hospital's nurse-led port access algorithm was adapted to be used in the ED setting. The recommendations for implementing CLABSI prevention initiatives in the acute care setting served as a guide for the emergency nurse education and training processes.[5-9]

As central line and CLABSI research continues to evolve, it will be important to further study the use of implanted ports separately from other nonpermanent central venous catheters in the setting of the NHSN definition of CLABSI. The rationale for each patient's implanted port placement is a critical covariate that may affect the study's outcome. Resources for establishing peripheral IV access, such as the portable ultrasound and vein-finding devices available in this hospital's emergency department, may have eased the concerns of patients who received a recommendation for peripheral IV access. This feasibility study focused on the perceptions of the emergency nurses. Collecting patient perceptions is a logical next step that would address concerns about potential harms associated with the port access algorithm.

During the study implementation process, the ED charge nurse and ED director were prepared to assist emergency nurses with patient conversations regarding a recommendation for peripheral IV access. This additional support was not requested by any emergency nurse during the study period, and the patient's emergency nurse managed all conversations. After completing the 1-month algorithm

implementation period, the emergency nurses expressed a desire to continue using the port access algorithm. The algorithm was continued with support from the ED director and hospital administration.

Neutropenia associated with cancer and cancer therapy is a documented risk factor for CLABSI.[11,12] All patients in our sample (n = 17) had a cancer diagnosis, and their implanted ports were placed for the purpose of administering anticancer therapy. The nurses providing care for the 3 patients who declined peripheral IV access reported that the patients' oncologist wanted their port used for all venous access. Messaging from the oncology community regarding the role of implanted ports may be a barrier to a patient's acceptance of a peripheral IV in situations where central venous access is not clinically required.

Consistent messaging from the emergency nurse and physician reportedly facilitated positive patient education interactions and the patient's acceptance of peripheral IV access. Several nurses began including their use of the port access algorithm in their nurse-to-nurse shift report to reinforce its importance and maintain consistent messaging for the patient. A paper version of the port access algorithm was available at all computer stations in the emergency department. The nurses reported that the ease of access to the algorithm aided integration of the algorithm into their daily workflow and expressed that the algorithm would have been more useful if it had been available in the EMR. Future studies may wish to explore the possibility of embedding tools such as the algorithm from this feasibility study into the EMR.

Limitations

Several limitations to the generalizability of the algorithm's implementation were identified. Although there was an improvement in the nurses' knowledge scores on the KAB questionnaire, the emergency nurses' sample was not powered, limiting the generalizability of the study findings. On the basis of a significance level of 0.5, power of .95, and effect size of 0.3, a total of 134 emergency nurse surveys would have been necessary to identify a statistically significant change between the pre- and postintervention KAB questionnaire scores. The convenience sampling in a single ED setting was not adequately powered to determine a significant effect of the nurse-led intervention on KAB questionnaire scores. The fidelity of the port access algorithm was measured by retrospective medical record review and was not directly observed.

This study was implemented in an emergency department of a large, urban tertiary hospital that previously had a well-implemented port access algorithm in place for hospital inpatient units. As a result, emergency nurses in our sample may have been aware of the concept of assessing for central line access indications before accessing a port, thus increasing their acceptance of the algorithm in the ED setting. Another potential limitation of this study is related to the acuity of the patient population. No patients classified as emergent (Emergency Severity Index–1) with an implanted port presented to the emergency department during the algorithm implementation period. A barrier as perceived by the emergency nurses was the time needed to provide CLABSI education and engage the patient in a discussion regarding peripheral IV access.

Implications for Emergency Clinical Care

CLABSI prevention is vital to patient outcomes, and emergency nurses are essential to the prevention of CLABSI in the hospital setting. The emergency nurse-led port access algorithm demonstrated the capacity of 1 hospital's emergency nurses to positively influence the culture of central line use by accessing implanted ports only when clinically necessary. Educating patients to focus on IP was also central to the study. Engaging emergency nurses, patients, and families in the ED setting is an innovative approach to improve patient safety and decrease the routine use of an implanted port in the acute care setting.

Conclusions

The implementation of an emergency nurse-led port access clinical algorithm led to a reduction in the emergency department's implanted port access rate from 87.5% before implementation of the algorithm to 17.6% during the study period. Patients admitted to the hospital from the emergency department did not require port access during their hospitalization. Patients admitted to the hospital with an accessed implanted port had blood cultures drawn on the day of admission, which were negative, and none required repeat blood cultures during their hospitalization.

The results of this study suggest that a nurse-driven protocol to guide decisions regarding implanted port access in the emergency department can be effective and may reduce the likelihood of port access during hospitalization, thus decreasing the patient's risk of CLABSI. Future studies are needed to determine whether the algorithm, nursing education, and patient-centered approach used in this study can be replicated and implemented across other organizations.

Author Disclosures

Conflicts of interest: none to report.

REFERENCES

1. Centers for Disease Control and Prevention. Catheter-associated bloodstream infection. Updated January 2021. Accessed January 21, 2021. https://www.cdc.gov/hai/pdfs/bsi/BSI_tagged.pdf
2. The Joint Commission. Central line-associated bloodstream infections toolkit and monograph. Published 2013. Accessed January 4, 2021. https://www.jointcommission.org/resources/patient-safety-topics/infection-prevention-and-control/central-line-associated-bloodstream-infections-toolkit-and-monograph/
3. Gorski LA. The 2016 infusion therapy standards of practice. *Home Healthc Now*. 2017;35(1):10-18. https://doi.org/10.1097/NHH.0000000000000481
4. Centers for Disease Prevention and Control. Bloodstream infection event (central line-associated bloodstream infection and non-central line associated bloodstream infection). National Healthcare Safety Network. Published January 2021. Accessed January 21, 2021. https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf
5. McAlearney AS, Hefner JL. Facilitating central line-associated bloodstream infection prevention: a qualitative study comparing perspectives of infection control professionals and frontline staff. *Am J Infect Control*. 2014;42(10)(Suppl):S216-S222. https://doi.org/10.1016/j.ajic.2014.04.006
6. Kirk JW, Sivertsen DM, Petersen J, Nilsen P, Petersen HV. Barriers and facilitators for implementing a new screening tool in an emergency department: a qualitative study applying the Theoretical Domains Framework. *J Clin Nurs*. 2016;25(19-20):2786-2797. https://doi.org/10.1111/jocn.13275
7. Esposito MR, Guillari A, Angelillo IF. Knowledge, attitudes, and practice on the prevention of central line-associated bloodstream infections among nurses in oncological care: a cross-sectional study in an area of southern Italy. *PLoS One*. 2017;12(6):e0180473. https://doi.org/10.1371/journal.pone.0180473
8. LeMaster CH, Hoffart N, Chafe T, Benzer T, Schuur JD. Implementing the central venous catheter infection prevention bundle in the emergency department: experiences among early adopters. *Ann Emerg Med*. 2014;63(3):340-350.e1. https://doi.org/10.1016/j.annemergmed.2013.09.006
9. Bianco A, Coscarelli P, Nobile CGA, Pileggi C, Pavia M. The reduction of risk in central line-associated bloodstream infections: knowledge, attitudes, and evidence-based practices in health care workers. *Am J Infect Control*. 2013;41(2):107-112. https://doi.org/10.1016/j.ajic.2012.02.038
10. Gill JC, Oakley DJ, Wnwuemene OA. Strategies to aid identification of apheresis PowerFlow ports: a case report. *J Emerg Nurs*. 2021;47(1):21-27. https://doi.org/10.1016/j.jen.2020.10.004
11. Alkilany M. CLABSI during neutropenia among oncology adults post chemotherapy. *Middle East J Nurs*. 2016;10(3):25-27. https://library1.unmc.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=119639832&login.asp&site=ehost-live&scope=site
12. Maki DG, Kluger DM, Crnich CJ. The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. *Mayo Clin Proc*. 2006;81(9):1159-1171. https://doi.org/10.4065/81.9.1159
13. Chopra V, Flanders SA, Saint S, et al. The Michigan appropriateness guide for intravenous catheters (MAGIC): results from a multispecialty panel using the RAND/UCLA appropriateness method. *Ann Intern Med*. 2015;163(6)(suppl):S1-S39. https://doi.org/10.7326/M15-0744
14. Boyce JM, Nadeau J, Dumigan D, et al. Obtaining blood cultures by venipuncture versus from central lines: impact on blood culture contamination rates and potential effect on central line-associated bloodstream infection reporting. *Infect Control Hosp Epidemiol*. 2013;34(10):1042-1047. https://doi.org/10.1086/673142
15. Ziegler MJ, Pellegrini DC, Safdar N. Attributable mortality of central line associated bloodstream infection: systematic review and meta-analysis. *Infection*. 2015;43(1):29-36. https://doi.org/10.1007/s15010-014-0689-y
16. Lipitz-Snyderman A, Elkin EB, Atoria CL, et al. Provider differences in use of implanted ports in older adults with cancer. *Med Care*. 2015;53(7):646-652. https://doi.org/10.1097/MLR.0000000000000368
17. Benchimol EI, Smeeth L, Guttmann A, et al. The REporting of studies Conducted using Observational Routinely collected health Data (RECORD) statement. *PLoS Med*. 2015;12(10):e1001885. https://doi.org/10.1371/journal.pmed.1001885
18. Howick J, Webster RK, Rees JL, et al. TIDieR-Placebo: a guide and checklist for reporting placebo and sham controls. *PLoS Med*. 2020;17(9):e1003294. https://doi.org/10.1371/journal.pmed.1003294
19. Ogrinc G, Davies L, Goodman D, Batalden P, Davidoff F, Stevens D. SQUIRE 2.0 (Standards for QUality Improvement Reporting Excellence): revised publication guidelines from a detailed consensus process. *BMJ Qual Saf*. 2016;25(12):986-992. https://doi.org/10.1136/bmjqs-2015-004411
20. Adler D, Abar B, Durham DD, et al. Validation of the Emergency Severity Index (Version 4) for the triage of adult emergency department patients with active cancer. *J Emerg Med*. 2019;57(3):354-361. https://doi.org/10.1016/j.jemermed.2019.05.023

Journal of
EMERGENCY NURSING

Pain Medication Administered and Prescribed to Patients With an Ankle Sprain Treated in an Emergency Department: A Record-Based Cohort Study

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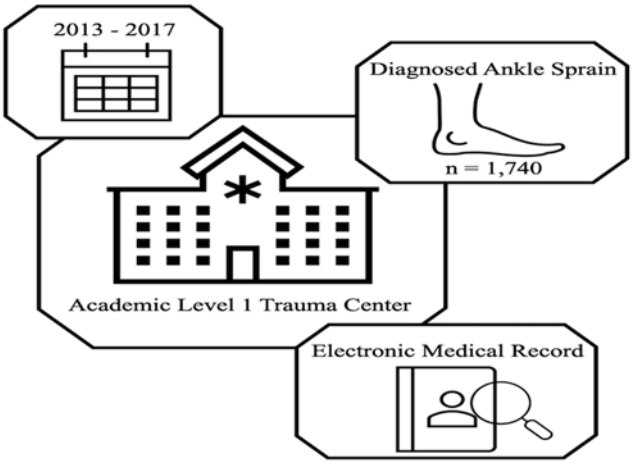

54% of encounters were instructed to take over-the-counter medication.

58% of encounters were given opioids, NSAIDs, non-opioid analgesics or muscle relaxants in the emergency department.

28% of encounters received a prescription for opioids or NSAIDs at discharge.

A greater percentage of encounters ≤15 years of age received NSAIDs or non-opioid analgesics, and those >15 years were given opioids.

Opioids were the most common medication administered in the emergency department and prescribed at discharge until 2016.

Pain Medication Administered and Prescribed to Patients With an Ankle Sprain Treated in an Emergency Department: A Record-Based Cohort Study

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Contribution to Emergency Nursing Practice

- What is already known on the emergency care provided for an ankle sprain: Previous research has demonstrated that many patients do not receive the recommended care for an ankle sprain when reporting to an emergency department.
- The main finding of this paper is that patients with an ankle sprain are regularly provided medication while receiving treatment in the emergency department and instructed to continue taking over-the-counter medication as needed.
- Recommendations for translating the findings of this paper into emergency clinical practice include reducing the medication-prescribing rates. Health care providers working in the emergency medicine setting should educate patients with an ankle sprain on nonpharmacologic alternatives to pain management and recommend that they seek further follow-up care such as physical therapy.

Abstract

Introduction: Recent data indicate that patients treated in the emergency department for an ankle sprain receive multiple medications. However, research has not been able to accurately identify all the medications because of study limitations. The primary purpose of this study was to document the type of medication, number of doses, and number of encounters given a prescription at discharge or instructions to take over-the-counter medication. The secondary purpose was to determine if the proportion of encounters given each type of medication varied on the basis of age, sex, race, and year.

Methods: A retrospective record-based cohort study design was used to review the electronic medical records (N = 1740) of encounters reporting to a southeast academic level 1 trauma center and diagnosed with an ankle sprain between 2013 and 2017. All relevant data were extracted for nonsteroidal anti-inflammatory drugs, muscle relaxants, opioids, and nonopioid analgesics.

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J Emerg Nurs 2021;47:609-620.
Available online 19 February 2021
0099-1767

https://doi.org/10.1016/j.jen.2020.12.011

Results: Fifty-eight percent of the encounters had at least 1 dose of medication administered in the emergency department. Twenty-eight percent received a prescription at discharge, and 54.5% were instructed to take over-the-counter medication. Cumulatively, opioids accounted for most of the medications, but the yearly rates declined from 2013 to 2017. A greater proportion of patients aged ≤15 years received nonsteroidal anti-inflammatory drugs or nonopioid analgesics. Most of the patients aged >15 years received opioid medication.

Discussion: Patients are primarily given an opioid or nonsteroidal anti-inflammatory drug in the emergency department. Fewer patients receive a prescription at discharge but are regularly instructed to take over-the-counter medication.

Key words: Nonsteroidal anti-inflammatory drugs; Opioids; Analgesics; Chart review

Introduction

Approximately 9% of all primary diagnoses made in emergency departments in the United States are for injuries to the ankle and foot.[1] The most common injury is an ankle sprain.[2] Previous research has estimated that 1 million people seek medical attention every year in emergency departments across the US for an ankle sprain.[3] Despite the incidence rate, an ankle sprain is often viewed as an innocuous injury that requires minimal treatment and results in few long-term consequences. However, numerous studies have demonstrated that a large proportion of ankle sprains leads to persistent disability, chronic pain, and functional deficiencies well beyond the initial insult.[4] Therefore, research is needed to better understand how these injuries are treated so that future investigators can improve the care that patients with an ankle sprain receive.

An ankle sprain causes an immediate increase in acute musculoskeletal pain, swelling, and a loss in joint function. The clinical practice guidelines recommend that an ankle sprain be treated conservatively with nonsteroidal anti-inflammatory drugs (NSAIDs) or nonopioid analgesics in conjunction with rest, ice, compression, and elevation.[5-7] However, research has shown that many patients are prescribed opioids to minimize their pain, which goes against the clinical practice guidelines. Delgado et al[8] analyzed private insurance data for patients aged >18 years and reported that 25% of the adults treated in emergency departments were prescribed a 3-day supply of opioids. However, it is well documented that adolescents (aged <18 years) are at risk of sustaining an ankle sprain,[9] and the odds of receiving an opioid prescription from the emergency department rise every year between the ages of 10 and 25 years.[10] Therefore, Kosik et al[11] expanded on these prior findings by examining data collected through the National Hospital Ambulatory Medical Care Survey (NHAMCS). The authors did not restrict the age or type of insurance for patients included in their analysis and compared all medications administered in the emergency department, prescribed at discharge, or both. They found that 75.5% of the patients received multiple medications, including opioids administered in the emergency department, prescribed at discharge, or both. Although the authors included a sample that was more representative of the general population, they were only able to accurately identify the first listed medication despite reporting that some patients were given multiple medications. As a result, some patients might have been given an opioid while receiving treatment in the emergency department or a prescription and not properly identified.

Only examining opioid-prescribing patterns at discharge and not accurately identifying all medications limit the understanding of the current prescribing patterns for an ankle sprain. A complete understanding of the type and number of medications administered in the emergency department and prescribed at discharge is important because minimizing symptoms (eg, pain and swelling) through pharmacologic therapies may create a sense of recovery before normal healing can occur after injury.[12,13] Reducing symptoms and imparting a perception of recovery through multiple medications or more potent drugs could lead patients to return to their normal activity within a short period of time after injury.[14,15] A quick return to activity may increase the risk for a recurrent injury or the development of chronic dysfunction.[13] In addition, adolescent and young adult populations have the highest incidence rate for an ankle sprain,[9] and if given an opioid prescription during this stage of life, it can increase the risk for future opioid misuse.[16] This is supported by research demonstrating that patients with an ankle sprain prescribed a higher dose of opioids have a 5-fold increased risk of transitioning to prolonged opioid consumption.[8] Therefore, implementing nonpharmacologic alternatives to reduce the amount and type of medication administered in the emergency department and prescribed at discharge is an area that can be targeted by future researchers to improve the current care given to patients with an ankle sprain and reduce the risk of other unwanted consequences. Thus, a more detailed investigation involves comprehensively describing the prescribing patterns by examining individual patient records to classify the type of medication and quantify the total number of doses administered in the emergency department or prescriptions given at discharge.

We reviewed the electronic medical records (EMRs) of encounters with an isolated diagnosis of an ankle sprain to (1) describe the type of medication administered or prescribed, (2) quantify the number of doses administered in the emergency department and prescribed at discharge, (3) calculate the morphine milligram equivalents (MME) of all opioid prescriptions given at discharge, and (4) document if the patients were instructed to take over-the-counter medication. Our secondary purpose was to determine if the proportions of the type of medication administered in the emergency department and prescribed at discharge varied on the basis of age, sex, race, and year.

Methods

STUDY DESIGN

A retrospective record-based cohort study design was conducted to review the EMRs of 1740 encounters reporting to a southeast regional academic level 1 trauma center between January 2013 and December 2017. This study was approved by the University of Kentucky Institutional Review Board (approval number: 45203).

SELECTION OF PATIENTS

All ED encounters with a single diagnosis of an ankle sprain were identified using the relevant *International Classification of Diseases, Ninth Revision* (*ICD-9*: 845.00-845.09) or *International Classification of Diseases, Tenth Revision* (*ICD-10*: S93.401A or S94.402A) codes. An encounter with a concomitant diagnosis code was excluded.

PROCEDURES

All data were entered and managed using a custom REDCap electronic survey (Vanderbilt University) to minimize the variability in data being extracted and to monitor the trained abstractors. REDCap is a secure, Web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture, (2) audit trails for tracking data manipulation and export procedures, (3) automated export procedures for seamless data downloads to common statistical packages, and (4) procedures for data integration and interoperability with external sources.[17,18]

Demographic information extracted from each EMR included age, sex, race, body mass index, and injured limb (left, right, or unspecified). Age was categorized on the basis of the ranges used for the NHAMCS: (1) <15 years, (2) 15 to 24 years, (3) 25 to 44 years, (4) 45 to 64 years, (5) 65 to 74 years, and (6) >75 years.[19] Race was based on the US Census Bureau definitions and included (1) White American, (2) Black or African American, (3) Asian American, (4) American Indian and Alaska Native, (5) Native Hawaiian and other Pacific Islander, and 6) more than one race.[20] Body mass index was categorized using the ranges established by the Centers for Disease Control and Prevention: (1) <18.5 kg/m^2, (2) 18.5 to 24.9 kg/m^2, (3) 25.0 to 29.9 kg/m^2, and (4) >30.0 kg/m^2.[21]

All relevant medications administered in the emergency department or prescribed at discharge to manage the symptoms of an ankle sprain were extracted and categorized on the basis of the following descriptions: nonopioid analgesic medication consisted of acetaminophen. All schedule III and schedule II (eg, HYDROcodone/oxyCODONE-acetaminophen and HYDROmorphone) controlled substances were categorized as opioid analgesics. Medications such as naproxen, ibuprofen, and ketorolac were categorized as NSAIDs. Medications such as methocarbamol, cyclobenzaprine, and tiZANidine were categorized as muscle relaxants.

The number of doses administered in the emergency department during an encounter and the number of prescriptions given at discharge were recorded for each type of medication. In addition, the number of tablets and dose in milligrams per tablet were recorded for all opioid prescriptions given at discharge to calculate the MME. The MME per prescription were calculated using established conversion factors.[22] The total MME were calculated for encounters given more than 1 opioid prescription at discharge. The MME prescribed at discharge were categorized on the basis of previously published cutoffs that were created to reflect the common tablet quantities dispensed for the most potent opioid prescribed, oxyCODONE 5 mg.[8] The specific MME cutoffs used were 1 to 75 MME (<10 tablets), 76 to 150 MME (11 to 20 tablets), 151 to 225 MME (21 to 30 tablets), and >225 MME (>30 tablets).

Written instructions to take over-the-counter medications as needed were documented (yes/no) for all included patients.

STATISTICAL ANALYSIS

Summary statistics, including frequency and percentages, were calculated for all demographic information and primary outcome measures.

Pearson chi-square or Fisher exact tests were used to determine if the proportions of each type of medication administered in the emergency department or prescribed at discharge differed on the basis of age, sex, race, and

year. The age categories 45 to 64 years, 65 to 74 years, and >75 years were combined to balance the distribution of age. Race was recategorized to "people who identify race as white" and "races other than white-only" owing to the low number of documented patients in all categories besides "people who identify race as white." In addition, statistical analysis was not performed on muscle relaxants because they were given to less than 1% of the patients both in the emergency department and at discharge.

SPSS version 25.0 (IBM Corp, Armonk, NY) was used to calculate all summary statistics. SAS version 9.4 (SAS Institute Inc, Cary, NC) was used to perform all statistical comparisons. The a priori alpha level was set at $P < .05$.

Results

Primary demographic data are listed in Table 1. Most of the encounters were aged between 15 and 44 years (66%), women (55.7%), and people who identify race as white (72.9%).

A total of 948 (54.5%) encounters were documented as having been instructed by the treating emergency physician to take over-the-counter medication as needed on discharge.

The number of encounters having a dose of medication administered in the emergency department compared with the number of encounters with a medication prescribed at discharge can be found in Table 2. More than half (n = 1008 [58%]) of the encounters received at least 1 dose of medication while receiving treatment in the emergency department, and 27.5% (n = 479) of the encounters were given a prescription at discharge.

The number of doses for each type of medication administered in the emergency department and the number of prescriptions given at discharge for each type of medication are listed in Table 3. More doses of opioid medication were administered in the emergency department (44%) than all other types of medication and accounted for most prescriptions at discharge (49%). These data translated into 29% of all encounters having been administered 1 or more doses of opioid medication while receiving treatment in the emergency department and 15% given at least 1 prescription at discharge (Table 4). Most opioids prescribed at discharge were for 1 to 75 MME or 76 to 150 MME (Supplementary Table 1).

NSAIDs were the second most common medication administered in the emergency department (40%) and prescribed at discharge (47%). This equated to 27% of all encounters having been administered 1 or more doses of NSAID medication while receiving treatment in the emergency department and 14% given at least 1 prescription at discharge (Table 4).

TABLE 1
Demographic information of the 1740 encounters with an ankle sprain included from 2013 to 2017

Demographic information	Number of encounters	Percentage of encounters
Age, y		
< 15	349	20
15-24	587	34
25-44	562	32
45-64	209	12
65-74	21	1
≥ 75	12	1
Sex		
Female	970	56
Male	770	44
Race		
People who identify race as white	1268	73
Black or African American	384	22
Asian American	34	2.0
American Indian and Alaska native	0	0
Native Hawaiian and other Pacific Islander	3	<1
More than one race	20	1
Unknown	31	2
BMI, kg/m^2		
< 18.5	11	<1
18.5-24.9	153	8
25.0-29.9	128	7
≥ 30.0	236	14
Unknown	1212	70
Injured limb		
Right	877	50
Left	834	49
Unspecified	28	1

BMI, body mass index.

For medication administered in the emergency department (Table 4), encounters for younger age groups were significantly more likely to receive NSAIDs ($\chi^2 = 40.06$, $P < .01$) or nonopioid analgesics ($\chi^2 = 72.16$, $P < .01$) (Table 4). Meanwhile, older age groups were significantly ($\chi^2 = 141.66$, $P < .01$) more likely to receive opioids than younger age groups (Table 4). A similar relationship was observed for race because people who identify race as

TABLE 2
The number of encounters with a medication administered in the emergency department compared with the number of encounters with a medication prescribed at discharge (N = 1740)

Prescription at discharge	Administered in the emergency department					Total
	None, n (%)	1 dose, n (%)	2 doses, n (%)	3 doses, n (%)	4 doses, n (%)	
None	608 (35)	529 (30)	120 (7)	4 (< 1)	-	1261 (72)
1 prescription	115 (7)	262 (15)	57 (3)	5 (< 1)	1 (< 1)	440 (25)
2 prescriptions	9 (< 1)	20 (1)	8 (< 1)	1 (< 1)	-	38 (2)
3 prescriptions	-	1 (< 1)	-	-	-	1 (<1)
Total	732 (42)	812 (46)	185 (11)	10 (< 1)	1 (< 1)	1740 (100)

white were more likely to receive opioids than races other than white-only ($\chi^2 = 15.87$, $P < .01$). No differences were observed between the sexes.

For medication prescribed at discharge (Table 4), encounters for younger age groups were less likely to be given a prescription for either NSAIDs ($\chi^2 = 43.57$, $P < .01$) or opioids ($\chi^2 = 96.85$, $P < .01$). In addition, more races other than white-only were given an NSAIDs prescription at discharge than people who identify race as white ($\chi^2 = 9.05$, $P < .01$).

The Figure displays the yearly percentage of all encounters and the type of medication administered in the emergency department and prescribed at discharge. Across the years 2013 to 2017, an overall significant positive trend was observed in the percentage of encounters administered NSAIDs ($\chi^2 = 16.00$, $P < .01$) and nonopioid analgesics in the emergency department ($\chi^2 = 32.37$, $P < .01$), whereas the percentage of encounters administered opioids had a downward trend ($\chi^2 = 22.97$, $P < .01$). Similarly, the percentage of encounters prescribed opioids at discharge showed a significant decline from 27.4% in 2013 to 5.6% in 2017 ($\chi^2 = 66.76$, $P < .01$), whereas the percentage of patients prescribed NSAIDs at discharge had an overall positive trend across all years ($\chi^2 = 26.56$, $P < .01$).

Additional data describing the number of doses for each type of medication and the different combinations administered in the emergency department and prescribed at discharge are listed in Supplementary Tables 2-4.

Discussion

We performed a retrospective records-based cohort study and found that 58% of all encounters with an ankle sprain treated at a level 1 trauma center from 2013 to 2017 had a medication administered in the emergency department. Meanwhile, 28% of the encounters received a prescription at discharge, and 54.5% were instructed to take over-the-counter medication as needed. To further describe this pattern, we recorded the number of doses administered in the emergency department and the number of prescriptions. We found that most encounters had a single dose of medication administered in the emergency department or 1 prescription written at discharge (Table 2). However, approximately 20% had overlapping medication

TABLE 3
The number of doses for each type of medication administered in the emergency department and the number of prescriptions given at discharge

Type of medication	Administered in the emergency department		Prescribed at discharge	
	Number of doses	Percentage	Number of prescriptions	Percentage
NSAID	486	40	245	47
Nonopioid	193	16	6	1
Opioid	534	44	254	49
Muscle relaxant	3	<1	14	3
Total	1216	100	519	100

NSAID, nonsteroidal anti-inflammatory drug.

TABLE 4
The number and percentage of encounters within each sub-category that had each type of medication administered in the emergency department or prescribed at discharge

Demographic information	NSAIDs		Nonopioid		Opioid		Muscle relaxant	
	n (%)	Point estimate	n (%)	Point estimate	n (%)	Point estimate	n (%)	Point estimate
Administered in the emergency department								
Total (n [%/1,740])	480 (27%)		192 (11%)		506 (29%)		3 (<1%)	
Age (years)								
≤15	138 (39%)	$\chi^2 = 40.06$***	81 (23%)	$\chi^2 = 72.16$***	23 (7%)	$\chi^2 = 141.66$***	-	-
15-24	150 (26%)		61 (10%)		155 (26%)		1 (<1%)	
25-44	151 (27%)		33 (6%)		225 (40%)		2 (<1%)	
≥ 45	41 (17%)		17 (7%)		103 (43%)			
Sex								
Male	218 (28%)	$\chi^2 = 0.36$	75 (10%)	$\chi^2 = 2.36$	218 (28%)	$\chi^2 = 0.40$	2 (<1%)	-
Female	262 (27%)		117 (12%)		288 (30%)		1 (<1%)	
Race*								
White	338 (27%)	$\chi^2 = 3.85$	131 (10%)	$\chi^2 = 0.73$	403 (32%)	$\chi^2 = 15.87$***	2 (<1%)	-
Nonwhite	139 (32%)		52 (12%)		96 (22%)		1 (<1%)	
Prescription at discharge								
Total (n [%/1,740])	245 (14%)		6 (<1%)		254 (15%)		14 (<1%)	
Age (years)								
≤15	18 (5%)	$\chi^2 = 43.57$***	3 (<1%)	Fisher's $P = .07$	5 (1%)	$\chi^2 = 96.85$***	-	-
15-24	81 (14%)		0 (0%)		66 (11%)		4 (<1%)	
25-44	116 (21%)		3 (<1%)		129 (23%)		7 (<1%)	
≥ 45	30 (12%)		0 (0%)		54 (22%)		3 (<1%)	
Sex								
Male	105 (14%)	$\chi^2 = 0.23$	3 (<1%)	Fishers $P = 1.00$	116 (15%)	$\chi^2 = 0.24$	3 (<1%)	-
Female	140 (14%)		3 (<1%)		138 (14%)		11 (<1%)	
Race*								
White	162 (13%)	$\chi^2 = 9.05$**	4 (<1%)	Fishers $P = .65$	192 (15%)	$\chi^2 = 1.29$	10 (<1%)	-
Other than white-only	82 (19%)		2 (<1%)		57 (13%)		4 (<1%)	

NSAID; non-steroidal anti-inflammatory drug.
* Values in column may not add to the total because of missing information on race. $P < .05$.
** $P < .01$,
*** $P < .001$.

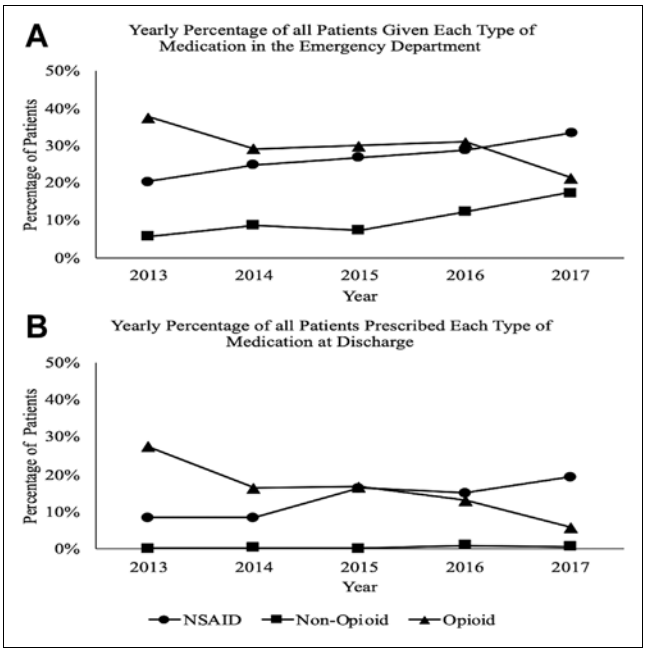
administered in the emergency department and a prescription written at discharge. Therefore, our data suggest that ED providers are primarily administering a single dose of medication to minimize symptoms in the emergency department and less commonly prescribing medication to alleviate symptoms after a patient is discharged. Furthermore, instead of being prescribed medication at discharge, more than half of the patients are being instructed to alleviate their symptoms by taking over-the-counter medication at home.

We identified 4 different types of medication administered or prescribed. NSAIDs and nonopioid analgesics combined accounted for more than half of all the medication. This is in agreement with the recommendations made by international experts and different medical associations, including the National Athletic Trainers Association, American Physical Therapy Association, and the American Academy of Family Physicians.[5-7,23] Therefore, our data suggest that most patients reporting to an emergency department receive the recommended type of medication for pain management. However, it is important to acknowledge that opioids were commonly administered in the emergency department and prescribed at discharge. Prescription opioids are not listed in the clinical practice guidelines for an ankle sprain because of the potential for other unintended consequences. For example, adolescents and young adults have the highest incidence rate for an ankle sprain.[9] Researchers have demonstrated that receiving an opioid prescription as an adolescent increases the potential for future opioid misuse later in life by 33%.[16] Others have shown that patients with an ankle sprain with an opioid prescription for >225 MME had nearly a 5-fold increased probability of transitioning to prolonged opioid consumption.[8] We only documented 2 encounters having received an opioid prescription above this threshold across 5 years. Instead, most opioid prescriptions were for <75 MME or fewer than 10 tablets (Supplementary Table 1).

Despite the likelihoods not being listed in the clinical practice guidelines, there is a possibility that the patients we documented as having received an opioid medication in the emergency department or in a prescription at discharge subjectively reported pain intensity levels that warranted more aggressive medications than over-the-counter drugs. Opioid medication is primarily intended to treat moderate to severe acute musculoskeletal pain. We did not extract this information because previous research has determined that pain intensity levels are not associated with a patient with an ankle sprain being given a dose of opioid medication in the emergency department, in a prescription at discharge, or both.[24] Not extracting this information prevents us from ruling out the possibility that there might have been situations where patients reported pain intensity levels that warranted opioid medication. In fact, a randomized controlled trial that comprised patients with an ankle sprain reporting moderate to severe pain intensity levels demonstrated that a single dose of traMADol-acetaminophen or HYDROcodone-acetaminophen administered in the emergency department decreased pain intensity during the first 4 hours postinjury.[25] In addition, the patients included in this randomized controlled trial were prescribed a 5-day supply of opioids at discharge and reported greater pain intensity reductions at the 1-week follow-up than those who had received a placebo.[25] Therefore, patients with an acute ankle sprain experiencing moderate to severe acute pain intensity levels might warrant, and benefit from, a low dose of opioid medication. However, the recent American Society for Pain Management Nursing position statement does not recommend prescribing doses of opioid medication only on the basis of a patient's pain intensity level because it neglects other essential elements of assessment and may contribute to further unintended consequences.[26] In addition to pain intensity levels, other factors such as the patient's age; pain history; previous use of, and response, to opioids; and comorbidities should be considered before opioids are prescribed.[26]

Our results are in agreement with prior research. Delgado et al[8] explored private insurance claims data to determine the opioid prescription rate at the time of discharge for adults with an acute ankle sprain. The authors demonstrated that 25.1% of these patients received a 3-day opioid prescription and large variations in state-level prescribing rates. Kosik et al[11] expanded on these findings through a secondary analysis of the NHAMCS by incorporating all medications used to treat an ankle sprain and differentiating among those administered to patients with an ankle sprain in the emergency department, prescribed at discharge, or both. They estimated that 48.9% of all patients with an ankle sprain received a single medication, and the 2 most common types were NSAIDs and opioids. However, Kosik et al[11] noted that 25.9% of the patients received 2 to 4 medications, but the authors could not accurately identify the type of medication owing to limitations associated with the survey design.

The data we present in the current study add to the body of literature by fully describing the type, the number of doses or prescriptions, and the different combinations (eg, NSAID and opioid) commonly given to a patient with an ankle sprain in the emergency department. For example, an NSAID was frequently combined with either an opioid or a nonopioid analgesic (Supplementary Tables 2-4). In contrast, some encounters were associated with multiple doses of opioid medication in the emergency department. Further describing all medications



FIGURE

Yearly percentage of all patients (N = 1740) given each type of medication (A) in the emergency department and (B) prescribed at discharge. NSAID, non-steroidal anti-inflammatory drugs.

and the different combinations is important because it provides insight into the use of medications for symptom management after an ankle sprain. Although it may be reasonable to prescribe medication to alleviate symptoms, solely relying on medication may lead to a false sense of recovery before healing has occurred. Quickly masking symptoms with medication may be a contributing factor to the hastened return to physical activity (<72 hours) previously demonstrated after an acute ankle sprain.[14,15] Returning to physical activity before having fully recovered could indirectly contribute to the high reinjury rates.[14,15] Therefore, health care providers should also emphasize the need for physical therapy as a nonpharmacologic alternative for pain management and to restore symptom-free function.

We also examined the influence of age, sex, and race on each type of medication administered in the emergency department or prescribed at discharge. Notably, a greater percentage of encounters aged <15 years were given NSAIDs or nonopioid medication. Conversely, a larger percentage of encounters aged >15 years were given opioid medication while receiving treatment in the emergency department (Table 4). However, this trend is not the same for medication prescribed at discharge. Regardless of the type, most of the medication prescribed at discharge was for encounters aged >15 years. In addition to age, a relationship was observed between race and opioid medication administered in the emergency department and NSAIDs prescribed at discharge. Specifically, encounters for people who identify race as white were more likely to be given opioids while receiving treatment in the emergency department than encounters for races other than white-only. A recent retrospective chart review of a Midwestern metropolitan area emergency department found that African American people diagnosed with acute low-back pain were less likely to receive an opioid in the emergency department than people who identify race as white.[27] The authors suggest that implicit biases based on racial stereotypes likely influence the pain management decisions made by the treating health care providers.[27] We suspect a similar relationship between implicit biases based on racial sterotypes and pain management decisions may be a possible explanation for our results (Table 1).

Finally, we observed a significant association between the year and the type of medication administered in the emergency department and prescribed at discharge. Specifically, opioids were the primary medication administered in the emergency department from 2013 to 2017 (Figure). A similar trend was observed at discharge from 2013 to 2015. This decline continued with approximately 6% of all encounters receiving an opioid prescription in 2017. These yearly rates are largely reflective of the current opioid prescribing habits in the US over the past decade.[28] The decline in the number of opioid prescriptions is largely attributed to the increased awareness among health care providers and the current prescribing guidelines. As a result of this decline in opioid prescriptions, our data suggest that patients are more likely to receive NSAIDs or nonopioid analgesics while receiving treatment in the emergency department or at the time of discharge. Therefore, it would seem that patients treated in the emergency department for an ankle sprain continue to have their symptoms managed with medication, but the type of medication has changed across the 5 years of data.

Limitations

There are limitations that need to be considered when interpreting our data. First, we identified ED encounters of an ankle sprain using *ICD-9* and *ICD-10* codes. Using this approach may have resulted in encounters being improperly included in the analyses owing to incorrect *ICD* code diagnosis. Furthermore, this approach to retrospectively identify ED visits may result in missing relevant encounters that could have been included in the analyses but were not owing to incorrect *ICD* code diagnosis. However, we made a concerted effort during the data extraction to ensure that only

encounters with signs and symptoms consistent with an acute ankle sprain were included in the analysis. In addition, we included a small number of patients (n = 74) who had more than 1 encounter with an *ICD* code diagnosis of an ankle sprain. There is a possibility that patients presenting twice to the emergency department for the same injury might have received different treatment during each visit. However, we do anticipate that the small addition of these multiple encounters had a significant effect on the overall results.

A second limitation is that we only documented the medication listed in the charts of encounters treated for an isolated ankle sprain. This limits our ability to conclude if the patients prescribed medication at discharge actually filled the prescription. It also prevents us from knowing the amount of medication consumed after the prescription was filled. Prospective research is needed to confirm whether the patients filled their prescription and the amount consumed after being discharged from the emergency department. In addition, we did not record whether the patient had taken a nonopioid or an NSAID before arrival, which would have precluded administration of this medication in the emergency department. In this situation, the only pharmacologic treatment option for the patient would be an opioid medication. Likewise, we did not document if patients were provided nonpharmacologic alternatives to pain management such as cryotherapy, imagery, distraction, or aromatherapy.

Another limitation is that only patients seeking care at a single southeast regional academic level 1 trauma center from 2013 to 2017 were included. This could reduce the generalizability of our results for patients treated in other regions of the US or different ambulatory care settings such as a physician's office or walk-in clinics. In addition, it is well documented that prescribing patterns have changed in the past decade because of new guidelines to address the opioid crisis in the US.[28] In fact, our data suggest that there was a decline in opioid prescribing across all years. Therefore, the known changes in prescribing patterns should be taken into consideration when interpreting our data.

Finally, we did not extract other variables that may influence a health care provider's clinical decision to prescribe medication. For example, the primary symptom that patients with an ankle sprain typically report is elevated levels of acute musculoskeletal pain. We did not extract this information because previous authors determined that the level of pain intensity measured on a 0 to 10 scale was not associated with opioid prescription in the emergency department or at discharge for patients with an acute ankle sprain.[24] However, the medication we documented in the current study is primarily intended to treat moderate to severe acute musculoskeletal pain. Therefore, not knowing the level of pain intensity reported by patients may limit our understanding of the rationale for prescribing medication. It may be important for future research to consider the influence of underlying factors such as level of pain intensity or other clinical indicators that may have an impact on clinical decision-making when deciding to prescribe medication.

Implications for Emergency Clinical Care

Our findings indicate that patients with an ankle sprain are generally given medication while receiving treatment in the emergency department and occasionally prescribed NSAIDs or opioids at discharge. In addition, more than half of the patients are instructed to take over-the-counter medication as needed. These data demonstrate how common medication is relied on by health care providers in emergency medicine settings when treating patients with an acute ankle sprain. Therefore, our data have implications for emergency clinical practice centered around pain management in patients with low-acuity trauma.

A qualitative research study demonstrated that physicians commonly rely on pain medication because they lack the time and resources to inform patients about alternative treatments.[29] Of note, many patients treated in the emergency department recognize this because they often report not being told about alternative therapies and subsequently feel left out of the decision-making process regarding their pain management.[30] Emergency nurses play an essential role, serving as advocates for patients and providing further education. An ankle sprain clinical practice guideline written for nurses highlights the need to educate patients on the appropriate use of medication, including the type, dose, frequency, and adverse effects.[31] Our data support this need for patient education because patients were commonly given medications or instructed to take over-the-counter drugs.

Nurses in emergency clinical settings can also play an important role in discussing nonpharmacologic alternative pain management treatments. Notably, rest, ice, compression, and elevation are often the first-line nonpharmacologic alternatives. Current recommendations suggest that ice should be applied intermittently for 20 minutes throughout the first week postinjury for pain relief.[32] In addition, patients should be nonweight bearing while using crutches or partial-weight bearing while using external support such as a tensor bandage, air-splint, or a walking boot. Finally, nurses and other support staff should discuss with the patient the benefit of attending supervised physical therapy for further treatment. At the time of discharge, if

supervised physical therapy is not available, nurses or other support staff should give patients a home-based exercise program comprising gentle ankle range-of-motion exercises, muscle strengthening, and static balance exercises.

All the aforementioned recommendations require health care providers working in emergency clinical settings to be familiar with their professional clinical practice guidelines. These guidelines are statements designed to help practitioners make decisions about the care they provide. Previous research has demonstrated that adherence to ankle sprain clinical practice guidelines varies among physical therapists.[33,34] We are unaware of any current studies examining compliance to clinical practice guidelines to manage an ankle sprain in the emergency medicine setting. Our data, which demonstrate that prescription opioids were being given occasionally to patients with an acute ankle sprain, support the need for future research to review current practices. Reviewing current practices can help identify barriers and enhance the implementation of clinical practice guidelines and improve quality in health care. It may also help develop protocols that encourage nonpharmacologic alternatives for pain management[35] and the creation of premade resources to be distributed by health care providers to encourage patients to seek further follow-up care such as physical therapy.

Conclusions

Our study demonstrates that most people seeking care at a southeast regional academic level 1 trauma center for an ankle sprain received 1 or more medications while receiving treatment in the emergency department. Opioids accounted for most of the medications administered in the emergency department, followed by NSAIDs. Fewer patients were prescribed medication at the time of discharge and, instead, were instructed to take over-the-counter medication. However, 15% of the patients received an opioid prescription at the time of discharge, which goes against the current practice guidelines. Most patients aged <15 years received NSAIDs or a nonopioid analgesic. In comparison, more patients aged >15 years were given opioids than adolescents and children.

Author Disclosures

Conflicts of interest: none to report.

This work was supported by a University of Kentucky College of Health Sciences Faculty Research Grant. The project was also supported by the National Institutes of Health National Center for Advancing Translational Sciences (grant number UL1TR001998). The content is solely the responsibility of the authors and does not necessarily represent the official view of the National Institutes of Health.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2020.12.011.

REFERENCES

1. Rui P, Kang K. *National Hospital Ambulatory Medical Care Survey: 2017 emergency department summary tables.* National Center for Health Statistics. Accessed August 2020. https://www.cdc.gov/nchs/data/nhamcs/web_tables/2017_ed_web_tables-508.pdf
2. Lambers K, Ootes D, Ring D. Incidence of patients with lower extremity injuries presenting to US emergency departments by anatomic region, disease category, and age. *Clin Orthop Relat Res*. 2012;47(1):284-290. https://doi.org/10.1007/s11999-011-1982-z
3. Shah S, Thomas AC, Noone JM, Blanchette CM, Wikstrom EA. Incidence and cost of ankle sprains in United States emergency departments. *Sports Health*. 2016;8(6):547-552. https://doi.org/10.1177/1941738116659639
4. Gribble PA, Bleakley CM, Caulfield BM, et al. Evidence review for the 2016 International Ankle Consortium consensus statement on the prevalence, impact and long-term consequences of lateral ankle sprains. *Br J Sports Med*. 2016;50(24):1496-1505. https://doi.org/10.1136/bjsports-2016-096189
5. Vuurberg G, Hoorntje A, Wink LM, et al. Diagnosis, treatment and prevention of ankle sprains: update of an evidence-based clinical guideline. *Br J of Sports Med*. 2018;52(15):956. https://doi.org/10.1136/bjsports-2017-098106
6. Martin RL, Davenport TE, Paulseth S, Wukich DK, Godges JJ; Orthopaedic Section American Physical Therapy Association. Ankle stability and movement coordination impairments: ankle ligament sprains. *J Orthop Sports Phys Ther*. 2013;43(9):A1-A40. https://doi.org/10.2519/jospt.2013.0305
7. Kaminski TW, Hertel J, Amendola N, et al. National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes. *J Athl Train*. 2013;48(4):528-545. https://doi.org/10.4085/1062-6050-48.4.02
8. Delgado MK, Huang Y, Meisel Z, et al. National variation in opioid prescribing and risk of prolonged use for opioid-naive patients treated in the emergency department for ankle sprains. *Ann Emerg Med*. 2018;72(4):389-400.e1. https://doi.org/10.1016/j.annemergmed.2018.06.003
9. Waterman BR, Owens BD, Davey S, Zacchilli MA, Belmont Jr PJ. The epidemiology of ankle sprains in the United States. *J Bone Joint Surg Am*. 2010;92(13):2279-2284. https://doi.org/10.2106/JBJS.I.01537
10. Van Winkle PJ, Ghobadi A, Chen Q, Menchine M, Sharp AL. Association of age and opioid use for adolescents and young adults in community emergency departments. *Am J Emerg Med*. 2018;37:1397-1403. https://doi.org/10.1016/j.ajem.2018.10.021

11. Kosik KB, Hoch MC, Humphries RL, Villasante Tezanos AG, Gribble PA. Medications used in U.S. emergency departments for an ankle sprain: an analysis of the National Hospital Ambulatory Medical Care Survey. *J Emerg Med*. 2019;57(5):662-670. https://doi.org/10.1016/j.jemermed.2019.08.025
12. Hubbard TJ, Hicks-Little CA. Ankle ligament healing after an acute ankle sprain: an evidence-based approach. *J Athl Train*. 2008;43(5):523-529. https://doi.org/10.4085/1062-6050-43.5.523
13. Miklovic TM, Donovan L, Protzuk OA, Kang MS, Feger MA. Acute lateral ankle sprain to chronic ankle instability: a pathway of dysfunction. *Phys Sportsmed*. 2018;46(1):116-122. https://doi.org/10.1080/00913847.2018.1409604
14. Roos KG, Kerr ZY, Mauntel TC, Djoko A, Dompier TP, Wikstrom EA. The epidemiology of lateral ligament complex ankle sprains in National Collegiate Athletic Association Sports. *Am J Sports Med*. 2017;45(1):201-209. https://doi.org/10.1177/0363546516660980
15. Medina McKeon JM, Bush HM, Reed A, Whittington A, Uhl TL, McKeon PO. Return-to-play probabilities following new versus recurrent ankle sprains in high school athletes. *J Sci Med Sport*. 2014;17(1):23-28. https://doi.org/10.1016/j.jsams.2013.04.006
16. Miech R, Johnston L, O'Malley PM, Keyes KM, Heard K. Prescription opioids in adolescence and future opioid misuse. *Pediatrics*. 2015;136(5):e1169-e1177. https://doi.org/10.1542/peds.2015-1364
17. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208. https://doi.org/10.1016/j.jbi.2019.103208
18. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381. https://doi.org/10.1016/j.jbi.2008.08.010
19. Bryant E, Shimizu I. Sample design, sampling variance, and estimation procedures for the National Ambulatory Medical Care Survey. *Vital Health Stat 2*. 1988;(108):1-39.
20. United States Census Bureau. About race. Published October 2020. Accessed August 2020. https://www.census.gov/topics/population/race/about.html
21. National Heart Lung and Blood Institute. The practical guide for identification, evaluation, and treatment of overweight and obesity in Adults. Published October 2000. Accessed August 2020. https://www.nhlbi.nih.gov/files/docs/guidelines/prctgd_c.pdf
22. Centers for Disease Control and Prevention. CDC guideline for prescribing opioids for chronic pain. Published August 2019. Accessed March 2020. https://www.cdc.gov/drugoverdose/prescribing/guideline.html
23. Tiemstra JD. Update on acute ankle sprains. *Am Fam Physician*. 2012;85(12):1170-1176.
24. Kosik KB, Hoch MC, Villasante-Tezanos AG, Gribble PA. Visit characteristics associated with opioids administered or prescribed during emergency department visits for ankle sprain between 2010 and 2015. *PM R*. 2020;12(7):647-654. https://doi.org/10.1002/pmrj.12326
25. Hewitt DJ, Todd KH, Xiang J, Jordan DM, Rosenthal NR; CAPSS-216 Study Investigators. Tramadol/acetaminophen or hydrocodone/acetaminophen for the treatment of ankle sprain: a randomized, placebo-controlled trial. *Ann Emerg Med*. 2007;49(4):468-480, 480.e1-e2. https://doi.org/10.1016/j.annemergmed.2006.08.030
26. Pasero C, Quinlan-Colwell A, Rae D, Broglio K, Drew D. American society for pain management nursing position statement: prescribing and administering opioid doses based solely on pain intensity. *Pain Manag Nurs*. 2016;17:291-292. https://doi.org/10.1016/j.pmn.2016.08.002
27. Dickason RM, Chauhan V, Mor A, et al. Racial differences in opiate administration for pain relief at an academic emergency department. *West J Emerg Med*. 2015;16(3):372-380. https://doi.org/10.5811/westjem.2015.3.23893
28. Guy Jr GP, Zhang K, Bohm MK, et al. Vital signs: changes in opioid prescribing in the United States, 2006-2015. *MMWR Morb Mortal Wkly Rep*. 2017;66(26):697-704. https://doi.org/10.15585/mmwr.mm6626a4
29. Dekker AE, Kleiss I, Batra N, et al. Patient and clinician incentives and barriers for opioid use for musculoskeletal disorders a qualitative study on opioid use in musculoskeletal setting. *J Orthop*. 2020;22:184-189. https://doi.org/10.1016/j.jor.2020.04.016
30. Smith RJ, Rhodes K, Paciotti B, Kelly S, Perrone J, Meisel ZF. Patient perspectives of acute pain management in the era of the opioid epidemic. *Ann Emerg Med*. 2015;66(3):246-252.e1. https://doi.org/10.1016/j.annemergmed.2015.03.025
31. Common Problems of the Musculoskeletal System. First Nations and Inuit Health Branch (FNIHB) Clinical Practice Guidelines for Nurses in Primary Care. Government of Canada. Published May 2013.
32. Bleakley CM, McDonough SM, MacAuley DC, Bjordal J. Cryotherapy for acute ankle sprains: a randomised controlled study of two different icing protocols. *Br J Sports Med*. 2006;40(8):700-705. https://doi.org/10.1136/bjsm.2006.025932
33. van der Wees PJ, Hendriks EJ, Jansen MJ, van Beers H, de Bie RA, Dekker J. Adherence to physiotherapy clinical guideline acute ankle injury and determinants of adherence: a cohort study. *BMC Musculoskelet Disord*. 2007;8:45. https://doi.org/10.1186/1471-2474-8-45
34. Kooijman MK, Swinkels IC, Veenhof C, Spreeuwenberg P, Leemrijse CJ. Physiotherapists' compliance with ankle injury guidelines is different for patients with acute injuries and patients with functional instability: an observational study. *J Physiother*. 2011;57(1):41-46. https://doi.org/10.1016/S1836-9553(11)70006-6
35. Duncan RW, Smith KL, Maguire M, Stader 3rd DE. Alternatives to opioids for pain management in the emergency department decreases opioid usage and maintains patient satisfaction. *Am J Emerg Med*. 2019;37(1):38-44. https://doi.org/10.1016/j.ajem.2018.04.043

Appendix

SUPPLEMENTARY TABLE 1

The number and percentage of encounters given an opioid prescription, with an MME for each category

MME	Number of encounters	Percentage of encounters prescribed an opioid at discharge
1-75	154	61
76-150	55	22
151-225	2	< 1
>225	2	< 1
Unknown	41	16

MME, morphine milligram equivalents.

SUPPLEMENTARY TABLE 2

The number of encounters and percentage of the total sample (N = 1740) given either 1 or more doses of medication in the emergency department or prescriptions at discharge only

Number of doses or prescriptions for each type of medication	Administered in the emergency department only, n (%)	Prescription given at discharge only, n (%)
1 dose or prescription		
NSAID	239 (14)	69 (4)
Nonopioid	102 (6)	1 (< 1)
Opioid	187 (11)	45 (2)
Relaxant	1 (< 1)	-
Total	529 (30)	115 (7)
2 doses or prescriptions		
2 NSAIDs	4 (< 1)	-
2 nonopioids	1 (< 1)	-
2 opioids	10 (< 1)	-
2 muscle relaxants	-	-
Nonopioid and NSAID	61 (3)	1 (< 1)
Nonopioid and opioid	4 (< 1)	-
Nonopioid and muscle relaxant	-	-
NSAID and opioid	40 (2)	7 (< 1)
NSAID and muscle relaxant	-	1 (< 1)
Opioid and muscle relaxant	-	-
Total	120 (7)	9 (< 1)
3 doses or prescriptions		
Nonopioid, NSAID, and opioid	2 (< 1)	-
Opioid, muscle relaxant, and NSAID	1 (< 1)	-
2 NSAIDs and nonopioid	1 (< 1)	-
Total	4 (< 1)	-

NSAID, nonsteroidal anti-inflammatory drug.

SUPPLEMENTARY TABLE 3

The number of encounters and percentage of the total sample (N = 1740) given a single dose of medication in the emergency department and 1 prescription at discharge

Type of medication prescribed	Type of medication administered in the emergency department				Total, n (%)
	NSAID, n (%)	Nonopioid, n (%)	Opioid, n (%)	Muscle relaxant	
Type of prescription given at discharge					
NSAID	66 (4)	7 (< 1)	47 (3)	-	120 (7)
Nonopioid	-	1 (< 1)	-	-	1 (< 1)
Opioid	7 (< 1)	1 (< 1)	131 (8)	-	139 (8)
Muscle relaxant	1 (< 1)	-	1 (< 1)	-	2 (< 1)
Total	74 (5)	9 (< 1)	179 (10)	-	262 (15)

NSAID, nonsteroidal anti-inflammatory drug.

SUPPLEMENTARY TABLE 4

The number of encounters and percentage of the total sample (N = 1740) given 1 or more doses of medication in the emergency department and 1 or more prescriptions at discharge

Type of medication administered in the emergency department	Type of prescription given at discharge	Number of patients (% of total sample [N = 1740])
2 doses administered in the emergency department and 1 prescription given at discharge		
NSAID, opioid	NSAID	20 (1)
NSAID, opioid	Opioid	18 (1)
Opioid, opioid	Opioid	10 (< 1)
Nonopioid, NSAID	NSAID	4 (< 1)
Nonopioid, opioid	Opioid	3 (< 1)
Nonopioid, NSAID	Opioid	1 (< 1)
Opioid, relaxant	Opioid	1 (< 1)
Total		57 (3)
1 dose administered in the emergency department and 2 prescriptions given at discharge		
Opioid	Opioid, NSAID	9 (< 1)
Opioid	Opioid, muscle relaxant	6 (< 1)
Opioid	NSAID, muscle relaxant	2 (< 1)
Opioid	NSAID, nonopioid	1 (< 1)
Nonopioid	NSAID, opioid	1 (< 1)
NSAID	Opioid, NSAID	1 (< 1)
Total		20 (1)
2 doses administered in the emergency department and 2 prescriptions given at discharge		
Opioid, NSAID	Opioid, NSAID	5 (< 1)
Nonopioid, NSAID	Nonopioid, NSAID	2 (< 1)
Opioid, NSAID	Muscle relaxant, opioid	1 (< 1)
Total		8 (< 1)
3 doses administered in the emergency department and 1 prescription given at discharge		
2 opioids, NSAID	Opioid	3 (< 1)
3 opioids	Opioid	2 (< 1)
Total		5 (< 1)
1 dose administered in the emergency department and 3 prescriptions given at discharge		
NSAID	NSAID, muscle relaxant, opioid	1 (< 1)
Total		1 (< 1)
3 doses administered in the emergency department and 2 prescriptions given at discharge		
2 opioids, NSAID	Opioid, muscle relaxant	1 (< 1)
Total		1 (< 1)
4 doses administered in the emergency department and 2 prescriptions given at discharge		
Nonopioid, opioid, 2 NSAIDs	Opioid	1 (< 1)
Total		1 (< 1)

NSAID, nonsteroidal anti-inflammatory drug.

ENA Position Statement: Mitigating the Effects of Climate Change on Health and Health Care: The Role of the Emergency Nurse

EMERGENCY NURSES ASSOCIATION

Description

Earth's climate is changing more rapidly than at any other point in the history of modern civilization, and it is largely a result of human activity.[1-7] The impact of climate change is being experienced globally and is projected to intensify in the future.[4,6,8] Climate change affects communities in many ways: the economy, social systems, quality of water, ecosystems, agriculture and food, infrastructures, oceans and coasts, tourism, human health, and quality of life.[4,6,7]

A major contributor to the warming of the climate system is the health care sector, accounting for 8% of greenhouse gas emissions in the United States and 4.5% globally.[8-10] The main greenhouse gases responsible for climate change are carbon dioxide, methane, nitrous oxide, and fluorinated gases.[11] In conjunction with black carbon, these gases impair the earth's reflective capacity while simultaneously absorbing solar radiation that is re-emitted to Earth's atmosphere, ultimately leading to surface warming.[11] Rising global temperatures are associated with more frequent and severe storms, intense heat, drought, worsening air quality, and changes in the distribution of pathogens.[8,11-16] Water scarcity, land degradation, and desertification also have accelerated in the past century owing to natural disasters, environmental pollution, and destruction of green space.[12,17-21] More frequent and intense extreme weather and climate-related events, as well as changes in average climate conditions, are expected to damage infrastructure, ecosystems, and social systems that provide essential benefits to communities.

The physical environment where people live, learn, work, and play, which is affected by rising global temperatures, is a social determinant of health.[22,23] Future climate change is expected to further disrupt many aspects of life, posing challenges to those most vulnerable populations including children, older adults, pregnant women, some communities of color, immigrants, lower-income and under-resourced communities, and those with comorbidities (eg, immunocompromised, allergies, respiratory disease) who have a lower capacity to prepare for and cope with extreme weather and climate-related events.[1,2,4,6-8,24-26]

Ambient air pollution contributes to 4.2 million premature deaths worldwide and is associated with increased morbidity from numerous illnesses.[27,28] More than 90% of children are subjected to fine particulate matter that exceeds health standards, whereas maternal exposure is associated with an increase in preterm births, low birth weight, and stillbirths.[29] Poor air quality also leads to emergency visits for asthma, chronic obstructive pulmonary disease, cardiovascular events, and mental health complaints.[7,12,26-28,30] In 2018, a record number of older adults (220 million) were exposed to at least 1 heatwave,[8] with exposure to the stress of extreme heat causing nephropathy, electrolyte disturbances, cerebrovascular events, congestive heart failure, and preterm births.[8,12,31,32] Psychological stress owing to displacement, socioeconomic consequences, and exposure to trauma is anticipated to rise with the increased prevalence of climate-related natural disasters.[12] Providing education to patients and their families on climate change and disaster readiness may help them prepare and mitigate these consequences.

The severity of the impact of future climate change will depend fundamentally on action taken to reduce greenhouse gas emissions and adapt to anticipated changes.[1,2,4,6] Without proactive action and substantial changes, climate-related risks will continue to grow. According to the World Health Organization,[28] climate change can be mitigated by transitioning to sustainable and efficient energy practices, conserving and protecting resources, designing climate-resilient infrastructure, and adopting methods of sustainable waste disposal and management practices. The emergency nurse can serve as a voice to mitigate climate change through advocacy, research, patient education, and community educational programs. In addition, the emergency nurse has various opportunities to engage others to assist in adaptation and mitigation strategies, increase awareness regarding the impact of climate change and health, support climate-friendly practices and

initiatives in health care, and join others in the call for immediate action on climate change and policies that support climate adaption and mitigation.

Emergency Nurses Association Position

It is the position of the Emergency Nurses Association (ENA) that:

1. Climate change is a global public health problem.
2. Global action to significantly reduce greenhouse gas emissions can substantially reduce climate-related risks.
3. Emergency nurses advocate to promote nursing educational opportunities and research regarding the effects of climate change on the environment and human health.
4. Emergency nurses provide evidence-based discharge education to patients and their families on relevant climate change related disaster readiness to increase their awareness of the threats and prevention strategies and reduce chronic disease exacerbations.
5. Emergency nurses and administrators lead initiatives to explore and implement strategies to design and redesign health care facilities to reduce carbon emissions and the environmental impact.
6. Emergency nurses, administrators, and health care facilities seek ways to increase energy efficiency, reduce waste, incorporate renewable energy, and help build collaborative opportunities within the community to address climate change.

Background

The Intergovernmental Panel on Climate Change defines climate change as a transformation in the state of the climate that continues for an extended period and can be recognized by the variability of its properties.[6,33] It also can be considered to be any change in climate over time, whether a result of natural changes or a consequence of human activity. Climate change is a global health problem that requires collaboration across various sectors to promote community climate resilience and sustainable, long-term transformation.[34] The heat-trapping nature of carbon dioxide and other greenhouse gases has been recognized since the 1800s as being a large contributor to climate change.[6] Human activities such as the burning of fossil fuels and land use changes such as deforestation have caused a rapid acceleration in the atmospheric concentration of greenhouse gases.[6,35-42] Scientists continue to observe climbing temperatures over the past century, which are attributed to changes in greenhouse gas concentrations. These effects of a changing climate are linked to fundamental health issues and pose existential risks to everyone.

Heat waves have become more frequent and prolonged, and the number of extreme cold waves has increased. Extreme heat has been associated with an increased risk of morbidity and mortality.[43,44] Kang et al.[44] found that heat waves were significantly associated with increased risk of out-of-hospital cardiac arrest events during the afternoon when temperatures were at their highest. Other researchers have shown that thermoregulatory mechanisms are impaired in the elderly, as well as those with chronic illnesses such as diabetes, hypertension, and congestive heart failure.[44-46] Globally, there has been a shrinkage of glaciers, decreasing the mass of the Greenland and Antarctic ice sheets. The sea level has risen because of these melting glaciers and the thermal expansion of warmer water.[47] As the Earth's climate continues to change, helping to adjust the daily health behaviors including mediating effects of risk perception of patients will be an important public health intervention for emergency nurses.

Climate change has led to various temperature anomalies.[48] Warmer air holds more moisture and contributes to an increase in heavy precipitation in some areas. Conversely, drier regions, such as the US Southwest have experienced drought. Whereas extreme heat and droughts are not uncommon for certain areas such as East Africa, droughts in this region have become drier and much hotter than usual affecting farming, health, humanitarian efforts, and resettlement.[49] These outcomes remain consistent with projections that wet regions will become wetter and drier regions will become drier.

With the anticipation of more flooding, emergency nurses can expect to see increased drownings, heart attacks, hypothermia, blunt trauma caused by wind-borne objects, vehicle-related crashes, snakebites, electrocutions, wound infections, and water-borne diseases.[50-53] Intensity of hurricanes and frequency of wildfires are both additional examples of the changing climate.[54] Although the annual number of wildfires varies, the overall number of burned acres is increasing,[55] which leads to increased air particulates and smoke exposure causing increased respiratory illnesses and ED visits.[56-58] In addition, particulate air pollutants released by burning fossil fuels are shortening human life in many regions of the world. Psychological stress, political instability, forced migration, and conflict are other unsettling consequences. Those most vulnerable such as the chronically ill and under-resourced communities will be most affected by the devastating consequences.[10]

Emergency nurses can help to increase awareness of and mitigate the effects of climate change through research, education, and community outreach. Energy optimization is 1 strategy for reducing carbon emissions. For example, emergency care settings can upgrade to energy-efficient equipment, replace incandescent light bulbs with LED bulbs, and install lighting control systems such as occupancy

sensors.[16,20,24,59-61] The use of renewable and alternative energy sources (eg, solar-powered photovoltaic, water pumps, wind) are additional means of reducing fossil fuel use.[9,16,59-62] Combined heat and power technology is another alternative; this technology captures excess heat from electricity generation and uses it for thermal energy.[9] Energy production is not the only source of carbon emission: more than half of the nitrogen oxides emitted globally are from fuels used for transportation.[8] Using locally sourced food and on-site food production (eg, rooftop gardens) in hospital cafeterias and catering are methods of reducing emissions from transporting supplies while modeling sustainable food practices.[8,16,24]

Emergency care settings can further reduce transport emissions by supporting staff use of environmentally conscious forms of transport (eg, cycling) and advocating for vehicles (eg, ambulances) that use alternative fuel, are electric, or have zero emissions.[12,63] Emergency nurse leaders can incorporate climate resilient solutions into facility renovation and future design.[8,12,59] For example, the consideration of landscape features that reduce thermal stresses, use passive cooling and lighting techniques,[8,19,64] and install green roofs or reflective rods to reduce the heat-island effect.[15,16,20,59,65-67] Facilities can protect and conserve water by transitioning to water-efficient equipment (eg, low-flow faucets and toilets), adopting water-recycling procedures (eg, rainwater harvesting for landscape irrigation), and mitigating potential contamination of water sources.[15-17,19,59,68] Bioswales, aquifer storage and recovery, and desalination are examples of sustainable stormwater management practices.[17,21,69] Chemicals used interiorly (eg, cleaning supplies) and exteriorly (eg, pesticides and herbicides) also can negatively affect water and soil quality. Adopting integrated groundskeeping practices aimed at reducing the use of environmentally harmful chemicals is 1 approach to mitigating soil and water contamination.[16,68,70]

Sustainable waste management is necessary to preserve resources and reduce greenhouse gas emissions.[8] Examples of sustainable approaches include reusing and recycling of industrial materials, composting, using alternative waste management technology (eg, anaerobic digestion of organic waste), and disposing of electronics in environmentally conscientious ways (eg, reusing, refurbishing, or recycling materials).[8,16,20,69-73] Emergency departments also have the opportunity to reduce general (nonhazardous) and regulated waste. Regulated waste may be infectious, pathologic (human tissues), sharps, chemical (eg, disinfectants, batteries, solvents), pharmaceutical (eg, expired, unused, or contaminated drugs), and cytotoxic (waste with genotoxic properties).[70] Pharmaceutical management and disposal is a significant area of opportunity for reducing waste and preventing environmental contamination.[1] Pharmaceutical take-back programs are 1 way in which organizations are already combating this issue that could be further expanded.[74,75] In addition, emergency care settings can adopt processes that promote efficient pharmaceutical use such as reducing storage redundancy and modifying purchasing habits (eg, use of therapeutic alternatives, selecting 2-part polyolefin intravenous devices that weigh up to one-third less).[59,60]

Integrating environmental health into nursing and educating emergency nurses on climate change are important components of the reduction of health care's carbon footprint.[12,20,22,24,26] Emergency nurses can positively influence practice by supporting policies related to climate change, modeling healthy behaviors that promote sustainability, and taking measures to minimize waste.[10,12,15,16,22,26,28,71] Emergency nurses are also in the unique position of being able to educate patients and families on environmentally safe ways to dispose of regulated waste (eg, unused medication, medical supplies).

Unfortunately, climate change is not universally accepted as a public health hazard by health care professionals in the United States despite being one of the greatest global health threats of this century.[7,76] It is important for emergency nurses to increase their understanding of the health threats associated with climate to assist in recognizing and anticipating climate-associated effects and become more engaged in the development and effective implementation of prevention, mitigation, and adaptation strategies.

Resources

Reduce your facility's energy use (operations). American College of Physicians. Published 2017. Accessed June 12, 2021. https://www.acponline.org/system/files/documents/advocacy/advocacy_in_action/climate_change_toolkit/energy_management.pdf

Commercial buildings. Energy Star. Accessed June 12, 2021. https://www.energystar.gov/buildings/about-us/howcan-we-help-you/build-energy-program/guidelines

Reidmiller DR, Avery CW, Easterling DR, et al. *Volume II: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment.* U.S. Global Change Research Program; 2018.

Federal energy management program. U.S. Department of Energy. Published 2020. Accessed June 12, 2021. http://energy.gov/eere/femp/federal-energy-management-program

REFERENCES

1. American Academy of Pediatrics. Environmental health. Accessed June 12, 2021. https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Environmental-Health/Pages/Environmental-Health.aspx
2. Council on Environmental Health. Global climate change and children's health. *Pediatrics*. 2015;136(5):992-997. https://doi.org/10.1542/peds.2015-3232
3. Chao Q, Feng A. Scientific basis of climate change and its response. *Glob Energy Interconnection*. 2018;1(4):420-427. https://doi.org/10.14171/j.2096-5117.gei.2018.04.002
4. Reidmiller DR, Avery CW, Easterling DR, et al. Overview. *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*. U.S. Global Change Research Program; 2018:33-71.
5. Lovejoy TE, Hannah L. *Biodiversity and Climate Change*. Yale University Press; 2019.
6. Pachauri RK, Meyer LA. Climate change 2014: synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change. The Intergovernmental Panel on Climate Change; 2014. Accessed June 12, 2021. https://www.ipcc.ch/report/ar5/syr/
7. Ziegler C, Morelli V, Fawibe O. Climate change and underserved communities. *Prim Care*. 2017;44(1):171-184. https://doi.org/10.1016/j.pop.2016.09.017
8. Watts N, Amann M, Arnell N, et al. The 2019 report of the Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet*. 2019;394(10211):1836-1878. https://doi.org/10.1016/S0140-6736(19)32596-6
9. American College of Physicians. Reduce your facility's energy use (operations). Accessed June 12, 2021. https://www.acponline.org/system/files/documents/advocacy/advocacy_in_action/climate_change_toolkit/energy_management.pdf
10. Centers for Disease Control and Prevention. Solomon CG, LaRocque RC. Climate change – a health emergency. *N Engl J Med*. 2019;380(3):209-211. https://doi.org/10.1056/NEJMp1817067
11. National Center for Environmental Health. Environmental health topics. Accessed June 12, 2021. https://www.cdc.gov/nceh/
12. Ghazali DA, Guericolas M, Thys F, Sarasin F, Arcos González P, Casalino E. Climate change impacts on disaster and emergency medicine focusing on mitigation disruptive effects: an international perspective. *Int J Environ Res Health*. 2018;15(7):1379. https://doi.org/10.3390/ijerph15071379
13. Khan MD, Thi-Vu HH, Lai QT, Ahn JW. Aggravation of human diseases and climate change nexus. *Int J Environ Res Public Health*. 2019;16(15):2799. https://doi.org/10.3390/ijerph16152799
14. Ruszkiewicz JA, Tinkov AA, Skalny AV, et al. Brain diseases in changing climate. *Environ Res*. 2019;177: 108637. https://doi.org/10.1016/j.envres.2019.108637
15. The National Academies of Sciences, Engineering, Medicine. *Climate change. Evidence and causes: update 2020*. The National Academies Press; 2020. https://www.nap.edu/catalog/25733/climate-change-evidence-and-causes-update-2020
16. U.S. Climate Resilience Toolkit. Sustainable and climate-resilient health care facilities toolkit. Updated July 16, 2018. Accessed June 12, 2021. https://toolkit.climate.gov/tool/sustainable-and-climate-resilient-health-care-facilities-toolkit
17. American Society of Landscape Architects. Improving water efficiency: residential bioswales and bioretention ponds. Accessed June 12, 2021. https://www.asla.org/bioswales.aspx
18. European Environmental Agency. Soil, land, and climate change. Published September 30, 2019. Accessed June 12, 2021. https://www.eea.europa.eu/signals/signals-2019-content-list/articles/soil-land-and-climate-change#:~:text=Climate%20change%20affects%20soil&text=Continuing%20declines%20in%20soil%20moisture,dramatic%20impacts%20on%20food%20production
19. Food and Agriculture Organization of the United Nations. Water scarcity – one of the greatest challenges of our time. Published March 20, 2019. Accessed June 12, 2021. http://www.fao.org/fao-stories/article/en/c/1185405/
20. Health Care Without Harm. Climate change, health, and health care: how physicians can help. Accessed June 12, 2021. https://noharm-uscanada.org/sites/default/files/Climate.Physician.Network.pdf
21. World Health Organization. Climate change: land degradation and desertification. Published October 26, 2020. Accessed June 12, 2021. https://www.who.int/globalchange/ecosystems/desert/en/
22. Castner J, Amiri A, Rodriguez J, et al. Advancing the symptom science model with environmental health. *Public Health Nurs*. 2019;36(5):716-725. https://doi.org/10.1111/phn.12641
23. Office of Disease Prevention and Health Promotion. Neighborhood and built environment. Accessed June 12, 2021. https://health.gov/healthypeople/objectives-and-data/browse-objectives/neighborhood-and-built-.
24. American Medical Association. Global climate change and human health H-1:35.938. Updated 2019. Accessed June 12, 2021. https://policysearch.ama-assn.org/policyfinder/detail/climate%20change?uri=%2FAMADoc%2FHOD.xml-0-309.xml
25. Gamble JL, Balbus J, Berger M, et al. Populations of concern. *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. U.S. Global Change Research Program; 2016:247-286. https://health2016.globalchange.gov/high/ClimateHealth2016_09_Populations.pdf
26. Haines A, Ebi K. The imperative for climate action to protect health. *N Engl J Med*. 2019;380(3):263-273. https://doi.org/10.1056/NEJMra1807873
27. Castner J, Polivka BJ. Nursing practice and particulate matter exposure. *Am J Nurs*. 2018;118(8):52-56. https://doi.org/10.1097/01.NAJ.0000544166.59939.5f
28. Climate change and human health – risks and responses. *Summary*. World Health Organization. Published 2003. Accessed June 12, 2021. https://www.who.int/globalchange/summary/en/index9.html
29. Bekkar B, Pacheco S, Basu R, DeNicola N. Association of air pollution and heat exposure with preterm birth, low birth weight, and stillbirth in the US: a systematic review. *JAMA Netw Open*. 2020;3:(6) e208243. https://doi.org/10.1001/jamanetworkopen.2020.8243
30. Szyszkowicz M, Kousha T, Castner J, Dales R. Air pollution and emergency department visits for respiratory diseases: a multi-city case crossover study. *Environ Res*. 2018;163:263-269. https://doi.org/10.1016/j.envres.2018.01.043
31. Holden E. Climate change is having widespread health impacts. Scientific American. Published September 16, 2019. Accessed June 12, 2021. https://www.scientificamerican.com/article/climate-change-is-having-widespread-health-impacts/

32. The Medical Society Consortium on Climate & Health. International Federation of Gynecology and Obstetrics: Statement on the Climate Crisis and Health. Published April 18, 2020. Accessed June 12, 2021. https://medsocietiesforclimatehealth.org/medical-society-policy-statements/international-federation-gynecology-obstetrics-statement-climate-crisis-health/
33. Pachauri RK, Resinger A. *Climate change 2007: synthesis report. Contribution of working groups I, II and III to the fourth assessment report of the Intergovernmental Panel on Climate Change*. Intergovernmental Panel on Climate Change; 2007. Accessed June 12, 2021. http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html
34. American Public Health Association. APHA's climate change and health needs assessment: Fall 2017-Winter 2018. Accessed June 12, 2021. https://www.apha.org/-/media/files/pdf/topics/climate/needs_assessment.ashx?la=en&hash=029B821EF6EB26E013F877887ACF2FDA8E2D6E6A
35. Climate Institute. Deforestation and climate change. Published April 18, 2017. Accessed June 12, 2021. http://climate.org/deforestation-and-climate-change/
36. Fossil fuels. Environmental and Energy Study Institute (n.d.). Accessed June 12, 2021. https://www.eesi.org/topics/fossil-fuels/description
37. United States Environmental Protection Agency. Greenhouse gas emissions: sources of greenhouse gas emissions. Updated April 14, 2021. Accessed June 12, 2021. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions
38. National Aeronautics and Space Administration. The causes of climate change. Published June 10, 2021. Accessed June 12, 2021. https://climate.nasa.gov/causes/
39. Nunez C. Climate 101: deforestation. National Geographic. Published February 7, 2019. Accessed June 12, 2021. https://www.nationalgeographic.com/environment/global-warming/deforestation
40. Tong S, Ebi K. Preventing and mitigating health risks of climate change. *Environ Res*. 2019;174:9-13. https://doi.org/10.1016/j.envres.2019.04.012
41. Wolff N, Masuda Y, Meijaard E, Wells JA, Game ET. Impacts of tropical deforestation on local temperature and human well-being perceptions. *Glob Environ Change*. 2018;52:181-189. http://doi.org/10.1016/j.gloenvcha.2018.07.004
42. Wood N, Roelich K. Tensions, capabilities, and justice in climate change mitigation of fossil fuels. *Energy Res Soc Sci*. 2019;52:114-122. https://doi.org/10.1016/j.erss.2019.02.014
43. Gasparrini A, Guo Y, Hashizume M, et al. Mortality risk attributable to high and low ambient temperature: a multicountry observational study. *Lancet*. 2015;386(9991):369-375. https://doi.org/10.1016/s0140-6736(14)62114-0
44. Kang SH, Oh IY, Heo J, et al. Heat, heat waves, and out -of-hospital cardiac arrest. *Int J Cardiol*. 2016;221:232-237. https://doi.org/10.1016/j.ijcard.2016.07.071
45. Balmain BN, Sabapathy S, Louis M, Morris NR. Aging and thermoregulatory control: the clinical implications of exercising under heat stress in older individuals. *Biomed Res Int*. 2018;2018: 8306154. https://doi.org/10.1155/2018/8306154
46. Kenney Craighead DH, Alexander LM. Heat waves, aging, and human cardiovascular health. *Med Sci Sports Exer*. 2014;46(10):1891-1899. https://doi.org/10.1249/FMSS.0000000000000325
47. Lindsey R. Climate change: global sea level. Updated January 25, 2021. Accessed June 12, 2021. https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level
48. Ban J, Shi W, Cui L, et al. Health -risk perception and its mediating effect on protective behavioral adaption to heat waves. *Environ Res*. 2019;172:27-33. https://doi.org/10.1016/j.envres.2019.01.006
49. Oxfam. A climate in crisis. Published April 27, 2017. Accessed June 12, 2021. https://www-cdn.oxfam.org/s3fs-public/mb-climate-crisis-east-africa-drought-270417-en.pdf
50. FitzGerald G, Toloo GS, Baniahmadi S, Crompton D, Tong S. Long -term consequences of flooding: a case study of the 2011 Queensland floods. *Aust J Emerg Manag*. 2019;34(1):35-40. https://search.informit.org/doi/10.3316/agispt.20190304007305
51. Vanasse A, Cohen A, Courteau J, et al. Association between floods and acute cardiovascular diseases: a population-based cohort study using a Geographic Information System approach. *Int J Environ Res Public Health*. 2016;13(2):168. https://doi.org/10.3390/ijerph13020168
52. Wright LD, D'Elia CF, Nichols CR. Impacts of coastal waters and flooding on human health. In: Wright LD, Nichols CR, eds. *Tomorrow's Coasts: Complex and Impermanent*. Springer; 2019:151-166.
53. Yadav R, Somashekar D, Sodha SV, Laserson KF, Venkatesh S, Chauhan H. Post-flood rapid needs assessment in Srinagar City, Jammu and Kashmir State, India, September, 2014. *Disaster Med Public Health Prep*. 2019;13(2):133-137. https://doi.org/10.1017/dmp.2018.21
54. Center for Climate and Energy Solutions (n.d.). Hurricanes and climate change. Accessed June 12, 2021. https://www.c2es.org/content/hurricanes-and-climate-change/
55. Congressional Research Service. Wildfire statistics. Updated May 4, 2021. Accessed June 12, 2021. https://fas.org/sgp/crs/misc/IF10244.pdf
56. Centers for Disease Control and Prevention. Climate and health: wildfires. Accessed June 12, 2021. https://www.cdc.gov/climateandhealth/effects/wildfires.htm
57. Lorelei de Jesus A, Thompson H, Knibbs LD, et al. Long term trends in $PM_{2.5}$ mass and particle number concentrations in urban air: the impacts of mitigation measures and extreme events due to changing climates. *Environ Pollut*. 2020;263:(Part A) 114500. https://doi.org/10.1016/j.envpol.2020.114500
58. United States Environmental Protection Agency. Wild-land fire research: health effects research. Updated April 16, 2021. Accessed June 12, 2021. https://www.epa.gov/air-research/wildland-fire-research-health-effects-research
59. Centers for Disease Control and Prevention. Sustainability. Accessed June 12, 2021. https://www.cdc.gov/sustainability/index.htm
60. Healthcare Environmental Resource. Pharmaceuticals: hazard waste. Accessed June 12, 2021. https://www.hercenter.org/hazmat/pharma.php
61. United States Environmental Protection Agency. Green engineering. Published February 14, 2017. Accessed June 12, 2021. https://www.epa.gov/green-engineering
62. United States Department of Energy (n.d.). Federal energy management program. Office of Energy Efficiency & Renewable Energy. Accessed June 12, 2021. http://energy.gov/eere/femp/federal-energy-management-program
63. Celis-Morales CA, Lyall DM, Welsh P, et al. Association between active commuting and incident cardiovascular disease, cancer, and mortality:

prospective cohort study. *BMJ*. 2017;357:j1456. https://doi.org/10.1136/bmj.j1456
64. Hussain M, Butt AR, Uzma F, et al. A comprehensive review of climate change impacts, adaptation, and mitigation on environmental and natural calamities in Pakistan. *Environ Monit Assess*. 2019;192(1):48. https://doi.org/10.1007/s10661-019-7956-4
65. The White House. Office of the Press Secretary. Executive order–planning for federal sustainability in the next decade. Published March 19, 2015. Accessed June 12, 2021. https://obamawhitehouse.archives.gov/the-press-office/2015/03/19/executive-order-planning-federal-sustainability-next-decade
66. United States Environmental Protection Agency. Sustainable materials management (SMM). Updated June 1, 2021. Accessed June 12, 2021. https://www.epa.gov/smm
67. World Health Organization (n.d.). Operational framework for building climate-resilient health systems. Accessed June 12, 2021. https://www.who.int/globalchange/publications/building-climate-resilient-health-systems/en/
68. United States Environmental Protection Agency. Sustainable water infrastructure. Updated June 10, 2021. Accessed June 12, 2021. https://www.epa.gov/sustainable-water-infrastructure/water-efficiency-water-suppliers
69. United States Environmental Protection Agency. Cleaning up electronic waste (E- waste). Updated June 10, 2021. Accessed June 12, 2021. https://www.epa.gov/international-cooperation/cleaning-electronic-waste-e-waste
70. The Joint Commission. Regulated waste – OSHA definition 2020 [FAQ entry]. Published March 19, 2020. Accessed June 12, 2021. https://www.jointcommission.org/en/standards/standard-faqs/hospital-and-hospital-clinics/environment-of-care-ec/000001237/
71. American College of Emergency Physicians. Impact of climate change on public health and implications for emergency medicine. Published June 2018. Accessed June 12, 2021. https://www.acep.org/patient-care/policy-statements/impact-of-climate-change-on-public-health-and-implications-for-emergency-medicine/
72. U.S. Department of Health and Human Services. HHS Sustainable and Climate Resilient health care facility Initiative. Accessed June 12, 2021. https://toolkit.climate.gov/sites/default/files/SCRHCFI%20Checklist%20Composite_Form.pdf
73. United States Environmental Protection Agency. Sustainable management of food (n.d.). Updated May 22, 2021. Accessed June 12, 2021. https://www.epa.gov/sustainable-management-food
74. Alnahas F, Yeboah P, Fliedel L, Abdin AY, Alhareth K. Expired medication: societal, regulatory and ethical aspects of a wasted opportunity. *Int J Environ Res Public Health*. 2020;17(3):787. https://doi.org/10.3390/ijerph17030787
75. National Conference of State Legislatures. State prescription drug return, reuse and recycling laws. Published August 4, 2020. Accessed June 12, 2021. https://www.ncsl.org/research/health/state-prescription-drug-return-reuse-and-recycling.aspx
76. Chan EY. Climate change is the world's greatest threat – in celsius or fahrenheit? *J Environ Psychol*. 2018;60:21-26. https://doi.org/10.1016/j.jenvp.2018.09.002

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How to cite this article:

Kolbuk ME, Gillespie GL, Hilderbrand L, Stone EL; ENA Position Statement Committee. Position statement: mitigating the effects of climate change on health and health care: the role of the emergency nurse, *J Emerg Nurs* 2021;47(4):621–626. https://doi.org/10.1016/j.jen.2021.05.004

Emergency Nurses' Guide to Neonatal Lumbar Punctures

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Abstract

A neonatal lumbar puncture can present many challenges for emergency nurses that may not be seen with older children or adults. It is imperative that emergency nurses have the knowledge and training related to the procedure to ensure a positive process for the neonate, involved family and health care team members, as well as the overall outcomes of the procedure. This paper provides a practical guide to the essential knowledge for a neonatal lumbar puncture in the emergency department. The main points conveyed in this paper include considerations such as indications for a neonatal lumbar puncture, how to prepare for the procedure, how to position the neonate, possible complications, and caregiver support.

Key words: Emergency nurse; Emergency department; Neonate; Lumbar puncture; Fever; Caregiver

Introduction

A lumbar puncture (LP) is an invasive procedure of the lumbar spine for diagnostic or therapeutic purposes. Owing to the high risk for sepsis in the neonatal period, LPs are commonly performed when neonates present with signs or symptoms of possible infection.[1] Approximately 321 000 neonates per year are seen in emergency departments.[2] Fever accounts for 92% of all neonatal ED visits.[3] A neonatal LP can present many challenges for emergency nurses that may not be seen with older children or adults. Because of this, it is important for emergency nurses to have knowledge and skills of the procedure for an LP, its indications, procedure preparation, neonate positioning, potential complications, and how to support the parents or caregiver.

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J Emerg Nurs 2021;47:627-632.
Available online 11 March 2021
0099-1767

https://doi.org/10.1016/j.jen.2020.12.004

Indications

There is a wide range of reasons for why a neonate may need an LP. The most common reason for the procedure is fever.[4] Owing to neonates' underdeveloped immune system, they are at higher risk for infection and sepsis; thus, fevers must be treated seriously.[5] Other LP indications include seizure activity, vomiting, irritability, jaundice, or bulging fontanel.[6] The purpose of an LP in a neonate is to evaluate the cerebrospinal fluid (CSF) for meningitis. Meningitis in neonates is linked to a high risk of mortality and morbidity, as well as long-term complications, including neurologic deficits and cerebral palsy.[6] If the CSF shows increased inflammatory cells, increased protein level, or low glucose level, it could be indicative of meningitis.[7] The CSF should also be cultured to look for the growth of any organisms that may indicate a bacterial infection.[8] The culture results will determine the type of infection.

Preparing for the Procedure

The preparation for an LP procedure for a neonate requires numerous supplies. Most facilities have prepackaged LP trays with the necessary equipment for a medical provider to perform the procedure. In general, the items include the following: a spinal needle, 5 mL and 10 mL syringes,

4 sterile specimen tubes, gauze pads, betadine swab sticks, lidocaine, fenestrated drape, towel, and bandage. LPs are considered sterile procedures; therefore, appropriate personal protective equipment (PPE) is required for each person in the room. Emergency nurses should follow the institutional policy and procedure for the use of appropriate PPE. The PPE includes a sterile gown, gloves, and mask. In addition, appropriate-size sterile gloves and additional needles are important to have at the bedside in case the first attempt is unsuccessful. To minimize the risk of infection during the procedure, ensure that the site is free from cellulitis before performing the LP. An LP through an area of cellulitis can cause meningitis.[7] The emergency nurse or the holder at the bedside should ensure that the medical provider is maintaining a sterile technique during the entire procedure. The emergency nurse should also require all staff members involved in the procedure to wear appropriate PPE to help keep the site sterile. As required by the Joint Commission, a preprocedure time-out should be taken to reduce the risk of performing a procedure on the wrong patient or at the wrong location. The preprocedure time-out should include all members of the team present for the procedure, and these team members should agree on the patient identity, the correct procedure site, and the procedure being completed.[9]

The procedure can cause discomfort; therefore, it is helpful to have sucrose water at the bedside. The methods of delivering sucrose water are to give the neonate a pacifier dipped in the sucrose water or give small amounts through an oral syringe. When using an oral syringe, the typical effective dosing ranges from 0.1 mL to 2 mL.[10] Sucrose water decreases the neonate's perception of pain by activating an opioid response.[11] Other types of analgesia that may be used include topical lidocaine, jet-injected lidocaine, locally injected 1% lidocaine, or intranasal fentaNYL.[12]

Monitoring is essential during an LP to ensure that the neonate does not have any unexpected, acute changes in vital signs. Proper monitoring and continuous airway assessment by a nurse or respiratory therapist are crucial during the procedure in case of respiratory arrest or respiratory failure owing to positioning during the procedure.[7] Vital sign changes that may be seen include bradypnea or apnea, bradycardia, and oxygen desaturation.[13] Continuous cardiopulmonary and oxygen saturation monitoring should be incorporated during all LP procedures. The emergency nurse should ensure that neonate resuscitative oxygen supplies such as a nonrebreather and bag-valve mask, suction, and emergency medications are readily available if needed.

The number of attempts should be limited to decrease the risk of infection and pain.[14] The emergency nurse can increase the probability of a successful procedure with limited attempts by keeping the neonate comfortable during the procedure, maintaining the neonate's correct position, and confirming the correct needle size. Emergency nurses and trained health care providers must act as patient advocates and limit the number of attempts for the neonate.

Caregiver Support

An LP can be extremely stressful for a parent or caregiver of a neonate. The emergency nurse should make every attempt to ease caregiver concerns during the entire ED visit. Providing education is one of the most important roles of the emergency nurse regarding the neonate's family. Caregivers often feel more reassured and remain calmer with information given to them regarding the process and reasoning behind the procedure for an LP.[7] The provider obtains consent for the procedure; however, emergency nurses may begin providing education as soon as they are aware that an LP will be performed. One opportunity for the nurse to provide parental education is while setting up for the procedure. When having these difficult conversations, it is important for the emergency nurse to be empathetic, exhibit open communication, and remember that family-centered care is the basis for pediatric care.[15] The parent or caregiver should be given the opportunity to ask questions, and information should be reiterated regarding the process of the LP and what to expect postprocedure.

Emergency nurses must remember that caregivers of neonates may have increased anxiety in general.[16] The emergency nurse or emergency staff should provide breastfeeding mothers with appropriate equipment for pumping, as well as privacy, if the neonate is unable to feed. For family and neonate comfort, the emergency nurse should assess if the families have the necessary supplies to care for the neonate while they wait, such as diapers, wipes, formula, bottles, or a pacifier. Emergency nurses should support the entire family to make them feel more comfortable with the LP process.

Caregiver presence during an LP varies by institution. Some institutions do not allow caregivers to be present owing to the risk of contamination to the sterile field. Caregivers may wait in a parent room or the ED lobby, depending on the institution. If caregivers are asked to leave, emergency nurses should carefully explain the rationale for having them out of the room during the procedure, specifically the risk of infection. Increased stress may occur owing to the separation; therefore, emergency nurses should assess and offer additional support from the social work, pastoral care, or other support staff. The emergency nurse should provide the family reassurance that the neonate will not

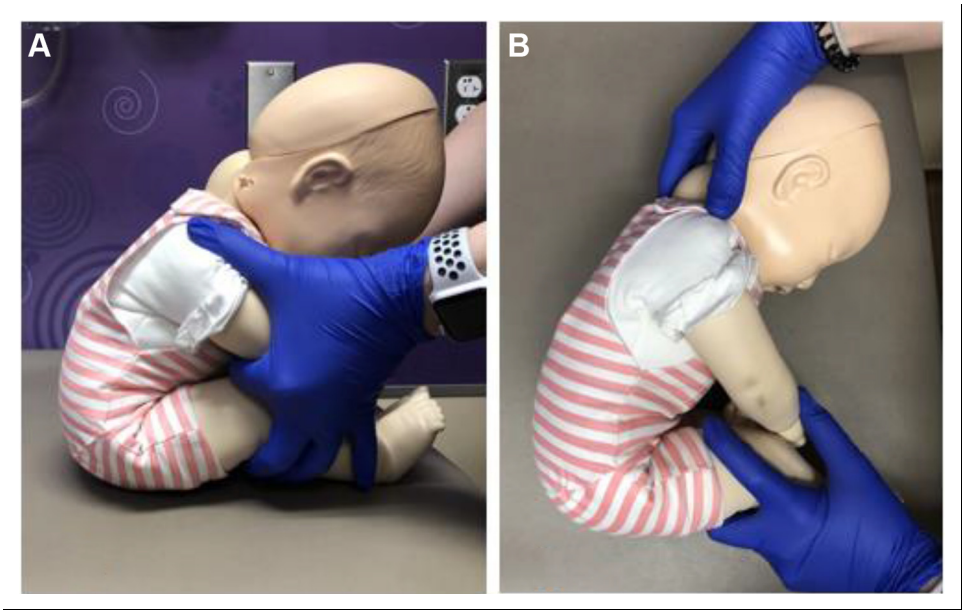

FIGURE 1

A. Sitting position. B. Side-lying or lateral position. Mannequin pictured here. Clothing would be removed in actual patient.

be alone and that the caregiver can come back to the room immediately after the procedure.

After the procedure, the emergency nurse should provide the caregiver with information about how the neonate coped during the procedure. The emergency nurse should provide all necessary education to the caregiver, including the necessity of having the neonate remain lying on the back for at least an hour if possible, the signs and symptoms to watch for, and when to notify a member of the care team. Parents or caregivers should notify a member of the health care team immediately if the infant develops redness, drainage, or swelling at the site, or presents with persistent irritability.

Neonate Positioning

Correct positioning is an essential component of an LP. Only trained emergency nurses and other health care professionals should be permitted to hold the neonate during an LP to prevent respiratory compromise. Parents should not be permitted to hold the neonate during the LP. Emergency nurses may place neonates in 1 of the 2 recommended positions during an LP (Figure 1). The purpose of positioning is to facilitate easier entry to the subarachnoid space and enable access to the CSF. The choice of positioning is determined by the provider. One possible position is the "sitting position." In the "sitting position," the neonate is placed in a seated position with their back facing the provider. Facing the neonate, the holder positions the neonate so that the neonate's head and legs are tucked inward toward the abdomen to give the neonate's back a rounded appearance. The hips must be aligned for the provider to find the appropriate landmarks. These landmarks are found by the provider using an imaginary line, called the intercristal line (Figure 2), that joins the superior and posterior aspects of the right and left iliac crests.[17] By palpating these landmarks, the provider can then find an intervertebral space above or below the point where the needle will be inserted.[17]

A second possible position is the side-lying or lateral position. In this position, the neonate lies on their side with the back facing the provider performing the procedure. The holder faces the neonate and maintains proper positioning. Just as in the "sitting position," the holder should tuck the neonate's head and legs inward toward the abdomen to give the neonate's back a rounded appearance. The hips should again be aligned correctly.

Maintaining a patent airway is an important consideration during all LP procedures. Each position used during an LP, if done incorrectly, can cause respiratory failure or respiratory arrest. Neonates have lower respiratory reserve than an older infant or child and weaker diaphragmatic muscles; therefore, it is essential that a trained health care provider such as an emergency nurse or respiratory therapist provides constant monitoring of the neonate.[13] The provider should be prepared to intervene when there is an acute change in respiratory status. Neonates may also cry and

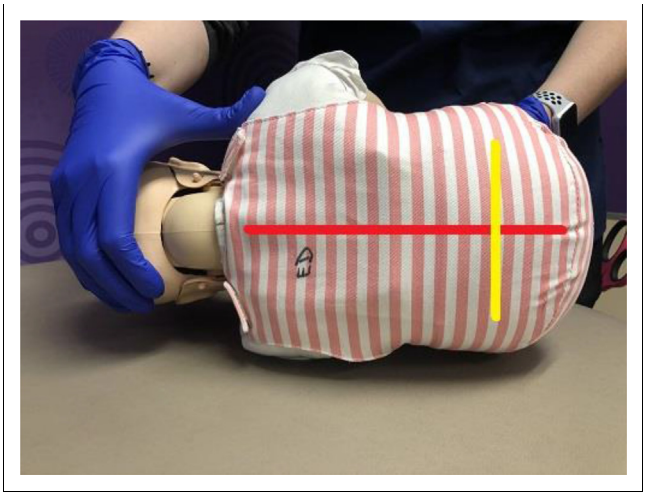

FIGURE 2

The left lateral position. The yellow line represents the intercristal line. The red line represents the spinal cord. Mannequin pictured here. Clothing would be removed in actual patient.

move during the procedure; therefore, a trained health care provider should hold the neonate to maintain the correct position. Often, an unsuccessful LP is due to the neonate's movement or improper positioning.[18]

Potential Procedural Complications

Anticipated and unanticipated complications may occur during the procedure. Some postprocedure complications are more difficult to assess in a neonate. Astute nursing assessment is critical in the identification of postprocedural complications. Because of the many potential procedural and postprocedural complications, it is important to frequently assess vital signs and maintain cardiorespiratory and oxygen saturation monitoring during and after the procedure. Assessment of the procedure site should also be done frequently to watch for signs of bleeding or infection.

PAIN

One of the most common complications is pain. Pain and discomfort are expected complications during and after LPs and should be assessed accordingly. One example of an appropriate pain scale to use in the neonatal population is the Neonatal Infant Pain Scale. It can be used to assess procedural pain in premature or full-term neonates.[19] Pain-reducing interventions should be used before, during, and after the procedure to ensure that pain is controlled. As previously mentioned, neonates may be given sucrose water as a nonpharmacologic pain intervention during the procedure. Other types of analgesia may be used, as discussed. Systemic pain control or general anesthesia is rarely used for pain control in this patient population.

Although unable to verbally communicate pain, neonates can display symptoms that alert the nurse to pain. Irritability and tachycardia are common symptoms of pain in neonates. Pain may be associated with a postprocedural headache. Therefore, neonates should remain lying flat for approximately 1 hour postprocedure. The caregiver can hold the neonate postprocedure but should be encouraged to keep the neonate's head level with the heart. The emergency nurse should be diligent in assessing for, and notifying the provider of, increased irritability, abnormal vital signs, or any sudden onset symptom or acute change in condition that may indicate pain and other complications.

INFECTION

Preventing infection at the procedure site is important because infection can lead to serious complications. Assessment of the procedure site should be done frequently to watch for signs of bleeding or infection. Specific signs of infection at the procedure site include redness or swelling of the site or purulent drainage. Other possible signs of infection include pain, lethargy, and any alteration in the neonate's neurologic status. Although neonates who have an LP are not typically discharged to home from the emergency department, the signs of infection to watch for are among important home-going instructions to give caregivers at discharge from the hospital.

SPINAL HEMATOMA/ABSCESS

An uncommon complication, but one that the nurse should be cognizant of, is a spinal hematoma or spinal abscess. Signs and symptoms of a spinal hematoma/abscess include sensory deficits or paralysis.[7] These take hours to days to develop postprocedure and are more likely to develop if there are multiple attempts during the procedure. To avoid missing this complication, the emergency nurse should communicate to the admitting nurse that an LP was performed and the number of attempts that were necessary. A spinal hematoma is more likely if the LP was difficult and produced bloody CSF;[7] therefore, this information should be conveyed to the inpatient nurse. Although spinal hematomas are a possibility, there are limited reports of this occurring in neonates.[6] The emergency nurse should also educate the neonate's caregivers about the potential for this complication and provide them with information about the signs and symptoms to watch for at home.

Implications for Emergency Nurses

An emergency nurse must be proficient in the process of an LP procedure for a neonate owing to the high risk of airway compromise and the anxiety a caregiver may have owing to the procedure. Although the LP procedure itself is similar at different facilities, each agency should have a policy and procedure regarding emergency nurse competency to assist with a neonatal LP. The emergency nurse should follow best practice but also use their own institutional policy and procedure for detailed guidance. A helpful resource that provides guidance on the process of an LP procedure is "Lumbar Puncture in the Neonate,"[20] available at the link in the reference list.

There are many actions that an emergency nurse should ensure happen before, during, and after the LP procedure. The emergency nurse should ensure that proper PPE is worn by all staff participating in the LP procedure. An adequately trained support person should be present for the caregiver of the neonate; they could be a child life specialist, if available, social worker, or pastoral care team member. Proper education must be provided to the neonate's caregiver preprocedure and at discharge. If the patient is being admitted, clear information must be conveyed to the neonate's inpatient nurse regarding potential complications.

Emergency nurses should also be aware of unique potential complications and the ways to prevent and treat them because prompt attention is vital to overall outcomes for neonates. First, emergency nurses must guarantee correct positioning of the neonate during the procedure. It is also imperative that the emergency nurse or respiratory therapist monitors the neonate's airway throughout the LP procedure. The emergency nurse should also be astute in recognizing pain during and after a neonatal LP to provide adequate pain management. The emergency nurse's role is critical to a successful and safe neonatal LP.

Conclusion

Neonates frequently present to the emergency department with fever or other symptoms that may require an LP. Without proper training and knowledge, an emergency nurse should not be assisting with the process of a neonatal LP. An emergency nurse should be competent in the essential correct positioning of a neonate during an LP owing to the major risk of airway compromise. Airway monitoring and treatment of airway complications should be of the highest priority for the emergency nurse. Ultimately, the emergency nurse's understanding and expertise during the LP will improve the procedure for the neonate, involved caregivers, and members of the health care team, as well as the overall outcomes of the procedure.

Author Disclosures

Conflicts of interest: none to report.

REFERENCES

1. Ershad M, Mostafa A, Dela Cruz M, Vearrier D. Neonatal sepsis. *Curr Emerg Hosp Med Rep*. 2019;7(3):83-90. https://doi.org/10.1007/s40138-019-00188-z
2. Lee HC, Bardach NS, Maselli JH, Gonzales R. Emergency department visits in the neonatal period in the United States. *Pediatr Emerg Care*. 2014;30(5):315-318. https://doi.org/10.1097/PEC.0000000000000120
3. Harrold J, Langevin M, Barrowman N, et al. Parental characteristics and perspectives pertaining to neonatal visits to the emergency department: a multicentre survey. *CMAJ Open*. 2018;6(3):E423-E429. https://doi.org/10.9778/cmajo.20180015
4. Scarfone R, Murray A, Gala P, Balamuth F. Lumbar puncture for all febrile infants 29-56 days old: a retrospective cohort reassessment study. *J Pediatr*. 2017;187:200-205.e1. https://doi.org/10.1016/j.jpeds.2017.04.003
5. Ali MA, Hammad A, Anwar HM. Accuracy of the hematological scoring system (HSS) for the diagnosis of neonatal sepsis in tertiary care hospital. *Prof Med J*. 2020;27(4):742-745. https://doi.org/10.29309/TPMJ/2020.27.04.3546
6. Aleem S, Greenberg R. When to include a lumbar puncture in the evaluation for neonatal sepsis. *Neoreviews*. 2019;20(3):e124-e134. https://doi.org/10.1542/neo.20-3-e124
7. Öncel S. Lumbar puncture of the newborn. In: Gabriel Cismaru, ed. *Beside Procedures*. Intech; January 1, 2018:Chapter 5. Accessed January 21, 2020. https://doi.org/10.5772/intechopen.70498
8. Leazer R, Erickson N, Paulson J, et al. Epidemiology of cerebrospinal fluid cultures and time to detection in term infants. *Pediatrics*. 2017;139(5):1-10. https://doi.org/10.1542/peds.2016-3268
9. The Joint Commission. 2020 national patient safety goals. Accessed October 25, 2020. https://www.jointcommission.org/standards/national-patient-safety-goals/-/media/c27cb0eca3154375a6da1ec2a7ed4c6f.ashx
10. Gao H, Gao H, Xu G, et al. Efficacy and safety of repeated oral sucrose for repeated procedure pain in neonates: a systematic review. *Int J Nurs Stud*. 2016;62:118-125. https://doi.org/10.1016/j.ijnurstu.2016.07.015
11. Boles J. Non-pharmacological strategies for addressing infant pain. *Pediatr Nurs*. 2017;43(2):98-100.
12. Balay EE, Hendrickson MA, Harvey B, Dewald J, Johnson B, Louie J. Optimizing analgesic use during infant lumbar puncture in the emergency department. *Pediatr Qual Saf*. 2020;5(2):e292. https://doi.org/10.1097/pq9.0000000000000292
13. Duru CO, Ederiane OE, Allen-Ameri D, Ibrahim ZF, Pondei K, Aliyu I. Does hypoxemia occur before, during or after lumbar puncture procedure in ill newborns? Our experience in a tertiary health center. *J Clin Neonatol*. 2017;6(3):173-178. https://doi.org/10.4103/jcn.JCN_23_17
14. Neal J, Kaplan S, Woodford A, Desai K, Zorc J, Chen A. The effect of bedside ultrasonographic skin marking on infant lumbar puncture

success: a randomized controlled trial. *Ann Emerg Med*. 2017;69(5):610-619. https://doi.org/10.1016/j.annemergmed.2016.09.014

15. Moe K, Skisland AV, Söderhamn U. Encountering parents of a sick newborn child. *Forskning*. 2017. Accessed August 1, 2020. https://sykepleien.no/sites/default/files/pdf-export/pdf-export-62625.pdf
16. Malak S, Crowley M, Mayes L, Rutherford H. Maternal anxiety and neural responses to infant faces. *J Affect Disord*. 2015;172:324-330. https://doi.org/10.1016/j.jad.2014.10.013
17. Baxter B, Evans J, Morris R, et al. Neonatal lumbar puncture: are clinical landmarks accurate? *Arch Dis Child Fetal Neonatal Ed*. 2016;101(5):F448-F450. https://doi.org/10.1136/archdischild-2015-308894
18. Procter C, Buys H, Carrara H, Thomas J. Risk factors for unsuccessful lumbar puncture in children. *S Afr Med J*. 2016;106(12):1230-1235. https://doi.org/10.7196/SAMJ.2017.v106i12.10703
19. Bomersbach A, Sochocka L. Assessment of the intensity of procedural pain in newborns treated in the intensive care unit measured by the Neonatal Infant Pain Scake (NIPS). *Prog in Health Sci*. 2018;8(2):33-39. https://doi.org/10.5604/01.3001.0012.8319
20. Gibbs L. RPA clinical practice guidelines: lumbar puncture in the neonate. Revised 2014. Accessed August 1, 2020. https://www.slhd.nsw.gov.au/RPA/neonatal%5Ccontent/pdf/Nursing%20Guidelines/Lumbar_puncture.pdf

Submissions to this column are encouraged and may be submitted at jenonline.org. Authors are encouraged to contact Section Editor Amber Adams, DNP, RN at bcamber19@gmail.com for presubmission guidance.

Emergency Nursing Review Questions: July 2021

Author: Sara Webb, MSN, C-PNP, CFNP, C-NPT, St Petersburg, FL
Section Editors: Carrie McCoy, PhD, MSPH, RN, CEN, and Sara Webb, MSN, C-PNP, CFNP, C-NPT

These review questions are based on the Emergency Nursing Core Curriculum and other resources pertinent to emergency nursing practice. They offer emergency nurses an opportunity to test their knowledge about their practice.

QUESTIONS

1. A patient presents to the emergency department with an anaphylactic reaction. Which factor puts them at an increased risk for severe, near-fatal, or fatal anaphylaxis?

A. Age below 65 years
B. Food as a trigger
C. Absence of urticaria
D. Diabetes

2. The most effective medication to treat anaphylaxis:

A. EPINEPHrine
B. H1 antihistamines
C. Steroids
D. H2 antihistamines

3. A patient returns to your emergency department after being treated for anaphylaxis 72 hours earlier. The initial reaction occurred 1 hour after taking an oral dose of Augmentin. They were adequately treated with steroids, EPINEPHrine, and antihistamines. Their symptoms resolved, and they were discharged home. They present to the emergency department today with complaints of a hoarse voice, urticaria, and tongue-swelling that began 15 minutes before their arrival. They have not taken any medications since discharge. This patient is most likely experiencing:

A. Uniphasic anaphylaxis
B. Biphasic anaphylaxis
C. Protracted anaphylaxis
D. Viral illness

4. A 2-year-old presents to the emergency department with complaint of a barking cough, stridor at rest, and use of accessory muscles. They are interactive and alert. What medications do you anticipate this patient receiving?

A. Racemic EPINEPHrine through intravenous (IV) infusion and steroids through nebulizer
B. Racemic EPINEPHrine through nebulizer and steroids orally or through IV infusion/intramuscular (IM) injection
C. Albuterol through nebulizer and acetaminophen orally
D. Steroids orally or through IV infusion/IM injection and albuterol through nebulizer

5. Signs of cold shock in a pediatric patient include:

A. Wide pulse pressure
B. Increased urine output
C. Flushed skin
D. Weak peripheral pulses

ANSWERS

1. Correct answer: C

Absence of urticaria, delay in the use of EPINEPHrine, severity of reaction, biphasic reaction, age above 65 years, cardiovascular or pulmonary disease, medication as a trigger, and uncontrolled asthma are all factors that increase the risk for severe, near-fatal, or fatal anaphylaxis.[1]

2. Correct answer: A

EPINEPHrine is the most effective treatment for anaphylaxis. It is a nonselective agonist of all adrenergic receptors, which are present in every body system affected by anaphylaxis. H1 antihistamines, H2 antihistamines, and steroids are all components used to adequately treat anaphylaxis;

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J Emerg Nurs 2021;47:633–634.
Available online 19 May 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.03.008

however, EPINEPHrine remains the most effective treatment.[2]

3. Correct answer: B

Biphasic anaphylactic reactions are characterized by an initial reaction, followed by an asymptomatic period of 1 hour or more and then a subsequent return of symptoms without further exposure to antigen. Uniphasic anaphylactic reactions typically peak within hours after symptom onset and then either resolve spontaneously or after treatment. Protracted anaphylactic reactions last hours to days without clearly resolving completely. This is not the typical presentation of a viral illness.[3]

4. Correct answer: B

Moderate croup is characterized by barking cough, stridor at rest, chest retractions, and use of accessory muscles. Patient remains alert and interactive. Management includes keeping patient calm and administering nebulized racemic EPINEPHrine and steroids orally or through IV infusion/IM injection. They should be observed after treatment for a minimum of 4 hours to monitor for any rebound respiratory distress. Croup is almost always viral in origin and does not require antibiotics unless there are additional signs or symptoms of a concurrent bacterial infection.[4]

5. Correct answer: D

The signs of pediatric cold shock include tachycardia; tachypnea without increased effort; delayed capillary refill time (>3 seconds); weak peripheral pulses; narrow pulse pressure; decreased urine output; irritability; decreased level of consciousness; and cold, pale, mottled, diaphoretic skin. These signs may often be subtle and require getting a detailed history. The signs of warm shock include warm and flushed skin, brisk capillary refill, and bounding pulses.[4]

REFERENCES

1. Golden DBK. Anaphylaxis: recognizing risk and targeting treatment. *J Allergy Clin Immunol Pract*. 2017;5(5):1224-1226. https://doi.org/10.1016/j.jaip.2017.06.028
2. Shaker M, Wallace D, Golden DB, et al. Anaphylaxis-a 2020 practice parameter update, systematic review, and Grading Recommendations, Assessment, Development, and Evaluation (GRADE) analysis. *J Allergy Clin Immunol*. 2020;145(4):1082-1123. Accessed April 29, 2021. https://www.jacionline.org/
3. UptoDate. Biphasic and Protracted Anaphylaxis. Lieberman PL. Updated 2020. Accessed January 5, 2020. https://www.uptodate.com/contents/biphasic-and-protracted-anaphylaxis#H23.
4. Mehra B, Gupta S. Common pediatric medical emergencies in office practice. *Indian J Pediatr*. 2018;85(1):35-43. https://doi.org/10.1007/s12098-017-2370-9. Published correction appears in *Indian J Pediatr*. 2018;85(2):164. https://doi.org/10.1007/s12098-017-2483-1

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The Story of a Broken Heart: Takotsubo Cardiomyopathy

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CE Earn Up to 12.0 Hours. See page 675.

Abstract

Licensed independent practitioners in emergency clinical practice are tasked with differentiating acute cardiac presentations. Despite its similarity in clinical presentation to acute coronary syndrome, Takotsubo cardiomyopathy is a unique cardiac disorder characterized by a stress-induced ballooning of the myocardium. Also known as the broken heart syndrome, Takotsubo cardiomyopathy most frequently occurs after an overwhelming emotional or physical stressor. The subsequent impaired contractility of the heart places the patient at risk of complications, including acute heart failure, cardiogenic shock, thromboembolism, arrhythmias, and left ventricular outflow obstruction. Takotsubo cardiomyopathy is similar in presentation to other cardiac disorders; therefore, clinicians in emergency settings must be efficient and effective in their diagnosis of this disorder on the basis of its distinct criteria. The current article uses most recent evidence to describe the etiology, pathophysiology, diagnosis, and recommended treatment for Takotsubo cardiomyopathy to support licensed independent practitioners in emergency departments in improving patient outcomes and reducing morbidity.

Key words: Takotsubo cardiomyopathy; Heart failure; Myocarditis; Acute coronary syndrome

Introduction

Takotsubo cardiomyopathy (TTC) is a cardiac disorder characterized by an acute ballooning of the left ventricle during systole, resulting in impaired contraction.[1] Takotsubo, a Japanese term for an octopus trap, refers to the distinct shape of the left ventricle in patients with TTC, often seen on transthoracic-echocardiographic imaging.[1] Known as broken heart syndrome, TTC occurs as an acute state of heart failure in instances of extreme emotional or physical stress as a result of vascular, metabolic, and hormonal changes.[1-3] Triggers for TTC vary widely and are highly subjective, with precipitating experiences ranging from an argument or breakup to an aneurysm rupture or natural disaster.[4] Interestingly, positive emotional triggers may also precede TTC.[4] Although TTC clinical presentation is similar to that of acute coronary syndrome (ACS) or myocarditis,[5] TTC occurs in the absence of coronary artery occlusion or plaques.[6]

Licensed independent practitioners (LIPs), including nurse practitioners, physicians, and physician assistants, may face challenges in initially diagnosing TTC owing to its similarity to other cardiac presentations; therefore, an understanding of the distinct diagnostic criteria of TTC is essential in differentiating and appropriately managing the syndrome. A literature search of nursing-specific publications on TTC yielded very few results. Specifically, we identified a recent review conducted by Abozenah et al[7] as well as a case report presented by Cantey[8] that contribute to the gradually growing body of knowledge on TTC. The limited number of nursing publications reflects a critical gap in knowledge dissemination, specifically knowledge that targets advanced nursing practice and LIPs in emergency departments. The goal of this article is to discuss the pathophysiology of TTC and provide evidence-based guidance for its diagnosis

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J Emerg Nurs 2021;47:635-642.
Available online 12 March 2021
0099-1767

https://doi.org/10.1016/j.jen.2020.12.014

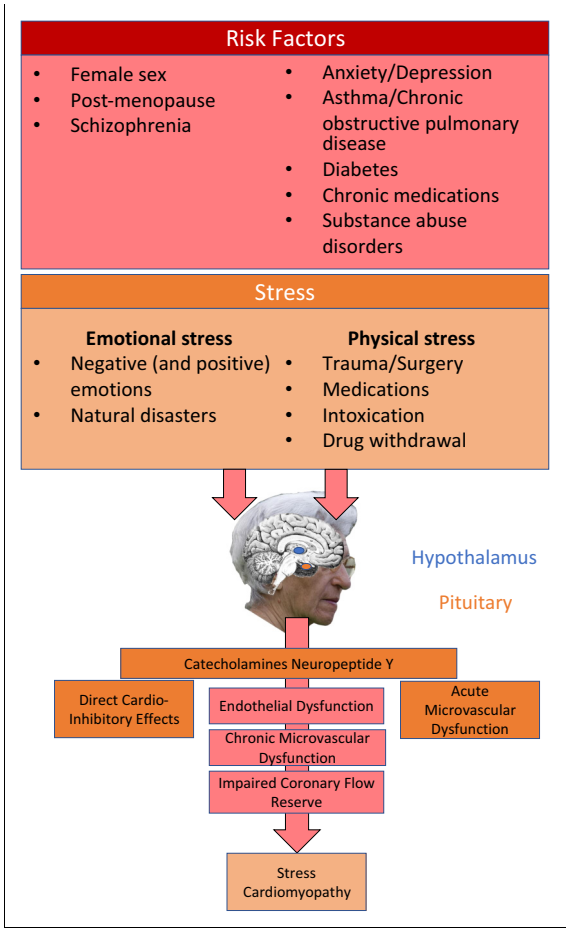

FIGURE 1
Broken heart syndrome: Takotsubo cardiomyopathy.

and management in emergency clinical practice. With adequate management of acute TTC, complications, including acute heart failure, cardiogenic shock, arrhythmias, left ventricular outflow tract obstruction (LVOTO), and thrombus formation, might be effectively avoided.[9]

Pathophysiology

ETIOLOGY, PREDISPOSING FACTORS, AND MECHANISM OF INJURY

Several theories have been developed in an effort to understand the etiology of TTC, although a single comprehensive understanding of the syndrome remains unclear. Theories have identified cardiotoxic surges of catecholamines and sympathetic stimulation as risk factors for the syndrome's acute onset (Figure 1). Acute cardiac impairment owing to microvascular dysfunction or vascular spasm has also been postulated as a probable cause of TTC.[1,4] Recent evidence has established that the mechanism of injury and pathogenesis of TTC, specifically the acute ballooning and impaired contraction of the left ventricle (Figure 2), are attributed to extensive monocyte-mediated myocardial inflammation, with a systemic inflammatory state persisting long after the acute development of TTC.[2]

Evidence from clinical practice guidelines emphasizes hormonal, genetic, neurologic, and psychiatric disorders as predisposing factors (Figure 1) for the development of TTC.[4] Patients with anxiety and/or depressive disorders are at an increased risk of developing TTC, as well as patients who have experienced stroke, subarachnoid hemorrhage, or seizure.[4] Owing to the influence of age-related hormonal estrogen changes, women who are postmenopausal experience the highest risk of developing TTC.[6] In fact, it is anticipated that more than 90% of the TTC cases are experienced by this cohort.[10]

LONG-TERM PROGNOSIS

TTC was once understood to resolve after the disorder's acute management;[2] however, recent evidence indicates that, contrarily, the long-term effects of TTC are clinically significant.[11] The systemic inflammatory response has been noted to persist for up to 5 months after the TTC onset,[2] resulting in cardiac congestion. In a recent systematic review measuring clinical outcomes in TTC, specifically in-hospital mortality, long-term mortality, and recurrence of TTC, Pelliccia et al determined that patients who had experienced TTC were at an increased risk of both in-hospital and long-term mortality and morbidity.[11] Increased risk of mortality was associated with older age, physical stressors, and atypical ballooning pattern. Although considered a relatively uncommon event, a recurrent episode of TTC occurred in approximately 1% of the evaluated patients,[11] indicating a need for effective follow-up care planning.

Diagnosis

Accurate diagnosis of TTC in clinical settings relies on the LIP's use of multiple diagnostic tools, including electrocardiogram (ECG), cardiac biomarkers, and coronary angiography to rule out coronary artery occlusion,[3,12] as well as ventriculography, echocardiography, and magnetic resonance imaging to visualize cardiac pathology.[6] Ultimately, noninvasive diagnostic testing cannot alone adequately identify TTC; therefore, invasive means are clinically required.[9] Findings from the international Takotsubo

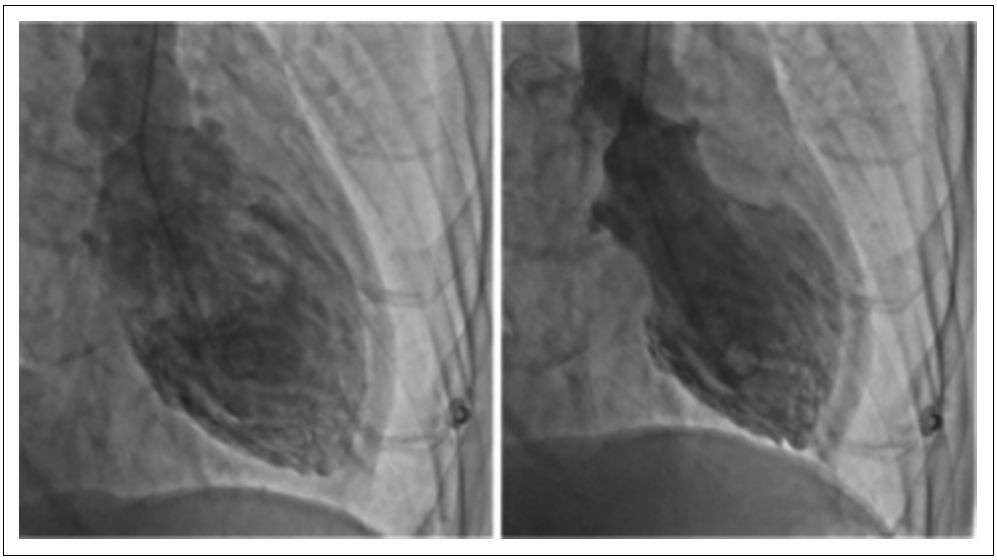

FIGURE 2

Echocardiographic picture of stress cardiomyopathy. (Reproduced with permission from Elsevier. Medina de Chazal H, Giuseppe Del Buono M, Keyser-Marcus L, et al. Stress cardiomyopathy diagnosis and treatment: JACC State-of-the-Art Review. *J Am Coll Cardiol.* 2018;72(16):1955-71.)

(InterTAK) registry suggest that the presumptive diagnosis of TTC begins with using the InterTAK scoring system (Table 1) to determine its pretest probability. The InterTAK Diagnostic Criteria were developed to create consensus in the differentiation and diagnosis of TTC in clinical settings.[4] It consists of 7 variables, with 5 of the variables assessing the patient's medical history and 2 variables assessing the patient's ECG. The total score from the tool is then translated into a probability of TTC (InterTAK diagnostic score).[13]

The acute presentation of TTC may lead clinicians to anticipate myocardial infarction or myocarditis. To guide

TABLE 1
InterTAK diagnostic score

Diagnostic criteria	Points
Female sex	25
Emotional stressor	24
Physical stressor	13
No evidence of ST depression on ECG	12
Psychiatric disorder	11
Neurologic disorder	9
Prolonged QTc interval	6
Diagnosis based on points accrued	
≥50 points Diagnose Takotsubo cardiomyopathy	≤31 points Diagnose acute coronary syndrome

InterTAK, international Takotsubo; ECG, electrocardiogram.

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TABLE 2
Differentiating cardiac dysfunction

Clinical presentation	Signs and symptoms	Diagnostic findings
TTC	• Chest pain, dyspnea, arrhythmias • Potential sudden cardiac death • May be preceded by emotional/physical stressor	ECG: • ST elevation, ST depression, QTc prolongation, and/or T-wave inversion Echocardiogram: • Hypokinesia or akinesia at apical, midventricular, basal, or focal sites Coronary angiography: • No evidence of obstructive CAD or plaque rupture
Myocardial infarction	• Chest pain, dyspnea, arrythmias • Potential sudden cardiac death	ECG: • ST elevation or depression; T-wave inversion Echocardiogram: • Regional wall motion abnormalities Coronary angiography: • Evidence of CAD with plaque rupture, thrombus, and coronary dissection
Myocarditis	• Chest pain, dyspnea, acute heart failure • Potential sudden cardiac death • May be preceded by upper respiratory tract infection or enteritis	ECG: • Nonspecific ST–T-wave changes Echocardiogram: • Global systolic abnormalities Coronary angiography: • No evidence of obstructive CAD or plaque rupture

Adapted from Medina de Chazal et al.[15]
ECG, electrocardiogram; CAD, coronary artery disease; TTC, Takotsubo cardiomyopathy.

LIPs in diagnosing TTC, Table 2 provides differentiating features of TTC in the context of clinical presentation, ECG findings, echocardiography, and coronary angiography.[12]

For a diagnosis of TTC to be confirmed, there must be evidence of short-term hypokinesis, akinesis, or dyskinesis present within the apex, midventricular, basal, or focal walls.[9] Although relatively uncommon, right ventricular wall motion abnormalities may be present. Although not an obligatory criterion, an emotional and/or physical stressor is anticipated as a precipitating factor. Evidence of newly developed ECG abnormalities, including ST elevation, ST depression, QTc prolongation, and/or T-wave inversion, as well as elevated troponin, creatine kinase–myocardial band, and B-type natriuretic peptide, may also be present. The absence of coronary artery disease or occlusive plaques differentiates TTC from myocardial infarction/ischemia, and this must be confirmed through angiogram before diagnosis. The cardiac biomarkers on admission in cases of TTC indicate an elevation of troponin equal to that of ACS and a slight increase in creatine kinase,[1,13] as well as a significant increase in B-type natriuretic peptide, indicating ventricular distension.[1,10] Finally, LIPs must rule

out underlying myocarditis or pheochromocytoma leading to LV dysfunction.[4]

Visible through echocardiography, the left ventricle will demonstrate wall motion abnormalities, most commonly at the apex.[9] The abundance of β-adrenergic receptors in the apical myocardium potentially increases its susceptibility to excessive catecholamine stimulation.[14] Therefore, apical rounding or ballooning (Figure 2) and reduced LV ejection fraction (LVEF) are common findings with echocardiography.[1] In patients with apical ballooning, transthoracic echocardiography will detect the presence or absence of LVOTO,[15] a condition that describes the obstruction of forward flow through the left ventricle, resulting in left ventricle hypertrophy secondary to increased afterload and, ultimately, left ventricle failure if left untreated.[16]

LIPs should consider assessing risk of thrombus formation as a critical aspect of their initial plan of care in the context of severe LV dysfunction and apical ballooning[17] because thrombus formation remains an adverse complication of TTC that poses a significant risk to the patient who is hemodynamically unstable.[6,9] Patients who present with apical ballooning and troponin I exceeding 10 ng/mL are at significantly higher risk of thrombus formation owing to akinesia, endothelial damage, and a hypercoagulable state in TTC.[18] LIPs should consider wall motion abnormalities, LVEF, and white blood cell count as critical aspects of their assessment of thrombus risk.[19]

Management

Because patients presenting with TTC will often experience chest pain, dyspnea, and ECG abnormalities that closely resemble ACS,[5] management of acute TTC will often involve ED protocols for ACS before the diagnostic confirmation of TTC.[6] Once a diagnosis of TTC is confirmed, interventions are recommended on the basis of the degree of the pathologic condition.[17] Standard care for the patient who is hemodynamically stable with TTC and who is understood to be at a relatively low risk of complications involves supportive care and telemetry monitoring for 48 hours.[14] For the patient who is hemodynamically unstable and who is considered at a higher risk of the aforementioned complications, more extensive measures are warranted with monitoring in specialized settings for >72 hours.[12,20] Treatment must be determined on a per-patient basis, with all pharmacologic interventions individualized on the basis of clinical presentation, hemodynamic status, and risk factors.[18]

HEMODYNAMIC STABILITY

As diagnostic results confirm TTC per the syndrome's distinct criteria with no evidence of complications, the LIP moves to supportive care[6,14] because a mild presentation of TTC is considered a self-limiting condition. The European Society of Cardiology recommends that a mild presentation of TTC, with no signs of heart failure (LVEF >45%) or complications, requires minimal or no treatment.[20]

HEMODYNAMIC INSTABILITY

Heart Failure

For patients presenting with acute heart failure resulting from TTC, characterized by a reduced LVEF of <45%,[20] the anticipated course of treatment involves the administration of diuretics and angiotensin-converting enzyme (ACE) inhibitors/angiotensin receptor blockers (ARBs) in the absence of LVOTO, as well as standard oxygenation and respiratory support for heart failure.[9] In a recent meta-regression analysis study, Brunnetti et al determined lower rates of recurrence of TTC among patients who were prescribed ACE or ARB therapy, whereas there was no significant difference for patients prescribed beta blockers.[21] In fact, Templin et al determined a significantly higher 1-year survival rate among patients with TTC who received ACE/ARB therapy.[22] A goal of treatment in heart failure is to prevent cardiac and pulmonary congestion; therefore, diuretic therapy may be indicated. Recent consensus from the European Society of Cardiology supports the use of furosemide in the acute phase of heart failure to prevent congestion by reducing preload and afterload.[23]

Arrhythmias

Patients presenting with TTC may experience an acute onset of arrhythmia, most commonly atrial fibrillation.[20] Patients with arrhythmias are considered at higher risk of mortality because a number of more life-threatening rhythms may develop, including atrial or ventricular tachyarrhythmias and ventricular fibrillation.[20] Once the diagnosis of TTC is confirmed and an arrhythmia is present during ECG monitoring, the recommended course of treatment is to initiate beta blockers. The LIP should consider adding low molecular weight heparin for patients with atrial fibrillation[20] owing to the rhythm's increased incidence of thrombus formation.[24]

Cardiogenic Shock

Recent evidence suggests that younger age (63± 14.9 years), male sex, low LVEF, apical ballooning, atrial fibrillation, and physical triggers are independent factors contributing to a higher risk of developing cardiogenic shock in TTC.[25] The patient presenting with cardiogenic shock and poor cardiac output requires standard treatment for shock, including fluid resuscitation to restore euvolemia.[9] In the absence of LVOTO, inotropic agents, specifically dopamine or dobutamine, may be used temporarily to improve systolic function.[7,14] If shock persists, the LIP should anticipate the transition of the patient to mechanical cardiac support in consultation with the most responsible health practitioner. After statistical analyses in a recent study (N = 2078), patients who underwent intra-aortic balloon pump, Impella ventricular support (Abiomed), and/or extracorporeal mechanical oxygenation (n = 39) had a significantly lower risk of in-hospital mortality compared with those who did not receive mechanical cardiac support.[25]

Thromboembolic Risk

On the basis of the LIP's assessment of the patient's risk of thrombus formation on the basis of the degree of akinesia as well as cardiac and inflammatory biomarkers, the administration of anticoagulation therapy may be indicated.[6,17] Patients experiencing TTC with higher degrees of akinesia through echocardiography as well as elevated troponin levels should be considered at an increased risk of developing a thromboembolism.[18] In a recent study from a multicenter international registry (n = 541), Santoro et al identified enoxaparin 1 mg/kg subcutaneously every 12 hours as an effective treatment for thrombus prevention in patients classified as at risk, specifically those with apical ballooning and troponin I exceeding 10 ng/mL. Warfarin and enoxaparin can be given together before discharge until a therapeutic value of international normalized ratio of 2.0 to 3.0 is reached.[18] On discharge, oral warfarin therapy as a single agent is recommended for a duration of 3 months to ensure long-term survival, with associated frequent monitoring of the international normalized ratio.[18]

LVOTO

As previously noted, a critical aspect of the LIP's care is determining the presence of LVOTO through transthoracic echocardiography.[14] Caution is advised in the administration of inotropic and/or vasodilating agents in patients experiencing LVOTO because these agents will likely worsen the obstruction by increasing hypercontractility and are widely contraindicated.[7,14] It is recommended to proceed with beta blockers in the cohort of patients with LVOTO,[6] specifically a short-acting beta blocker administered intravenously[20] because the medication may reduce the hypercontractile state and potentially clear the obstruction.[14] A recent case control study (n = 9) evaluated the efficacy and safety of esmolol, a short-acting selective beta-1 blocker, as an acute treatment for LVOTO in TTC.[26] It was determined that a continuous infusion of esmolol at a rate of 0.15 to 0.3 mg/kg/min for 24 hours, followed by 1.5 mg of bisoprolol orally, significantly and safely reduced the intraventricular gradient.[26]

Long-Term Management of Inflammation

Recent evidence has highlighted chronic persistence of inflammation and higher incidence of morbidity for many patients after the acute management of TTC[11] and has been attributed to persistent sympathetic dysfunction.[27] The LIP should consider the management of sustained sympathetic dysfunction and inflammation as an essential aspect of their care after an acute episode of TTC. In a recent double-blind randomized controlled trial (n = 48), Marfella et al evaluated the efficacy of α-lipoic acid (ALA) in improving adrenergic cardiac innervation as well as decreasing inflammation, oxidative stress, and myocardial damage among patients with TTC over a 12-month study period.[27] Of note, the treatment group receiving ALA achieved a statistically significant increase in LV uptake through myocardial scintigraphy compared with the placebo group. In addition, the treatment group experienced a significant reduction in inflammatory markers, namely plasma C-reactive protein, tumor necrosis factor–α, and nitrotyrosine. Considering the persistence of systemic inflammation after the acute management of TTC,[2] the LIP may choose to proceed with the prescribing of ALA as a means of managing potential long-term morbidity associated with TTC.[27]

Implications for Emergency Nurses

Emergency nurses are the first point of contact for patients seeking care through the emergency department; therefore, they have the responsibility of gathering clinical information that contributes to a broad clinical perspective and may lead to a differential diagnosis of TTC. A diagnosis of TTC

should remain a possibility for patients presenting with chest pain who are postmenopausal, female, have a confirmed psychiatric diagnosis, and/or have experienced a major stressor. An awareness of TTC's distinct clinical findings is essential for a timely diagnosis, and it is necessary that emergency nurses have access to educational materials inclusive of TTC's clinical findings and anticipated management. Collaboration among emergency nurses, clinical educators, and nursing managers is essential for effective training and education. In addition, support and financial allocation at an administrative level are necessary for continued research and education related to TTC.

Implications for Emergency Clinical Practice

Female sex and previous overwhelming stressor as well as psychiatric and/or neurologic disorders are predisposing factors that may lead clinicians to suspect a diagnosis of TTC in emergency settings when presenting with chest pain. TTC is similar to an acute myocardial infarction or myocarditis in its acute presentation; however, the LIP's prompt evaluation through ECG, echocardiography, and angiography will provide an accurate diagnosis. A timely differential diagnosis of TTC in the emergency department is imperative to ensure optimal patient outcomes. Patients presenting without complications require supportive care and telemetry monitoring for 48 hours. Patients presenting with, or those who develop, complications will require extensive measures and admission for >72 hours.

Managing complications: (1) acute heart failure warrants treatment with ACE inhibitors/ARBs and furosemide; (2) patients with atrial fibrillation require prophylactic low molecular weight heparin; (3) standard treatment protocol for cardiogenic shock should be observed, including fluid resuscitation and inotropes in the absence of LVOTO; (4) enoxaparin is effective in the acute management and prevention of a thromboembolism, followed by oral warfarin; (5) esmolol is effective in reducing pressure gradient among patients with acute LVOTO; (6) ALA may be effective in reducing serum inflammatory markers that remain elevated after the acute management of TTC.

Conclusion

TTC poses a unique challenge to clinicians owing to its ambiguous presentation and elusive etiology. The LIP must balance the necessity of prompt intervention in the context of an ACS presentation, with the required patience in awaiting diagnostic confirmation of TTC. Research continues to explore the intricacies and highly subjective nature of this syndrome, although impactful clinical guidance has supported practitioners with evidence-based comprehensive diagnostic criteria.[13,14] This article fills a very necessary gap in the literature and clinical awareness of TTC by targeting LIPs in emergency settings and offering evidence-based diagnostic criteria and treatment protocols. In the context of TTC, the LIP has the unique role of gathering the whole clinical picture, one in which emotional, physical, and mental well-being intersect to influence one's health status. With a comprehensive assessment of each individual patient's precipitating events and predisposing factors, as well as a thorough understanding of the diagnostic criteria, LIPs can feel supported in diagnosing and properly managing an acute episode of TTC. By applying evidence-based practice, the LIP can work efficiently and effectively, ultimately ensuring best patient outcomes.

Author Disclosures

Dr. El-Hussein, associate editor of the journal, had no role in the editorial review of or decision to publish this article.

REFERENCES

1. Ono R, Falcão LM. Takotsubo cardiomyopathy systematic review: pathophysiologic process, clinical presentation, and diagnostic approach to Takotsubo cardiomyopathy. *Int J Cardiol*. 2016;209:196-205. https://doi.org/10.1016/j.ijcard.2016.02.012
2. Scally C, Abbas H, Ahearn T, et al. Myocardial and systemic inflammation in acute stress-induced (Takotsubo) cardiomyopathy. *Circulation*. 2019;139(13):1581-1592. https://doi.org/10.1161/CIRCULATIONAHA.118.037975
3. Amin HZ, Amin LZ, Pradipta A. Takotsubo cardiomyopathy: a brief review. *J Med Life*. 2020;13(1):3-7. https://doi.org/10.25122/jml-2018-0067
4. Ghadri J-R, Wittstein IS, Prasad A, et al. International expert consensus document of Takotsubo syndrome (Part I): clinical characteristics, diagnostic criteria, and pathophysiology. *Eur Heart J*. 2018;39(22):2032-2046. https://doi.org/10.1093/eurheartj/ehy076
5. Christensen TE, Bang LE, Holmvang L, et al. I-MIBG scintigraphy in the subacute state of Takotsubo cardiomyopathy. *J Am Coll Cardiol Imaging*. 2016;9(8):982-990. https://doi.org/10.1016/j.jcmg.2016.01.028
6. Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol*. 2014;64(24):e139-e228. Published correction appears in *J Am Coll Cardiol* 2014;64(24):2713-2714. https://doi.org/10.1016/j.jacc.2014.09.017

7. Abozenah M, Kadado AJ, Aljamal A, et al. Concurring hypertrophic cardiomyopathy and Takotsubo cardiomyopathy: assessment and management. *Heart Lung*. 2020;00:1-12. https://doi.org/10.1016/j.hrtlng.2020.10.006
8. Cantey C. Takostubo syndrome: the great imposter. *Nurse Pract*. 2020;45(5):6-10. https://doi.org/10.1097/01.NPR.0000660372.50859.63
9. Sattar Y, Siew K, Connerney M, Ullah W, Alraies C. Management of Takotsubo syndrome: a comprehensive review. *Cureus*. 2020;12(1), e6556. https://doi.org/10.7759/cureus.6556
10. Madhavan M, Prascad A. Proposed Mayo Clinic criteria for the diagnosis of Tako-Tsubo cardiomyopathy and long-term prognosis. *Herz*. 2010;35(4):240-244. https://doi.org/10.1007/s00059-010-3339-x
11. Pelliccia F, Pasceri V, Patti G, et al. Long term prognosis and outcome predictors in Takotsubo syndrome: a systematic review and meta-regression study. *JACC Heart Fail*. 2019;7(2):143-154. https://doi.org/10.1016/j.jchf.2018.10.009
12. Bozkurt B, Colvin M, Cook J, et al. Current diagnostic and treatment strategies for specific dilated cardiomyopathies: a scientific statement from the American Heart Association. *Circulation*. 2016;134(23):e579-e646. Published correction appears in *Circulation* 2016;134(23):e652. https://doi.org/10.1161/CIR.0000000000000455
13. Ghadri JR, Cammann VL, Jurisic S, et al. A novel clinical score (InterTAK Diagnostic Score) to differentiate takotsubo syndrome from acute coronary syndrome: results from the International Takotsubo Registry. *Eur J Heart Fail*. 2017;19(8):1036-1042. https://doi.org/10.1002/ejhf.683
14. Lyon AR, Rees PSC, Prasad S, Poole-Wilson PA, Harding SE. Stress (Takotsubo) cardiomyopathy—a novel pathophysiological hypothesis to explain catecholamine-induced acute myocardial stunning. *Nat Clin Pr Cardiovasc Med*. 2008;5(1):22-29. https://doi.org/10.1038/ncpcardio1066
15. Medina de Chazal H, Giuseppe Del Buono M, Keyser-Marcus L, et al. Stress cardiomyopathy diagnosis and treatment: JACC state-of-the-art review. *J Am Coll Cardiol*. 2018;72(16):1955-1971. https://doi.org/10.1016/j.jacc.2018.07.072
16. Alboulhosn J, Child JS. Left ventricular outflow obstruction: subaortic stenosis, bicuspid aortic valve, supravalvular aortic stenosis, and coarctation of the aorta. *Circulation*. 2006;114(22):2414-2422. https://doi.org/10.1161/CIRCULATIONAHA.105.592089
17. Ghadri J-R, Wittstein IS, Prasad A, et al. International expert consensus document on Takotsubo syndrome (Part II): diagnostic workup, outcome and management. *Eur Heart J*. 2018;39(22):2047-2062. https://doi.org/10.1093/eurheartj/ehy077
18. Santoro F, Stiermaier T, Tarantino N, et al. Left ventricular thrombi in Takotsubo syndrome: incidence, predictors, and management: results from the GEIST (German Italian Stress Cardiomyopathy) Registry. *J Am Heart Assoc*. 2017;6(12):e006990. https://doi.org/10.1161/JAHA.117.006990
19. Ding KJ, Cammann VL, Szawan KA, et al. Intraventricular thrombus formation and embolism in Takotsubo syndrome: insights from the International Takotsubo Registry. *Arterioscler Thromb Vasc Biol*. 2020;40(1):279-287. https://doi.org/10.1161/ATVBAHA.119.313491
20. Lyon AR, Bossone E, Schneider B, et al. Current state of knowledge on Takotsubo syndrome: a position statement from the task force on Takotsubo syndrome of the Heart Failure Association of the European Society of Cardiology. *Eur J Heart Fail*. 2016;18(1):8-27. https://doi.org/10.1002/ejhf.424
21. Brunetti N, Santoro F, De Gennaro L, Correale M, Gaglione A, Di Biase M. Drug treatment rates with beta-blockers and ACE-inhibitors/angiotensin receptor blockers and recurrences in takotsubo cardiomyopathy: a meta-regression analysis. *Int J Cardiol*. 2016;214:340-342. https://doi.org/10.1016/j.ijcard.2016.03.196
22. Templin C, Ghadri JR, Diekmann J, et al. Clinical features and outcomes of Takotsubo (stress) cardiomyopathy. *N Engl J Med*. 2015;373(10):929-938. https://doi.org/10.1056/NEJMoa1406761
23. Mullens W, Damman K, Harjola V-P, et al. The use of diuretics in heart failure with congestion-a position statement from the Heart Failure Association of the European Society of Cardiology. *Eur J Heart Fail*. 2019;21(2):137-155. https://doi.org/10.1002/ejhf.1369
24. El-Hussein MT, Kilfoil L. The ABCs of atrial fibrillation. *Nurse Pract*. 2020;45(8):28-33. https://doi.org/10.1097/01.NPR.0000681780.47800.a3
25. Di Vece D, Citro R, Cammann VL, et al. Outcomes associated with cardiogenic shock in Takotsubo syndrome. *Circulation*. 2019;139(3):413-415. https://doi.org/10.1161/CIRCULATIONAHA.118.036164
26. Santoro F, Ieva R, Ferraretti A, et al. Hemodynamic effects, safety and feasibility of intravenous esmolol infusion during Takotsubo cardiomyopathy with left ventricular outflow obstruction: results from a multicenter registry. *Cardiovasc Ther*. 2016;34(3):161-166. https://doi.org/10.1111/1755-5922.12182
27. Marfella R, Barbieri M, Sardu C, et al. Effects of α-lipoic acid therapy on sympathetic heart innervation in patients with previous experience of transient Takotsubo cardiomyopathy. *J Cardiol*. 2016;67(2):153-161. https://doi.org/10.1016/j.jjcc.2015.07.012

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Sexual Assault Nurse Examiner/Forensic Nurse Hospital-based Staffing Solution: A Business Plan Development and Evaluation

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Abstract

Nationally and internationally, providing competent and sustainable sexual assault nurse examiner/forensic nurse coverage has been a shared challenge. This project, "Sexual Assault Nurse Examiner/Forensic Nurse Hospital-based Staffing Solution: A Business Plan Development and Evaluation," provides an example for assessment, construction, implementation, and evaluation of a business plan for a sustainable sexual assault nurse examiner/forensic nurse staffing solution. By using preexisting float pool positions and converting them to sexual assault nurse examiner emergency nurses, coverage for sexual assault nurse examiner examinations in a 16-hospital health system was established, which decreased sexual assault nurse examiner turnover related to burnout while increasing the sustainability of sexual assault nurse examiner nurses who provided quality care to patients who had experienced a sexual assault, domestic or intimate partner violence, elder or child abuse or neglect, assault, strangulation, or human trafficking. Implementation of the business plan resulted in a 179% increase in completed sexual assault nurse examiner examinations and a 242% increase in all types of completed forensic examinations from 2015 to 2019 as 7 new community hospitals were added to the health system. A sum of more than $20 000 allocated for training new sexual assault nurse examiners/forensic nurses was saved per year by using a sexual assault nurse examiner emergency nurse. By creating a supportive structure that fosters and sustains sexual assault nurse examiners/forensic nurses, both medical and mental health concerns can be addressed through trauma-informed care techniques that will affect lifelong health and healing as well as engagement in the criminal justice process for patients who have experienced sexual assault, abuse, neglect, and violence.

Key words: Sexual assault nurse examiner; Forensic nurse; Forensic program; Emergency department; Business plan development and evaluation; Sexual assault and rape

Introduction

Every 73 seconds, a person in the United States is sexually assaulted. As many as 4 out of 5 of these sexual assaults will go unreported or undisclosed.[1] For those who have survived a sexual assault, the aftermath includes a myriad of physical, emotional, and psychological effects that can affect overall health and wellness for a lifetime. Some of these effects can include safety concerns, sexually transmitted disease or infection, pregnancy, depression, posttraumatic stress disorder, anxiety or panic attacks, and sleep disorders, as well as unhealthy coping strategies such as substance abuse, eating disorders, or suicidal ideation.[1] There is a long, validated history of the positive impact that competent sexual assault nurse examiners (SANEs)/forensic nurses can have on the immediate medical needs, safety, and long-term emotional impact of a patient who has experienced sexual assault. Sexual assault forensic examinations (SAFEs) conducted by a trained SANE/

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J Emerg Nurs 2021;47:643–653.
Available online 21 April 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.03.011

forensic nurse result in improved comprehensive assessments, appropriate associated medical care and prophylactic treatment for exposures, proper evidence collection and preservation, maintained chain of custody, and skilled testimony in legal proceedings. Cases that received care from SANEs/forensic nurses are more likely to progress through the criminal justice system and result in guilty pleas and convictions at trial for a safer community.[2,3]

Background

Providing competent and sustainable SANE/forensic nurse expertise for patients who have experienced a sexual assault, abuse, or neglect has been a shared challenge among hospitals nationally and internationally. The International Association of Forensic Nurses (IAFN), which provides the scope and standards of practice for SANEs/forensic nurses, currently has more than 5000 members. The newly formed Academy of Forensic Nurses has acquired more than 500 members. Of these 2 organizations, only 1732 nurses worldwide are credentialed as SANE for Adults and Adolescents (SANE-A) or SANE-Pediatric.[4,5] Although there currently is no requirement for certification to practice as a SANE/forensic nurse, some states, jurisdictions, and organizations have enacted statutes, guidelines, and/or policies that define the training needed to provide examinations and evidence collection for patients seeking care after sexual assault or abuse.

The IAFN regularly updates educational guidelines with objectives that must be met for both SANE-Pediatric and SANE-A training. Pediatric and adult/adolescent SANE education have separate educational guidelines. Each requires a minimum of 40 didactic hours, with additional clinical competency contact hours guided by an experienced competent examiner for the respective practice areas. A combination adult and pediatric SANE education includes 64 didactic hours, followed by clinical competency contact hours with an experienced competent examiner. The IAFN currently has 970 registered SANE programs in the US.[5] According to the American Hospital Association, there are 6146 hospitals in the US.[6] Most of these hospitals do not have access to a SANE/forensic nurse. Of the hospitals that do have access to SANEs/forensic nurses, the SANE is either on call or provides limited coverage.

For hospitals using SANE/forensic nurse programs, high turnover rates of trained SANEs/forensic nurses create a challenge. Nationally, there is already a general shortage of SANEs for metropolitan hospitals and more so for rural hospitals. There are many contributing factors to high turnover rates besides the extensive training time required for safe practice in this field. SANEs/forensic nurses report experiencing higher moral distress. There is an intensity and pressure for perfection that comes with testifying in legal proceedings. Exposure to secondary and vicarious trauma can contribute to burnout and compassion fatigue.[7]

The experience of managing a SANE/forensic nurse program by lead author of this study has yielded additional insight into the high turnover rates for SANEs/forensic nurses. On average, 1 out of every 10 passionate nurses who complete training as SANEs/forensic nurses successfully complete orientation and begin independent practice. Many programs are challenged with coordinating novice SANEs/forensic nurses, mentorship with experienced SANEs/forensic nurses, and patient care experience. Programs with an on-call structure and a minimum call requirement employ SANEs/forensic nurses who also maintain a full-time position that takes priority. Owing to the random presentation of SANE cases, SANE nurses taking minimum call requirements often did not have a SANE case during their shift. When SANE cases did present, the off-duty SANE nurses were called to respond. The off-duty SANEs were not obligated to respond, and many were unable to do so because they were actively working, just completing a 12-hour shift, or beginning their shift at a primary employment. This results in extended time between cases and a loss of skill, competence, confidence, and desire to continue in this area of nursing. In addition, it is common for these SANE nurses to be required to fulfill holiday obligations for both positions. For all these reasons, the average length of stay in this field of nursing is 12 to 18 months after successful completion of orientation.

Purpose Statement

This project, "Sexual Assault Nurse Examiner/Forensic Nurse Hospital-based Staffing Solution: A Business Plan Development and Evaluation," provides an example for assessment, construction, implementation, and evaluation of a business plan for a sustainable SANE/forensic nurse hospital-based staffing solution.

Historical Program Review

In 1974, Saint Luke's Hospital of Kansas City (SLH) opened the first private rape treatment center in the US. During its formative years, physicians provided assessment and collection of kits while collaborating with advocacy and law enforcement. During the 1990s, sexual assault care transitioned to being nurse-facilitated, with physician support during the pelvic portion of the examination. All

nurses working in the SLH emergency department were required to attend SANE training for this level 1 trauma center. In the early 2000s, the field of forensic nursing expanded to apply forensic services to patients presenting for child abuse, elder abuse, intimate partner violence/domestic violence, assault, strangulation, and human trafficking. SANE-trained nurses established competency for these examinations as well as the speculum insertion for assessment, documentation, and collection of samples for the SANE examination and kit. These specialized services have grown hand in hand as the health system (HS) has added hospitals and services spanning areas beyond the Greater Kansas City metropolitan area to include 16 hospital locations in the metropolitan area as well as rural critical access and community locations. Although the SLH location had at least 1 SANE-trained nurse on each shift, the other locations, with fewer SANE consults, had either a list of SANE-trained nurses to call in or considered transfer to a facility with a SANE.

In October 2015, any nurse who had previously attended the 40-hour SANE/forensic nurse training was required to take a 4-hour refresher course. Many reported that they had not received SANE-specific continuing education since their initial SANE training. Forty-three nurses took the SANE refresher course with competency validation training. Most of those who attended the refresher course had not performed a SANE examination in years. This gap in practice clinically posed a low-incidence, high-risk situation especially for the SANEs who had completed fewer than 5 examinations in their practice. In the event that a patient presented requiring this specialized care, the SANE-designated nurse, with a full patient assignment, would be pulled out of regular staffing to conduct the examination. Each examination averaged 5 hours and included direct patient contact time and postexamination documentation and evidence management. During this examination time, the emergency department was short 1 clinical nurse. As key informants for the evaluation, clinical nurses in the emergency department voiced frustration with this process as well as the reported increased stress to the entire department when a SANE examination was being provided.

The expansion of SANE services system-wide increased the number of SANE consults throughout the HS. At times, an SLH SANE nurse would be the only SANE working in the HS and would be allocated to other entities to perform these specialty examinations. Not only was the department losing a staff nurse to a SANE consult, but that nurse was also lost to another location. This created even longer staffing gaps for the SLH emergency department. Table 1 summarizes coverage during this time in the program's history.

TABLE 1
2015 SANE and forensic examination coverage by facility

Facility	SANE coverage	Forensic examination coverage
1	SANE staffed each shift Pulled from the floor to provide 1:1	All emergency nurses provide examinations
2	SANE called in from list SANE responds if able	All emergency nurses provide examinations
3	SANE called in from list SANE responds if able	All emergency nurses provide examinations
4	SANE called in from list SANE responds if able	SANE on call or staff in emergency department pulled to provide examination
5	SANE called in from list SANE responds if able	SANE on call or staff in emergency department pulled to provide examination
6	SANE called in from list SANE responds if able	All emergency nurses provide examinations
7	SANE called in from list SANE responds if able	All emergency nurses provide examinations
8	No coverage, no SANE service Transfer to facility with service	No coverage, no forensic examination service
9	No coverage, no SANE service Transfer to facility with service	No coverage, no forensic examination service

Facility names deidentified.
SANE, sexual assault nurse examiner.

Market Analysis

The cost of training a SANE/forensic nurse was assessed. The initial cost of training included a 40-hour SANE/forensic nursing training that included IAFN-recommended didactic objectives. After this training, each nurse required 8 hours of skills competency using standardized patients for simulation of SAFEs, or SANE-A-Palooza.[8] Each nurse would require 8 or more hours' mentorship on SANE consults with an experienced examiner for program competency validation. Within the first year of practice, each SANE/forensic nurse completed a 4-hour crime laboratory kit observation. This initial cost, based on the average base rate of emergency nurses, was $2100 to $3000 per SANE nurse. Table 2 was created to compare area SANE programs' rate of pay, bonus/stipend, average pay per case, and call pay.

SANE Nurse Survey

The HS's decision support department administered the forensic nurse survey to the system's emergency nurses from February 1, 2016, to February 12, 2016. The survey was used to assess current staffing and SANE consult processes for each facility, SANE education, SANE-A certification status, number of examinations completed during practice, and subjective statements to describe obstacles to SANE practice. The survey invitation and link were distributed through email to a list of emergency nurses provided by the clinical forensic care program manager. In addition to the original invitation, a reminder was also sent out on February 10, 2016. Of the 61 recipients, 31 surveys were returned completed, for a response rate of 50.8%.

Nearly all the respondents had completed the SANE course, and 10% stated that they were SANE-A certified (Supplementary Figure 1). Half of them had completed fewer than 10 examinations in their career, whereas 14% had completed more than 100 examinations (Supplementary Tables 1-3). Approximately 50% of the respondents said that they would respond to multiple facilities and take calls. Those willing to take calls preferred 12-hour shifts. Some of the barriers to sustainable SANE practice included lack of training, time commitment (above full-time job requirements), and just "no interest." The greatest challenges that these nurses faced was an inability to maintain competency and continued education. The survey results reaffirmed the impact on department staffing levels during a SANE consult. SANE nurses were pulled to provide one-on-one care, leaving the department nurses to absorb patient assignments until the examinations were completed. Collaboration with the physicians and other nurses seemed to be favorable. The nurses reported not wanting SANE assignments owing to the potential of receiving a subpoena for court testimony. The survey identified the best support that the HS could provide these nurses: allowing them to shadow an experienced examiner on a regular basis and a refresher course or continuing education each year.

Recommendations were compiled from the survey to assist the HS in continuing an effective and safe SANE program. These recommendations centered on SANE nurse competence and confidence in performing the examinations. Yearly education focused on current evidence-based practice techniques with the development of a voluntary call program. This would ease the staffing and coverage concerns and relieve the anxiety of SANE nurses with minimal experience of, or exposure to, examinations.

Nurses were provided a free-text comment box and asked how SLH could support their SANE practice. Significant anonymous quotes from the SANE nurse survey, before the staffing solution implementation, included the following:

TABLE 2
SANE market analysis by program

Program	Rate of pay per case	Bonus/stipend	Average pay per case	Call pay
A	$250/training $350/noncertified $450/SANE-A certified	None	$350-$450	$2/h
B	$42/h, with 2 h minimum	None	$210*	$2/h
C	$48/h, with 2 h minimum	$100	$340*	$1.75/h
D	$425/examination	None	$425	$2/h
E	Time-and-a-half	None	Unknown	$2/h
F	$29.97/h	$0-$150	$149.85-$374.78*	None

SANE, sexual assault nurse examiner; SANE-A, sexual assault nurse examiner for adults and adolescents.
* Rate calculated with consideration to base pay and shift differentials for a 5-hour case time.

"I no longer feel competent doing SANE exams as we do not do enough. It should be individuals that have extensive training and do several a month."

"Although I LOVE taking care of this population, I will never choose it over my family if there is not an incentive for me to come in financially. I am away from them enough."

Lengthy times of exams. While it does not directly affect me, it leaves the rest of the floor short and if we are busy this makes me feel guilty I am letting my coworkers down. This I feel can compromise the care I give to my SANE patients. Also, regardless of how many situations I encounter, I always feel like I miss something either d/t different jurisdictions or lack of experience with each patient.

Baseline HS SANE Nurse Analysis

Baseline HS data that informed our business model planning included the percentage of nurses who completed SANE training (Supplementary Table 1), SANE certified nurses by facility (Supplementary Table 2), and number of SANE examinations completed by each nurse throughout their career by facility (Supplementary Table 3).

Table 3 displays the baseline number of examinations performed per facility.

Business-Model Options

Four options were presented to the chief nursing officers of each facility and system leadership using Microsoft PowerPoint (Microsoft Corporation), with a question-and-answer session (Table 4). Option 1 provided coverage for SANE examinations by the forensic care program manager Monday through Friday 7 AM to 7 PM. Over nights and weekends, 1 or 2 SANE nurses provide coverage in an on-call format with a base cost of $12 663 for call time. Challenges with the option 1 design include competition from other SANE programs that provide a higher rate of reimbursement for SANE examinations at $350 to $450 per examination. The HS SANE nurses' rate of pay was estimated at $179.85 to $209.85 with low volume.

Option 2 provided coverage for SANE examinations by the forensic care program manager Monday through Friday 7 AM to 7 PM, with 1 HS SANE nurse working 12-hour shifts on duty and 1 SANE nurse on call as backup over the weekend from Friday 7 PM through Monday 7 AM. This option also includes 2 nurses on call from Monday through Thursday 7 PM to 7 AM to cover SANE cases. The cost of this coverage was estimated at $178 104. This cost would be shared among the facilities according to the percentage of SANE cases seen (Table 5).

Option 3 provided coverage for SANE examinations by the forensic care program manager for the Monday to Friday shifts, with overnight and weekend coverage provided by a tier 3 SANE ED float pool registered nurse. The tiers in the float pool are defined by the employee's commitment to work in a specific setting. Tier 1 employees work at 1 hospital with a differential pay of $2/h. Tier 2 employees work at 2 or 3 hospitals with a differential pay of $4/h. Tier 3 employees work at 4 or more hospitals with a differential pay of $6/h. Additional differential pay was associated with working nights and weekends. The tier 3 SANE ED float pool registered nurse covers the night shift 7 nights a week and the day shift on Saturday and Sunday. Employee SANE nurses as tier 3 float staff will be allocated into unfilled night and weekend shifts after regular schedule sign-up. If there is a SANE case, that nurse would be deployed to that entity. If there are no open shifts to preallocate SANE staff after the regular schedule sign-up period, the resource management center (RMC) would allocate them to the busiest emergency department on a shift-by-shift basis. The float pool positions were already allocated. These open positions would have been filled by SANE emergency nurses. The receiving emergency department would pay the hours that this nurse works in its unit. Travel between the entities would be paid for by the receiving facility requesting a SANE consult.

Option 4, which was chosen for implementation by the nursing administration, included 6 full-time tier 3 SANE emergency nurses split, with half allocated to the night shift and half allocated to the day shift. Each of these nurses was

TABLE 3
Number of examinations performed in 2015 by facility

Facility	Number of SANE examinations
1	70
2	24
3	7
4	41
5	3
6	0
7	0
8	0
9	0

Facility names deidentified.
SANE, sexual assault nurse examiner.

TABLE 4
Annual cost: 4 hospital-based SANE staffing solutions

Option	Day M-F coverage	Night M-F coverage	Weekend coverage	Cost
1	Forensic care program manager	1-2 SANEs on call	1-2 SANEs on call	$12 663 Time-and-a-half callback pay for examinations
2	Forensic care program manager	1-2 SANEs on call	1 SANE on duty, 1 SANE on call	Estimated $178 104 Divided by facilities and percentage of cases
3	Forensic care program manager	Tier 3 ED SANE Float pool RN	Tier 3 ED SANE Float pool RN	Backfill open positions and fill staffing gaps
4	Tier 3 ED SANE Float pool RN	Tier 3 ED SANE Float pool RN	Tier 3 ED SANE Float pool RN	Backfill 6 open positions and fill staffing gaps

Day M-F coverage = 7 AM to 7 PM; night M-F coverage = 7 PM to 7 AM; weekend coverage = Friday 7 PM through Monday 7 AM.
M-F, Monday through Friday; SANE, sexual assault nurse examiner; RN, registered nurse.

TABLE 5
Cost per facility calculated on percentage of SANE cases

Facility	Facility cost	Hours of SANE coverage per pay period
1	$63 815.20	44
2	$25 393.68	16
3	$9420.47	4
4&5*	$40 458.19	26
6	$9420.47	4
7	$9420.47	4
8	$9420.47	4
9	$5364.23	1.5

Facility names deidentified.
SANE, sexual assault nurse examiner.
* Cost combined due to joint management.

scheduled for 3 12-hour shifts. These nurses completed a self-schedule for SANE coverage first and filled in ED shifts available to float emergency nurses for the remainder of their weekly obligation. Nurses worked 1 to 2 SANE shifts per week and 1 to 2 care ED shifts per week. This structure allowed for reprieve from SANE cases while maintaining the emergency nurse skill base as a staff emergency nurse. When a SANE case presented in the system, the SANE nurse on duty for the system would be deployed to that entity. When there were no open shifts to preallocate SANE staff after regular schedule sign-up period, the RMC would allocate them to the busiest emergency department on a shift-by-shift basis to provide support to throughput. The float pool positions were already allocated.

These open positions were filled by SANE emergency nurses. The receiving emergency department paid the hours that this nurse worked in its unit. Travel between the entities was paid for by the receiving facility requesting a SANE consult.

Strength of Option 4 Business Model

The tier 3 SANE emergency nurse's position provided structural support for SANEs/forensic nurses who are committed and compassionate toward patients who have experienced sexual assault. The tier 3 SANE emergency nurses received the highest differential pay as an impactful incentive. The full-time position has allowed for regular exposure to consults to maintain competency and an increase in the skill, knowledge, and confidence of each nurse. This resource is consistently available to all entities, including rural critical access locations. This high level of quality care has reduced regulatory risk. An example of regulatory risks averted with this model include nonexempt staff extending a regular shift beyond 18 hours to complete a SANE consult. When there are no SANE cases, the hours worked are absorbed into the productivity of each facility. By backfilling open positions and filling the staffing gaps, this model has ultimately reduced the cost of incentive pay in emergency departments in the system.

During the 2-year launching process, tier 3 SANE emergency nurses were hired, oriented to each facility, and mentored by the clinical forensic care program manager during SANE examinations to validate SANE competency. The implementation of this model has yielded a reduced turnover rate of SANE nurses and decreased the expense of SANE/forensic nurse training. Of the 13 SANE nurses who were hired for the tier 3 SANE emergency nurse positions, 2 nurses retired, and 2 completed their advanced practice

curriculum. Recruiting became less challenging because experienced examiners were attracted to this model and applied for these positions, further reducing initial education costs.

Several improvements in SANE nurse morale, sustainability, and quality of forensic examinations have developed with this staffing model. This new structure has decreased the need to work 2 sets of holidays and allowed time away from work to promote a healthy work/home-life balance. This model was designed for staff overlap in shifts. Each SANE nurse would be designated as the SANE on shift for 1 to 2 shifts per week and spend the remaining shifts filling a core ED position in the float pool. This model allowed for a reprieve from SANE cases and decreased the level of secondary/vicarious trauma. If additional reprieve was needed, the tier 3 SANE emergency nurses had the opportunity to trade SANE shifts for ED shifts from SANE team members. The ED staff no longer had concerns about calling and hoping that a SANE-trained nurse would respond, which in turn decreased wait times for patients requesting consults.

These tier 3 SANE emergency nurses were quickly accepted system-wide as experts in their field of SANE/forensic nursing. The tier 3 SANE emergency nurses are called on as a resource for internal forensic support and in the community because they provide education and lectures on requested topics to various stakeholders and organizations. Each tier 3 SANE emergency nurse is provided pay for a mandatory 4 hours of SANE/forensic nursing continuing education per year to build on their knowledge base using the most current evidence-based practice recommendations. If the nurse holds SANE-A certification, this fulfills part of the requirement of continuing education needed for recertification. Teaching internal forensic nursing classes and giving external community lectures fulfill the additional recertification requirement and have assisted the nurses in progressing up the clinical ladder within the HS. These tier 3 SANE emergency nurses have developed a close-knit group focused on moral support for each other. The team members meet monthly for process improvement case review and staff meetings to improve the structure and function of this core expert group. Burnout mitigation has also been implemented by the HS employee assistance program. Employee assistance program supervisor attends each monthly meeting and has provided assessments that included the professional quality-of-life scale for secondary trauma and burnout and also provided this group with specific techniques to cope with secondary/vicarious trauma.

Evaluation SANE Nurse Survey

Once the staffing model had been in place for 6 months, a second SANE nurse survey was administered to the SANE population of nurses to assess for changes. The HS's decision support department administered the forensic nurse survey to SANE-trained emergency nurses a second time from January 24, 2018, to February 7, 2018. The survey invitation and link were distributed through email to a list of emergency nurses provided by the forensic care program manager. Of the 37 recipients, 15 surveys were returned completed, for a response rate of 40.5%. Significant quotes from the anonymous SANE nurse survey after the staffing solution implementation:

> "I think it is working great. It is nice to always have coverage and know that our patients will have someone dispatched as soon as they present to the department."
>
> "They are very available to answer any questions or see patients as needed. I enjoy working with them in collaboration with this patient population. I feel very supported by them."
>
> "This is the same at all facilities. There are SANE nurses on staff in the system day and night or an on-call person who can be reached by calling Resource Management Center."
>
> Gosh. We had really hard feelings amongst the nurses until the float SANE nurse started. There were only a few nurses to cover the exams. It feels so much better not always having to do them. That was the primary cause of the bad feelings. The float nurse system has really helped.

Empiric Outcomes and Data

The implemented business plan allowed for overall growth of the forensic care program throughout the health care system, increasing SANE consults by 179% and overall forensic care program services for SANE, domestic violence/intimate partner violence, child abuse, elder abuse, assault, and strangulation by 242%. Tables 6 and 7 reflect the addition of 7 community hospital locations to the HS, adding to the volume of SANE cases.

Limitations of Option 4 Business Model

The implementation of the fourth business plan revealed several limitations. Entities that provided their own coverage with a voluntary on-call roster of passionate and devoted SANEs questioned the need for a change. An anonymous nurse commented on the survey, "It is not broken here, why fix it?" On implementation, the system had many SANE-trained nurses, but many did not want to

TABLE 6
SANE examinations from 2015 to 2019 by location

Facility	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
2015	70	24	7	41	3	0	0	0	0	na	na	na	na	na	na	na	145
2016	51	39	5	43	2	5	3	8	0	na	na	na	na	na	na	na	156
2017	100	41	13	50	1	12	7	20	0	na	na	na	na	na	na	na	244
2018	69	32	9	49	0	4	6	28	0	3	1	2	3	2	0	0	208
2019	96	36	13	49	5	5	5	29	0	3	1	3	9	6	0	0	260

Facility names deidentified.
SANE, sexual assault nurse examiner; na, entity not built yet.

TABLE 7
Clinical forensic examinations by type and facility in 2019

Type of examination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
SANE	96	36	13	49	5	5	5	29	0	3	1	3	9	6	0	0	260
DV	65	52	7	37	0	4	7	10	0	0	0	2	0	0	0	0	184
EA	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3
CA	4	14	1	6	0	2	3	2	0	0	0	0	0	0	0	0	32
A	52	37	3	21	0	1	6	11	1	0	0	0	0	0	0	0	132
SCS	35	24	2	14	0	3	4	10	0	0	0	0	0	0	0	0	92
Total	254	163	26	127	5	15	26	62	1	3	1	5	9	6	0	0	703

SANE, sexual assault nurse examiner; SA, sexual assault; DV, domestic violence/intimate partner violence; EA, elder abuse; CA, child abuse; A, assault; SCS, strangulation/choking/suffocation.

transition to working in the tier format at multiple locations. As a result, it was necessary to recruit outside of the HS. It took 2 years to hire and build the team of nurses: 3 0.9 full-time equivalent (FTE) tier 3 SANE emergency nurses on the night shift and 3 0.9 FTE tier 3 SANE emergency nurses on the day shift. During this period of time, 3 tier 3 SANE emergency nurses took an unplanned leave. The forensic care program manager and the remaining SANE staff covered the open shifts while training new SANE nurses. To prevent this kind of coverage strain on the manager and staff in the future, 2 additional 0.9 FTE nurses were added: 1 0.9 FTE nurse in the night shift and 1 0.9 FTE nurse in the day shift. This provided the depth that the team needed to allow for illness, injury, maternity leave, and vacation time without causing gaps in coverage or stress to SANE team members.

As mentioned, this business model decreased the need for incentive pay for the open shifts. Occasionally, tier 3 SANE emergency nurses were scheduled and assigned to facilities that were fully staffed. When this overstaffing occurred, core nursing staff in the emergency departments were sent home with paid time off or cost-contained. The RMC, in cooperation with the ED managers, uses a fair system to decide which staff to cost-contain. However, regular staff developed concerns regarding the use of paid time off that had been saved for planned vacations. Occasionally, when the tier 3 SANE emergency nurses were filling a staffing gap and were called to another facility for a SANE case, this left the starting facility short-staffed. Each ED unit was encouraged to plan for a staffing loss with internal resources.

Implications for Emergency Clinical Practice Managers

The tier 3 SANE emergency nurse staffing model has implications for emergency clinical practice. Emergency nurses and physicians as key informants of the model evaluation reported decreased stress knowing that a specialist was coming in to provide one-on-one care. Table 8 provides an overview of our business model plan development process that can be replicated at other sites. According to Kansas State Act 65-448 ("Qualified persons at medical care facilities to examine victims of sexual offenses, when; remedy for refusal; costs, 2017"), if a registered nurse or licensed physician assistant who has been specially trained to perform a sexual assault evidence collection is not

TABLE 8
Overview of logical model for initiating a SANE/forensic nurse hospital-based staffing solution business plan

Inputs	Activities	Short-term outcomes	Intermediate outcomes	Long-term outcomes
Review of local and statewide programs	Use SANE program development and operation guide to develop a strategic plan	Create a business plan	Recruitment of personnel	Develop a strategic plan for expansion/ improvement of services
Connect with local or statewide SART/ Coalition Against Domestic Violence and Sexual Assault (Office for Victims of Crime)	Conduct a needs assessment of the community Explore program models Identify essential components of a SANE program	Identify SANE program management goals Explore SANE education vendors	Complete SANE education didactic and skills competency Establish program evaluation process for improvement	

SANE, sexual assault nurse examiner; SART, sexual assault response teams.

available, the ED physician is required to offer this service. Recommendations for future costing formulas and financial analysis for return on investment are difficult to capture. Evaluations of this model cannot be specifically quantified in monetary units alone. Instead, for instance, there is monetary as well as nonmonetary value in the tier 3 SANE emergency nurses' pay incentive increase that ultimately increased retention and decreased turnover. Community partners approached the HS to enter into memorandums of understanding to provide SANE services. Patients who received the proper medical and forensic care from the start were less likely to suffer from exposure to sexually transmitted disease, infection, or pregnancy and would have access to the SANE for factual and expert testimony for legal proceedings. The cost to the emergency departments did not increase, specifically because positions were backfilled. The cost of the tier 3 SANE emergency nurse for a SANE examination was reimbursed by the District Attorney's office in Kansas or the Missouri Department of Public Safety. A sum of $20 000 per year was saved that would have been used in training owing to the turnover. Having the tier 3 SANE emergency nurses incorporated into core ED staffing fostered a working relationship and made them more approachable for clinical forensic questions or support, increasing staff satisfaction.

Implications for Policymakers and Stakeholders

Grantee sites across the US have received funds from the National Sexual Assault Kit Initiative. The National Sexual Assault Kit Initiative competitive grant awards funds to support reforms to improve the victim-centered approach and backlog prevention, as well as investigation and prosecution of sexual assault crimes through the testing of backlog SANE kits. As a result, many states are passing legislation to ensure access to SANEs/forensic nurses and protect the rights of victims of sexual assault. Sections 192.2520[9] and 197.315[10] of the Revised Statutes of Missouri require all hospitals statewide to provide patients with a SANE to perform the sexual assault forensic examination in person or through a telehealth network by January 1, 2023. Change is on the horizon for hospitals as states define the rights of survivors and victims of sexual assault. In 2020, section 595.201 of the Revised Statutes of Missouri was passed, affording survivors rights that included, but were not limited to, access to an employee or volunteer of a rape crisis center, a postexamination shower at no cost (unless unavailable), and the right to have a support person present during the examination as well as the interview with a law enforcement official. As in time-critical diagnosis programs, it is recommended to have nurse experts and program leaders who can provide oversight to reduce regulatory risks or statute violations.

Initiating a SANE/Forensic Nurse Hospital-based Staffing Solution

There are extensive and diverse resources that can be used to develop a SANE/forensic nurse program for hospitals that do not have this resource established. The most vital is hospital and administrative support. The IAFN provides a free 2-hour course: "Caring for the Sexually Assaulted

Patient When There is No SANE in Sight: A Training for ALL Healthcare Providers." This offering addresses knowledge gaps that include the basics in neurobiology of trauma, coordinated community response, medical forensic examination, and courtroom testimony.[11] This course is a preliminary training that can assist with the care of a patient who requires access to a SANE as a structured program is developed. The Office for Victims of Crime has developed a SANE program development and operation guide. This tool kit provides the following in-depth modules: Introduction to the SANE program development and operation guide; building a patient-centered, trauma-informed SANE program; building a sustainable SANE program; legal and ethical foundations for SANE practice; management of SANE programs; program operation costs and funding; identifying essential components of a SANE program; multidisciplinary response and the community; maintaining a quality program; expanding forensic nursing practice; and conclusion: "The Successful SANE Program."[12] A list of SANE/forensic nurse education sites is provided on the IAFN website, which includes both online virtual classroom and in-person trainings. One of the biggest challenges for hospitals developing a SANE/forensic nurse program is access to experienced SANE/forensic nurse mentorship for newly trained nurses. This need can be satisfied with clinical immersion courses such as SANE-A-Palooza.[8] Clinical immersion courses can also be used as a yearly competency validation by SANE programs that experience a low volume of patients who require one-on-one SANE care.

Conclusion and Recommendations

Each state, jurisdiction, and hospital system is unique, which requires individualized plans to address the training, staffing, and platform of support for SANEs/forensic nurses. By having a needs-based assessment that reviews the history and current market analysis coupled with an anonymous survey for SANE-trained nurses, specific obstacles to patient access to competent SANEs/forensic nurses can be identified and addressed. Building a staffing solution and business plan that are supportive of these specialized nurses reduces burnout related to secondary or vicarious trauma, fosters sustainable staff, increases the quality of care, and reduces legal and regulatory risks associated with this unique patient population. Reassessment of SANEs/forensic nurses and ED staff and the response to implementation of a staffing change is recommended to modify the plan for optimal outcomes. Hospitals with similar SANE staffing challenges are encouraged to support a sustainable SANE/forensic nurse staffing model, despite the limited financial reimbursement for this service.

Ultimately, this project has saved the system approximately $20 000 annually since implementation that would have been used to train new SANEs/forensic nurses. Patients who have experienced this type of trauma deserve the highest quality of care. Patients who receive the recommended services—medical forensic assessment and treatment, SAFE, prophylactic treatment for exposures, and connection to advocacy and legal resources if desired by a competent and compassionate SANE/forensic nurse who uses a trauma-informed, victim-centered approach—experience a decrease in adverse health impact and are more likely to seek additional support for healing.

Author Disclosures

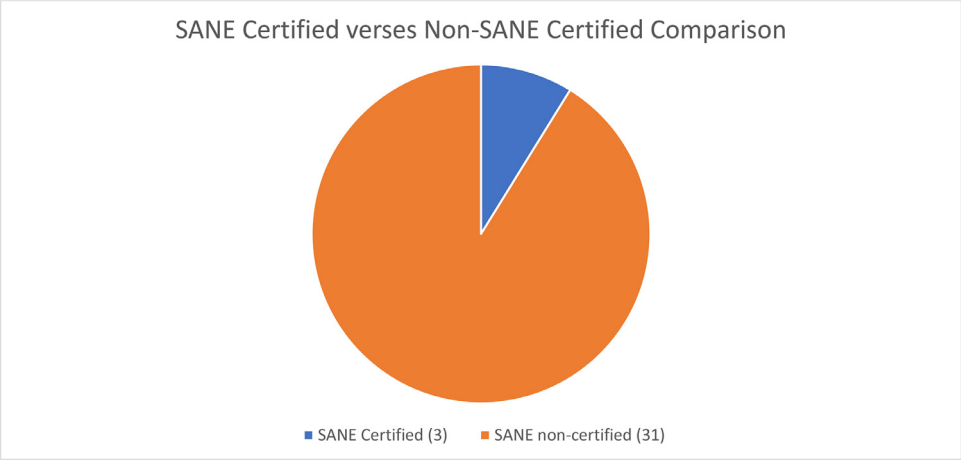
Conflicts of interest: none to report.

REFERENCES

1. Rape, Abuse & Incest National Network Statistics (RAINN). Accessed March 20, 2020. https://www.rainn.org/statistics
2. Campbell R, Patterson D, Adams AE, Diegel R, Coats S. A participatory evaluation project to measure SANE nursing practice and adult sexual assault patients' psychological well-being. *J Forensic Nurs*. 2008;4(1):19-28. https://doi.org/10.1111/j.1939-3938.2008.00003.x
3. Campbell R, Patterson D, Bybee D. Prosecution of adult sexual assault cases: a longitudinal analysis of impact of a sexual assault nurse examiner program. *Violence Against Women*. 2012;18(2):223-244. https://doi.org/10.1177/1077801212440158
4. Academy of Forensic Nursing. Accessed March 20, 2020. https://www.goafn.org
5. International Association of Forensic Nurses. Accessed March 20, 2020. https://www.forensicnurses.org/
6. American Hospital Association. Fast facts on U.S. hospitals, 2021. Accessed March 20, 2020. https://www.aha.org/statistics/fast-facts-us-hospitals
7. Karakachian A, Colbert A. Nurses' moral distress, burnout, and intentions to leave: an integrative review. *J Forensic Nurs*. 2019;15(3):133-142. https://doi.org/10.1097/jfn.0000000000000249
8. Witt JS, Carlson K, Colbert S, Cordle C, Hitchcock K, Kelly PJ. SANE-A-PALOOZA: a clinical immersion experience to close the gap for new sexual assault nurse examiners. *J Forensic Nurs*. 2015;11(2):101-106. https://doi.org/10.1097/JFN.0000000000000069
9. Revisor of Missouri. Revised Statutes of Missouri. Title XII PUBLIC HEALTH AND WELFARE. 192.2520. Chapter 192. Citation of law—definitions—telehealth network for victims of sexual offenses, requirements—contracts—report, contents—fund established, use of moneys

—rulemaking authority. 2020. *RS*Mo. https://revisor.mo.gov/main/OneSection.aspx?section=192.2520.

10. Revisor of Missouri. Revised Statutes of Missouri. Title XII PUBLIC HEALTH AND WELFARE. 197.135. Chapter 197. Forensic examinations, victims of sexual offense, requirements—waiver of telehealth requirements or this section, when—reimbursement of costs. 2020;197:135*RS*Mo. https://revisor.mo.gov/main/OneSection.aspx?section=197.135
11. International Association of Forensic Nurses. Caring for the sexually assaulted patient when there is no SANE in sight: a training for ALL healthcare providers. Accessed March 20, 2021. https://www.forensicnurses.org/general/custom.asp?page=NoSANEInSight
12. Office for Victims of Crime. SANE program development and operation guide. Office of Justice Programs. Accessed March 11, 2021. https://www.ovcttac.gov/saneguide/introduction/



SUPPLEMENTARY FIGURE

SANE-certified vs non–SANE-certified comparison. SANE, sexual assault nurse examiner.

SUPPLEMENTARY TABLE 1

Year SANE course completed by percentage

Year	Percentage of nurses who completed SANE training
1996	3.2
2003	3.2
2004	3.2
2005	3.2
2008	6.5
2009	3.2
2010	22.6
2011	6.5
2014	3.2
2015	19.4
na*	12.9

SANE, sexual assault nurse examiner.

* na = registered nurse did not complete SANE training and remaining nurses did not answer this question.

SUPPLEMENTARY TABLE 2

SANE-certified nurses by facility

Facility	Number of RNs certified SANE-A/Number of SANE-trained RNs
1	1/11
2	1/5
3	1/2
4	0/2
5	0/2
6	0/7
7	0/3
8	0/0
9	0/0
10	0/2

Facility names (1 to 9) deidentified; 10 = float pool.

RN, registered nurse; SANE, sexual assault nurse examiner.

SUPPLEMENTARY TABLE 3

Number of SANE examinations completed by each nurse throughout career by facility

Facility	<10	11-20	21-30	31-40	41-50	51-60	71-80	100+
1	4		2		1	1	1	2*
2	2	1	1					1
3	1							1*
4				1				
5				1				
6	5	1	1					
7	3							
8								
9								
10		1						1
Total	15	3	4	2	1	1	1	4

Facility names (1 to 9) deidentified; 10 = float pool.

SANE, sexual assault nurse examiner.

* =nurses worked at multiple entities in the system.

Lesbian, Gay, Bisexual, Transgender, Queer Cultural Competency Training to Improve the Quality of Care: An Evidence-based Practice Project

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CE Earn Up to 12.0 Hours. See page 675.

Abstract

Background: One evidence-based practice strategy to improve the provision of care for the lesbian, gay, bisexual, transgender, queer population is providing cultural competency training. The aim of this evidence-based practice project was to improve Knowledge and Skills, Openness and Support, and Oppression Awareness for emergency nurses when providing care to the lesbian, gay, bisexual, transgender, queer population in the military health system.

Methods: The single-unit, educational intervention posttest compared with unit personnel historical controls project took place in an emergency department within the military health system. The participants included registered nurses or licensed practical nurses working in the emergency department. The Ally Identity Measure tool was administered to an unmatched convenience sample of emergency nurses in a military health system pre- and postintervention to assess the intervention's effectiveness. Descriptive statistics and group difference testing (*t* test) were used.

Results: The mean Knowledge and Skills subscale score was improved between the pre- and postintervention groups ($t_{(70)} = -3.33$, $P = .001$). The mean Openness and Support subscale score was improved between the pre- and postintervention groups ($t_{(70)} = -2.06$, $P = .04$). The mean Oppression Awareness subscale demonstrated no significant difference between the pre- and postintervention groups ($t_{(70)} = -0.93$, $P = .36$).

Conclusion: This project illustrated the feasibility of an educational intervention to promote culturally competent care in the ED environment for the lesbian, gay, bisexual, transgender, queer population. The results illustrated that emergency nurses in this military health system were aware of the oppression that this vulnerable population faces.

Key words: Lesbian; gay; bisexual; transgender; queer; Emergency department; Emergency nursing; Emergency nurses; Cultural competency training; Educational intervention

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J Emerg Nurs 2021;47:654-660.
Available online 13 February 2021
0099-1767

https://doi.org/10.1016/j.jen.2020.12.007

Introduction

PROBLEM DESCRIPTION

Culturally competent or culturally congruent care includes providing care that is sensitive, knowledgeable, and meaningful for the population presenting for health care services.[1] One of the vulnerable populations that exists today is the lesbian, gay, bisexual, transgender, queer (LGBTQ) population. Shrader et al[2] note that standardized LGBTQ cultural competency training does not exist within the military health system (MHS) since the repeal of the Department of Defense directive "Don't Ask, Don't Tell" in 2011. The purpose of this project was to improve the Knowledge

and Skills, Openness and Support, and Awareness of Oppression when caring for the LGBTQ population in 1 emergency department within the MHS.

One challenge for health care providers when caring for this population is the lack of cultural competency training. Many organizations and experts have listed yearly LGBTQ cultural competency trainings as a strategy to improve care for the LGBTQ population.[3-5] Margolies et al[5] identify 3 common goals of LGBTQ cultural competency training: to increase knowledge, to increase LGBTQ-affirming attitude, and to increase LGBTQ-affirming behavior. Here, we describe the implementation of an evidence-based project in our unit to improve LGBTQ cultural competency among emergency nurses.

AVAILABLE KNOWLEDGE

The evaluated evidence indicated that both cultural competency training and promoting gender-inclusive environments are the beginning steps to improving the provision of care for the LGBTQ population.[3-5] Chisolm-Straker et al[6] identified that 85.2% of the emergency providers reported no formal training on the provision of care for the LGBTQ population, with 88% in the same study reporting caring for this population and 79.2% agreeing that sexual orientation/gender identity questions should be part of the electronic health record (EHR).

There are several barriers that emergency nurses face to provide culturally competent care. For example, the EHR data, wristband, or other retrievable health care data may conflict with the patient's currently preferred gender or name.[7] Lack of health care provider cultural competency was identified as a problem when accessing health care.[3,8,9] Furthermore, the estimated time for teaching LGBTQ health in a bachelor of science in nursing program was 2.12 hours,[10] recognizing that even recently educated staff may lack adequate depth in this crucial preparation.

Although not every study in the literature we reviewed illustrated an improvement in skills and attitudes,[11,12] all of the interventional studies demonstrated an increase in knowledge.[2,11-14] Furthermore, patients reported wanting to be asked sexual orientation/gender identity questions by health care staff,[7,15] and health care providers reported wanting increased training regarding providing culturally competent care for the LGBTQ population.[15]

Purpose

This was an evidence-based practice (EBP) project. The clinical question for this EBP project was the following: "Will the implementation of an independent, evidence-based, ED-specific, LGBTQ cultural competency education improve the knowledge, skills, and attitudes toward LGBTQ health care among emergency nurses?" The purpose of this project was to improve the Knowledge and Skills, Openness and Support, and Awareness of Oppression when caring for the LGBTQ population in 1 emergency department within the MHS.

Methods

DESIGN

This was a single-unit, EBP project using a pre- and poste-ducational intervention approach. Unmatched pre- and postintervention assessments of individual nurses were used for data collection.

CONTEXT

This project took place in an emergency department within the MHS where there is access to emergency care for adult and pediatric patients who are active military service members, military family members, and civilians presenting for emergency care. The MHS is a level III trauma center, with an annual volume of 66 000 patients. The number of nurse full-time equivalents was 66.

PARTICIPANTS

A purposive convenience sampling was used to recruit participants for this EBP project. The sample included participants who held a Registered Nurse (RN) or Licensed Practice Nurse (LPN) position within the EBP project setting and consented to participate in the study. Physicians, military health care specialists, and medical secretaries were excluded from the analysis.

PROJECT TEAM

The project leader was one of the educators for the emergency department and informed the staff of the educational opportunity during the daily shift huddles in the months before implementation. The project leader is a certified emergency nurse and certified pediatric emergency nurse. The project team included the project leader's doctorate of nursing practice chair and the chief nurse of emergency operations.

INTERVENTION

The intervention for this project was an evidence-based, culturally appropriate educational intervention. The resources that were used for the training included the National LGBTQIA+ Health Education Center[16] video "LGBT Voices: Perspectives on Healthcare;" the interactive presentation "Providing Quality Care to Lesbian, Gay, Bisexual, and Transgender Patients: An Introduction for Staff Training;" and the interactive presentation "Affirming LGBT People Through Effective Communication."

The interactive videos and education sessions provided information and practice scenarios on the avoidance of assumptions and effective communication techniques, as well as statistical data on the barriers and challenges that the LGBTQ population faces when accessing health care services. Information regarding local and national resources for LGBTQ individuals and health care providers was provided during the education session. Open discussion and practice scenarios were incorporated in the training for the emergency nurses to voice their perceptions and to reinforce best practices.

The Emergency Nurses Association (ENA)[3] toolkit was used to provide handouts on terminology, effective communication techniques, and types of gender-affirming surgeries during the sessions. An interactive presentation developed from the ENA[3] toolkit was delivered during the second training session with an open group discussion. The National LGBTQIA+ Health Education Center[16] is free to access, and the ENA[3] toolkit is free for members. Permission to use the National LGBTQIA+ Health Education Center's[16] presentations and ENA's[3] toolkit for training was obtained.

The cultural competency training was conducted in 2 30-minute, face-to-face, small group training sessions. The educational intervention took a total of approximately 50 to 75 minutes, accounting for open dialogue and discussion at each training session. The methodology was adjusted from the original plan of 5 short sessions with open dialogue to 2 lengthier sessions owing to the time needed for daily coronavirus disease (COVID-19) updates to staff in the morning shift huddles.

MEASURES

Participant demographic information was collected to include age, gender, gender assigned at birth, ethnicity, and education level. Completion of the pre- and postintervention surveys included the paper-and-pencil method. The data were then entered and analyzed with Intellectus[17] statistical software (Intellectus Statistics).

A preeducation and posteducation validated, reliable tool, the Ally Identity Measure (AIM) tool,[18] was used to assess and score the participants' Knowledge and Skills, Openness and Support, and Oppression Awareness both pre- and postintervention. The validated AIM tool was used for data collection after permission approvals from the researchers Jones et al.[18] The AIM tool uses a 5-point Likert scale, with 1, strongly disagree to 5, strongly agree.[18] The AIM tool includes 19 items that measure the Knowledge and Skills, Oppression Awareness, and Openness and Support when caring for the LGBTQ population.[18] The Knowledge and Skills scale includes 8 items that were tallied for a total score. The Oppression Awareness scale includes 4 items that were tallied for a total score. The Openness and Support scale includes 7 items that were tallied for a total score.[18] The approximate time taken to complete the tool was less than 15 minutes for both pre- and postintervention groups. The AIM tool has demonstrated good reliability (Cronbach α 0.76 to 0.88)[18] and good convergent and discriminant validity.[18]

The AIM tool was used in the ED setting by Bristol et al[13] in a similar study that was used as a guide for this EBP project. The methods of the Bristol et al[13] study were not replicated exactly. The educational intervention was modified, and the ED participants were limited to RNs and LPNs in the current study.

ANALYSIS

The 3 identified outcomes—Knowledge and Skills, Oppression Awareness, and Openness and Support identified on the AIM tool—were assessed using a 5-point Likert scale. The items were divided by each of the 3 measures and added for a score. Descriptive statistics, mean and SD, and an independent 2-tailed *t* test were used to determine differences in pre- and postintervention scores using Intellectus[17] statistical software. The Mann-Whitney 2-sample rank-sum test was included to supplement independent *t* test results when 1 or more of the assumptions for the *t* test were violated. *P*-values $\leq .05$ were considered significant.

SAMPLE-SIZE RECOMMENDATION FOR STUDY REPLICATION

A post hoc power analysis for an independent-sample *t* test was conducted in G*Power (Heinrich Heine University) to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a large effect size ($d = 0.8$), and 2 tails.[19] On the basis of the

assumptions, the recommended sample size to replicate this project was 61 per group.

ETHICAL CONSIDERATIONS

The study was approved by the Liberty University Institutional Review Board (IRB-FY19-20-100) and the institutional review board of the MHS ("Memo for Non-Research Determination" was provided). Consent was implied from the health care provider participants through the voluntary completion of the data collection tool. No patient data were collected for the EBP project.

Results

DESCRIPTIVE STATISTICS

The education was conducted in 2 sessions. A total of 42 health care providers (63%) participated in the first education session. A total of 39 health care providers (59%) participated in the second session of the educational intervention. The total sample included 36 preintervention and 36 unmatched postintervention surveys when only surveys from RNs and LPNs were included in the sample analysis. The results of the data analysis are outlined and described herein. Frequencies and percentages for the demographic data collected are presented in Table 1, and the summary statistics of the outcome measurements are presented in Table 2.

QUANTITATIVE RESULTS

The mean of the Knowledge and Skills subscale was significantly increased after the intervention compared with the preintervention group ($t_{(70)} = -3.33$, $P = .001$). The result was consistent using the Mann-Whitney U test ($U = 368.5$, $z = -3.15$, $P = .002$).

The second outcome measured was the Openness and Support subscale score. Descriptive statistics for the preintervention survey showed Openness and Support with a mean of 20.17 (SD = 6.95). The postintervention survey showed a mean of 23.69 (SD = 7.59), with a significant increase over the preintervention scores ($t_{(70)} = -2.06$, $P = .04$).

The third outcome measured was the Oppression Awareness subscale. The preintervention mean was 13.28 (SD = 3.81). The postintervention survey showed a mean of 14.14 (SD = 4.06) with no significant difference observed from the preintervention score ($t_{(70)} = -0.93$, $P = .36$). This result was consistent when analyzed using the Mann-Whitney U test ($U = 554$, $z = -1.06$, $P = .29$).

Discussion

SUMMARY

The results of this EBP project indicate that a unit-specific culturally appropriate educational intervention was feasible to implement and can contribute to an aggregate increase in Knowledge and Skills and Openness and Support for emergency nurses providing care to the LGBTQ population in the MHS. Overall, the average Knowledge and Skills score increased by 6.44%. The average Openness and Support score increased by 3.52%. There was no significant difference noted in the Oppression Awareness scores.

The results of this EBP study illustrated an increase in knowledge similar to that in 5 previous studies after the implementation of a cultural competency training.[2,11-14] Shrader et al[2] delivered an educational intervention in a sample of 51 individuals to increase cultural awareness when caring for the LGBTQ population. Posttest scores demonstrated improvements from pretest scores, ranging from 10% in the category "LGBT terminology" to 45% in the category "preventative measures." Additional educational categories included "cultural sensitivity," "barriers to care," and "pertinent health issues."[2] Donaldson et al[11] delivered an online LGBTQ educational intervention to a sample of 26 providers across health care disciplines. The participants demonstrated an increase in LGB knowledge and transgender knowledge from pre- to postassessment.[11] The study demonstrated no significance between pre- and postassessment in skills and attitudes.[11]

Maruca et al[12] implemented a transgender simulation to 47 nursing students. The researchers reported an increase in the Gay Affirmative Practice Scale scores postsimulation.[12] The current study illustrated a significant increase in Openness and Support and did not demonstrate a significant increase in Oppression Awareness postintervention. In contrast, Bristol et al[13] demonstrated a significant increase in Oppression Awareness and did not demonstrate a significant increase in Openness and Support.

INTERPRETATION

The education was intended to increase the Knowledge and Skills, Openness and Support, and Awareness of Oppression when caring for the LGBTQ population in 1 emergency department within the MHS. The mean scores for Knowledge

TABLE 1
Frequency table for demographic information (N = 72)

Variable	Preintervention group (n = 36), n (%)	Postintervention group (n = 36), n (%)
Age		
18-30	2 (6)	3 (8)
31-40	12 (33)	12 (33)
41-50	7 (19)	10 (28)
≥51	12 (33)	10 (28)
Missing	3 (8)	1 (3)
Ethnicity		
Caucasian	22 (61)	25 (69)
African American	2 (6)	2 (6)
Asian/Pacific Islander	0 (0)	1 (3)
Multiple	1 (3)	1 (3)
Other not listed	6 (17)	5 (14)
Missing	5 (14)	2 (6)
Gender		
Male	8 (22)	7 (19)
Female	26 (72)	29 (81)
Missing	2 (6)	0 (0)
Education		
Associate degree	10 (28)	12 (33)
Bachelor's degree	14 (39)	18 (50)
Graduate degree	7 (19)	4 (11)
Chose not to answer	1 (3)	1 (3)
Missing	4 (11)	1 (3)
Gender assigned at birth		
Male	7 (19)	6 (17)
Female	27 (75)	28 (78)
Missing	2 (6)	2 (6)

Owing to rounding, the percentages may not equal 100.

and Skills increased postintervention. During the open dialogue at each session, the emergency nurses voiced an appreciation for the knowledge provided in the education session. In addition, the emergency nurses voiced frustrations regarding the lack of sexual orientation/gender identity data collection in the current EHR owing to military regulations.

Openness and Support scores also increased postintervention. During the open dialogue at each session, the participants reported appreciation of, and an understanding of, the necessity for the training, especially because it was the first training for many participants. Individuals reported using the information the same day after the first part of the educational intervention. The participants reported feeling more comfortable with gender-affirming language and communication postintervention.

Oppression Awareness scores did not demonstrate a statistically significant difference between preintervention and postintervention. This result may be due to many of the individuals becoming aware of the challenges presented to the LGBTQ population through news and media reports. During the open dialogue at each education session, several participants reported having family members or close friends in the LGBTQ population and having noticed and witnessed the challenges that the LGBTQ population experiences in society and when accessing health care services. These shared experiences, coupled with the increase in Knowledge and Skills and Openness and Support, illustrate that a unit-specific cultural competency training may benefit other emergency departments and organizations to improve the provision of care for this vulnerable population.

TABLE 2
Mean Pretest and Posttest Data

Variable	M	SD	n	SE_m
Knowledge and Skills				
Preintervention	21.78	8.91	36	1.48
Postintervention	28.22	7.47	36	1.24
Openness and support				
Preintervention	20.17	6.95	36	1.16
Postintervention	23.69	7.59	36	1.27
Opression awareness				
Preintervention	13.28	3.81	36	0.64
Postintervention	14.14	4.06	36	0.68

Limitations

The project had several limitations. The first barrier to implementation was the current COVID-19 pandemic. Owing to COVID-19 limitations, a convenience sample was used, and the sample did not include 100% of the nursing staff. Staffing shortages were present owing to individuals being in quarantine. A post hoc power analysis illustrated a desired sample size of 61 participants per group. The sample size for each group in the current study was 36.

Open dialogue sessions were conducted in groups smaller than originally planned owing to COVID-19 social distancing restrictions. The survey used self-reporting that presents the potential for social desirability, meaning that participants may respond in a manner that is considered acceptable to others. Furthermore, the Oppression Awareness results demonstrated a less than 1% change from pre- to postintervention analysis. This may illustrate that it was more difficult to create a statistically significant change in knowledge in a population with a higher level of preexistent knowledge of the topic. The pre- and postintervention surveys were unmatched. Finally, most participants attended both sessions. However, owing to COVID-19 challenges and staffing issues, this was not 100%, which presents the potential for selection bias attributed to the measurements not being matched.

Implications for Emergency Clinical Practice

The ENA[3] and the Joint Commission[4] provide toolkits for organizations to implement LGBTQ cultural competency training. The National LGBTQIA+ Health Education Center[16] provides education, interactive learning modules, and evidence-based resources for administrators and educators to use to facilitate cultural competency training for their units. The ENA,[3] the Joint Commission,[4] and the National LGBTQIA+ Health Education Center[16] provide tools and resources for managers and executives to use to implement additional strategies to improve culturally appropriate care for the LGBTQ population. These strategies include implementing EHR prompts to address the patient's preferred name and pronouns; creating a culturally appropriate and welcoming environment; and informing or revising policies, procedures, and practices, to name a few.

A continued barrier to change includes individuals' previously held beliefs and biases. The LGBTQ population faces many challenges when accessing care in the current health care system. Frequent and annual education on communication techniques, affirming behaviors, and the avoidance of assumptions may prove beneficial in improving care and sustaining cultural competency when providing care for this vulnerable population. Nurse educators remain a crucial component of both reviewing the latest practices for caring for this population and mentoring the staff on monitoring these changes. Similar to best practices to improve the physiological aspects of care, cultural competency remains a fundamental part of providing quality and patient-centered care.

Conclusion

The shared experiences at the open dialogue sessions, coupled with the increase in Knowledge and Skills and Openness and Support, illustrate that a unit-specific cultural competency training may benefit other emergency departments and organizations to improve the provision of care for the LGBTQ population. The results for Knowledge and Skills demonstrated a significant improvement postintervention, Openness and Support illustrated significant improvements postintervention, but Oppression Awareness did not demonstrate a significant difference postintervention. The results illustrated that the individuals were aware of the oppression that the LGBTQ population faces. Therefore, nursing leaders may use this study as a guide to implement similar methodology to improve the Knowledge and Skills and Openness and Support of their health care staff to promote quality, patient-centered, and culturally competent care for this vulnerable population.

Author Disclosures

Conflicts of interest: none to report.

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of Womack Army Medical Center, the Defense Health Agency, Department of Defense, or the United States government.

REFERENCES

1. Yoost BL, Crawford LR. *Fundamentals of Nursing*. 2nd ed. Elsevier Evolve; 2020.
2. Shrader A, Caser K, Casper B, Kelley M, Lewis L, Calohan J. Military lesbian, gay, bisexual, and transgender (LGBT) awareness training for health care providers within the military health system. *J Am Psychiatr Nurs Assoc*. 2017;23(6):385-392. https://doi.org/10.1177/1078390317711768
3. Nurses Association. Care of LGBTQ patients in the emergency care setting toolkit. Emergency. Published 2018. Accessed January 15, 2020. https://ena.peachnewmedia.com/store/streaming/streamdetails.php?mode=stream&id=11425074
4. The Joint Commission. Advancing effective communication, cultural competence, and patient- and family-centered care for the lesbian, gay, bisexual, and transgender (LGBT) community: a field guide. Published October 2011. Accessed January 15, 2020. https://www.jointcommission.org/assets/1/18/LGBTFieldGuide.pdf
5. Marjolies L, Joo R, McDavid J. Best practices in creating and delivering LGBTQ cultural competency trainings for health and social service agencies. The United States Department of Justice. Published 2014. Accessed January 15, 2020. https://nicic.gov/best-practices-creating-and-delivering-lgbtq-cultural-competency-trainings-health-and-social-service
6. Chisolm-Straker M, Willging C, Daul A, et al. Transgender and gender-nonconforming patients in the emergency department: what physicians know, think, and do. *Ann Emerg Med*. 2018;71(2):183-188. https://doi.org/10.1016/j.annemergmed.2017.09.042
7. Acosta W, Qayyum Z, Turban JL, van Schalkwyk GI. Identify, engage, understand: supporting transgender youth in an inpatient psychiatric hospital. *Psychiatr Q*. 2019;90(3):601-612. https://doi.org/10.1007/s111126-019-09653-0
8. Stewart K, O'Reilly P. Exploring the attitudes, knowledge, and beliefs of nurses and midwives of healthcare needs of LGBTQ population: an integrative review. *Nurse Educ Today*. 2017;53:67-77. https://doi.org/10.1016/j.nedt.2017.04.008
9. Lisy K, Peters M, Schofield P, Jefford M. Experiences and unmet needs of lesbian, gay, and bisexual people with cancer care: a systematic review and meta-synthesis. *Psychooncology*. 2018;27(6):1480-1489. https://doi.org/10.1002/pon.4674
10. Lim F, Johnson MJ, Eliason MJ. A national survey of faculty knowledge, experience, and readiness for teaching lesbian, gay, bisexual, and transgender health in baccalaureate nursing programs. *Nurs Educ Perspect*. 2015;36(3):144-152. https://doi.org/10.5480/14-1355
11. Donaldson W, Smith HM, Parrish BP. Serving all who served: piloting an online tool to support cultural competency with LGBT U.S. military veterans in long-term care. *Clin Gerontol*. 2019;42(2):185-191. https://doi.org/10.1080/07317115.2018.1530323
12. Maruca AT, Diaz DA, Stockmann C, Gonzalez L. Using simulation with nursing students to promote affirmative practice toward the lesbian, gay, bisexual, and transgender population: a multisite study. *Nurs Educ Perspect*. 2018;39(4):225-229. https://doi.org/10.1097/01.NEP.0000000000000302
13. Bristol S, Kostelec T, MacDonald R. Improving emergency health care workers' knowledge, competency, and attitudes toward lesbian, gay, bisexual, and transgender patients through interdisciplinary cultural competency training. *J Emerg Nurs*. 2018;44(6):632-639. https://doi.org/10.1016/j.jen.2018.03.013
14. Strong K, Folse V. Assessing undergraduate nursing students' knowledge, attitudes, and cultural competence in caring for lesbian, gay, bisexual, and transgender patients. *J Nurs Educ*. 2015;54(1):45-49. https://doi.org/10.3928/01484834-20141224-07
15. Shetty G, Sanchez JA, Lancaster JM, Wilson LE, Quinn GP, Schabath MB. Oncology healthcare providers' knowledge, attitudes, and practice behaviors regarding LGBT health. *Patient Educ Couns*. 2016;99(10):1676-1684. https://doi.org/10.1016/j.pec.2016.05.004
16. National LGBTQIA$^+$ Health Education Center. We are the National LGBTQIA+ health education center. Published 2019. Accessed January 15, 2020. https://www.lgbthealtheducation.org/
17. Intellectus Statistics [Online computer software]. Intellectus Statistics. Published 2020. Accessed March 15, 2020. https://www.intellectusstatistics.com/
18. Jones KN, Brewster ME, Jones JA. The creation and validation of the LGBT Ally Identity Measure. *Psychol Sex Orientat Gend Divers*. 2014;1(2):181-195. https://doi.org/10.1037/sgd0000033
19. Faul F, Erdfelder E, Buchner A, Lang AG, G. *Power* Version 3.1.7. *[Computer Software]*. Uiversitat Kiel, Germany. Published 2013. Accessed March 15, 2020. https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower.html

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Adolescent With von Willebrand Disease Type 3 Spontaneous Abdominal Hemorrhage

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Contribution to Emergency Nursing Practice

- The current literature on nursing care of patients with von Willebrand disease type 3 recognizes that it is rare, and patients may present with severe bleeding from the skin, mucous membranes, gastrointestinal tract, or during menstruation.
- This article contributes a case example to improve the treatment of, and provide effective nursing care to, patients with this rare disorder. It highlights the importance of collaborating with hematology and pharmacy in providing critical and timely factor products to stop hemorrhage.
- Key implications for emergency clinical practice found in this article include the importance of a multidisciplinary approach in administering lifesaving interventions that control bleeding with factor products, obtaining diagnostic imaging, and preparing for interventional radiology and surgical interventions.

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J Emerg Nurs 2021;47:661—668.

0099-1767

https://doi.org/10.1016/j.jen.2021.04.008

Abstract

An adolescent female classified as unstable with a spontaneous abdominal hemorrhage was transferred to a level 1 pediatric trauma tertiary emergency department. Pertinent medical history included von Willebrand disease type 3, menorrhagia, and obesity. Preparation before patient arrival included mobilization of multidisciplinary medical team experts in hematology, pharmacy, blood bank, radiology, and nursing who provided lifesaving interventions. The administration of factor products, blood products, interventional radiology, emergent hepatic angiography, and embolization coordination resulted in a successful outcome. After an 18-day intensive hospital course, the patient returned home close to her baseline health status.

Key words: von Willebrand disease type 3; Humate-P; Vonvendi

Case Introduction

An adolescent female with abdominal pain and uncontrolled abdominal hemorrhage was transferred to a level 1 pediatric trauma tertiary hospital for a higher level of emergency services. The patient had a history of abdominal pain for 1 day but denied history of trauma, fever, chills, vomiting or diarrhea. Pertinent medical history included von Willebrand disease type 3 (VWD3), obesity, and menorrhagia. Despite multiple blood products, antifibrinolytics, and vasopressor administration before arrival, internal abdominal hemorrhage continued. The outside hospital administered 3 L of

intravenous (IV) 0.9% sodium chloride, IV piperacillin and tazobactam, 4 units of fresh frozen plasma (FFP) IV, 840 mg IV tranexamic acid, 2 units of packed red blood cells (PRBC) IV, desmopressin 25 mcg IV, and norepinephrine IV infusion at 15 mcg/min.

Although the outside hospital administered desmopressin, it is not typically successful in stopping hemorrhage for patients with VWD3.[1] Desmopressin action depends on the endogenous synthesis of von Willebrand factor (VWF) from endothelial cells, which is impaired in VWD3.[1-4] However, the outside hospital did not have VWF products, and a small subset of patients with VWD3 have been reported to respond to desmopressin.[1-4]

Prearrival Preparation

The hospital team understood that prearrival preparation was crucial for the best possible patient outcome. Of note, all digital diagnostic images from the outside hospital had been electronically transferred before the patient's arrival. A computed tomography (CT) scan of the abdomen and pelvis at the outside hospital showed bleeding from intrahepatic hematoma and hemoperitoneum (Figure 1). Consultations occurred with pediatric hematology, pediatric surgery team, anesthesia, interventional radiology (IR), pharmacy, blood bank, and pediatric critical care nurses in anticipation of the patient's arrival. Pediatric hematology recommended administration of weight-based Humate-P (Antihemophilic Factor/VWF Complex [Human]; CSL Behring GmbH). The ED physician contacted the pharmacist who brought 6800 units of Humate-P to the emergency department. The patient care plan included the incorporation of personal protective equipment for staff safety because this transfer happened in May 2020 during the coronavirus disease (COVID-19) pandemic.

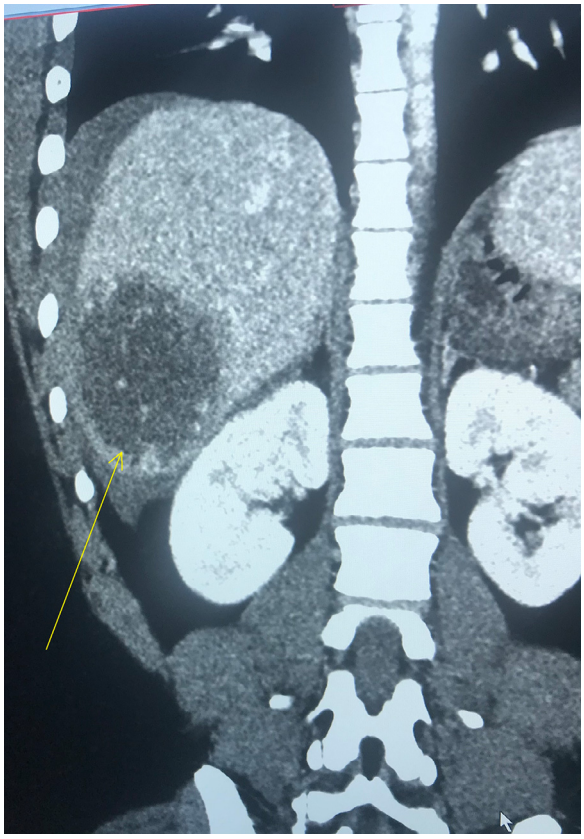

FIGURE 1

Contrast-enhanced coronal computed tomography image of the abdomen with a rounded, hypoattenuating lesion within the right hepatic lobe with ill-defined margins. There is evidence of a subcapsular or pericapsular fluid collection. Some stippled association foci of hyperattenuation or enhancement may reflect active hemorrhage. The 2 arrows point to areas described in this figure legend.

Arrival to the Emergency Department

The patient's airway was patent, color pale, skin diaphoretic, and behavior anxious on arrival to the emergency department. Vital signs included hypotension, blood pressure 79/50 mm Hg, sinus tachycardia, heart rate 110 to 160 beats per minute, and altered mental status. The patient's Glasgow Coma Scale score fluctuated from 15 when blood was administered by pressure bags to 12; when the blood infusion stopped, the patient's level of consciousness decreased such that she could open her eyes to verbal command, her words became incomprehensible, and she obeyed all motor commands. The abdominal examination revealed distension and diffuse pain in all quadrants. Pulses were palpable at the femoral site but not at the radial, deep popliteal, or posterior tibial sites. The patient was able to move all extremities. Repeat blood hemoglobin test demonstrated a decrease in the level to 8.5 g/dL despite 2 units of PRBC blood transfusions given before her arrival (Table 1). Norepinephrine IV was titrated to 20 mcg/min, 3 L of 0.9% sodium chloride IV bolus was given by pressure bag, and 2 units of PRBC were given by pressure bags to improve hemodynamics. IV Humate-P 6800 units (80 units of VWF:ristocetin cofactor [RCo] units per kg per dose of Humate-P)[1-3] were given per pediatric hematology recommendation to control bleeding. The patient only required 1 dose of Humate-P. Blood pressure and level of consciousness improved after administering Humate-P, IV fluids, and PRBC boluses. Humate-P was the required treatment to control VWD3 hemorrhage.[4] Other antifibrinolytic agents do not stop VWD3 hemorrhage.[4] Once Humate-P and other medications were administered, the patient

TABLE 1
Prearrival laboratory results

Laboratory test	Prearrival laboratory results	Normal laboratory results
White blood cell count, K/μL	14.1	4.0−11.0
Hemoglobin, g/dL	12.5	13.5−16.0
Hematocrit, %	37.5	37−47.0
Platelets, K/μL	596	150−400
Sodium, mEq/L	136	135−145
Potassium, mEq/L	3.5	3.6−5.1
Chloride, mEq/L	105	98−110
Carbon dioxide, mEq/L	21	20−30
Blood urea nitrogen, mg/dL	6	6−240
Serum creatinine, mg/dL	0.75	0.57−1.30
Glucose, mg/dL	167	70−139
Lactate, mmol/L	2.4	0.5−1

became stabilized to transfer to IR. On the way to IR, the family was given a brief visit with the patient and an update. The patient was brought to IR for angiography and embolization. Anesthesia intubated the patient in IR. The surgical team arranged for an operating room to be kept available in case surgical intervention was required. The success of the IR procedures eliminated the need for surgical intervention.

Hospitalization Course of Events

As previously mentioned, the patient was transferred from the emergency department to IR for arteriography and embolization. Anesthesia performed intubation in IR. The right hepatic arterial vascular hemorrhage was successfully embolized in IR (Figures 2 and 3). Intermittent hypotension was noted, which required IV vasopressor medication during the 48 hours of intubation in the pediatric intensive care unit. After extubation, the hypotension resolved. Neurologically, the patient remained stable. A chest CT scan demonstrated fluid overload from pleural effusions, which resolved after treatment. Hypotension resolved after extubation owing to compression on the vena cava. The patient's hypotension resolved after extubation due to the discontinuation of sedation medication. A cardiac echocardiogram identified possible thrombosis in the inferior vena cava and superior vena cava from the hepatic adenomas. Prophylactic heparin IV was started on hospital day 4 for the thrombosis concern. IV heparin was converted to prophylactic enoxaparin subcutaneous after 11 days.

The hepatic adenomas noted in the diagnostic studies necessitated serial abdominal pressure measurements that monitored for compartment syndrome. Abdominal pressure measurements remained within normal limits throughout the hospitalization. IV morphine was effective for abdominal pain management when the patient was intubated. Acetaminophen and heat packs provided sufficient pain relief after the patient was extubated. Gastric output was monitored with a nasogastric tube until the output was resolved. IV pantoprazole helped resolve gastric output. After the nasogastric tube was removed, the patient resumed a regular diet without issues. Repeat CT angiography of the abdomen was performed to monitor hepatic adenomas, which showed no further active bleeding, but hepatic lesions of unclear etiology. The differential diagnosis included hepatocellular carcinoma, which was ruled out because the alpha-fetoprotein and beta−human chorionic gonadotropin were at normal limits. The consensus was that contraceptive use led to the hepatic adenomas. Previous case reports had reported hepatic adenomas in adolescent women treated with norethindrone acetate.[5] The plan for this patient was to follow up with gastroenterology as an outpatient and frequently perform radiologic monitoring of the lesions. A CT scan of the abdomen/pelvis showed a right common femoral arterial pseudoaneurysm, which was monitored during the hospital course but did not require intervention. Fevers, rising inflammatory markers, and changes in clinical status indicated the need to obtain multiple sepsis evaluations. All blood cultures taken on hospital days 2, 5, and 7 remained negative. Urine and stool cultures taken on hospital day 6 remained negative. Nasal swabs for respiratory viral panel and COVID-19 produced negative results. Appropriate antibiotic coverage included a 7-day course of cefEPIME. The patient's right lower extremity maintained adequate perfusion after the right femoral artery was cannulated during embolization. Although the COVID-19 nasal swab was negative, staff wore proper personal protective equipment during aerosolizing procedures per hospital policy. During

TABLE 2
Prearrival and ED care timeline

Timeline	Prearrival and ED care
5:24 AM	Hospital received a call to transfer patient
	PICU attending accepted the transfer
	Pediatric ED physician notified patient to arrive by critical care transport helicopter
7:08 AM	Pediatric ED physician discussed case with IR resident
7:16 AM	Report from OSH to ED physician: Adolescent female with VWD3 received IV DDAVP 25 mcg, FFP 4 units, TXA 840 mg, and 2 units of PRBC. Plan was start norepinephrine infusion at 15 mcg/min for hypotension
	Transport team was on the scene, blood pressure 79/50, heart rate 110 beats per minute. Three peripheral IV access catheters in place
	Patient weight 85 kg
7:20 AM	Pediatric surgery paged
	Hospital Massive Transfusion Protocol activated
7:32 AM	Emergent consult was requested with pediatric surgery
7:34 AM	Case discussed with on-call pediatric hematology attending
	Recommendation for 80 units of VWF:RCo units per kg per dose of Humate-P (CSL Behring GmbH) IV
7:37 AM	Pharmacy was called to prepare Humate-P and bring to the emergency department
7:41 AM	PICU attending called and given an update
7:43 AM	Updated report: ETA 7 minutes per transport team. Patient awake, alert, oriented × 3, GCS score of 14, heart rate 116 beats per minute, oxygen saturation 98% on room air
7:46 AM	Pharmacy arrived with 6800 units of Humate-P
	(80 units of VWF:RCo units per kg per dose of Humate-P)
7:52 AM	IR resident in emergency department, IR attending aware of patient but not in hospital yet
7:59 AM	Patient arrived at emergency department
	Pediatric ED attending and nursing staff at bedside
	Pediatric surgery attending and residents in emergency department at bedside
	IR resident in emergency department at bedside
	Pharmacy in emergency department at bedside
	IV Humate-P 6800 units given
	(80 units of VWF:RCo units per kg per dose of Humate-P)
	Anesthesia consult requested by surgery
8:09 AM	Anesthesia at bedside
8:39 AM	Summation of prearrival and ED care
	PICU attending updated: adolescent female with medical history of VWD3 transferred to emergency department for evaluation of hemorrhagic shock, hemoperitoneum, bleeding from hepatic hemangioma. Received DDAVP, TXA, FFP, PRBC on norepinephrine infusion at 15 mcg. During the ED evaluation, IR and surgical consultation were at the bedside. The patient was given 80 units of VWF:RCo units per kg per dose of Humate-P. Blood pressure transiently dropped to systolic 90s during which norepinephrine infusion was increased to 20 mcg/min. Patient received 2 units of PRBC in emergency department.
	Family saw patient briefly on the way to IR
	Family updated on patient status and care plan
	Patient transferred to IR

DDAVP, desmopressin acetate; ETA, estimated time of arrival; FFP, fresh frozen plasma; GCS, Glasgow Coma Scale; IR, interventional radiology; IV, intravenous; OSH, outside hospital; PICU, pediatric intensive care unit; PRBC, packed red blood cells; TXA, tranexamic acid; VWD3, von Willebrand disease type 3; VWF:RCo, von Willebrand factor:ristocetin cofactor.

the hospital stay, the patient received a total of 8 units of PRBC and 4 units of FFP. Two units of PRBC were given at the outside hospital, 2 units during transport, 2 units in the emergency department, and 2 units in IR.

Medical staff monitored diagnostic laboratory studies during hospitalization because massive blood transfusions were required during initial stabilization and because of the history of a bleeding disorder. The physician ordered blood transfusion of the patient to maintain hemoglobin level >8 g/dL and fibrinogen level >150 mg/dL. Mild hypernatremia required monitoring, which resolved with IV fluid adjustments. Antifactor Xa assay diagnostic studies monitored plasma heparin levels with the goal of maintaining 0.1 units/mL to

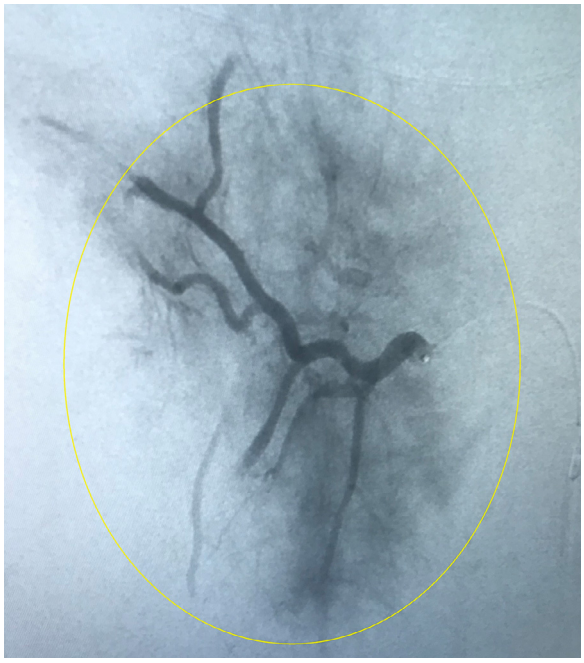

FIGURE 2

Preintervention catheter-directed angiography of the hepatic arterial vasculature demonstrated a large area of ill-defined enhancement reflecting hemorrhage seen in the area enclosed in the circle.

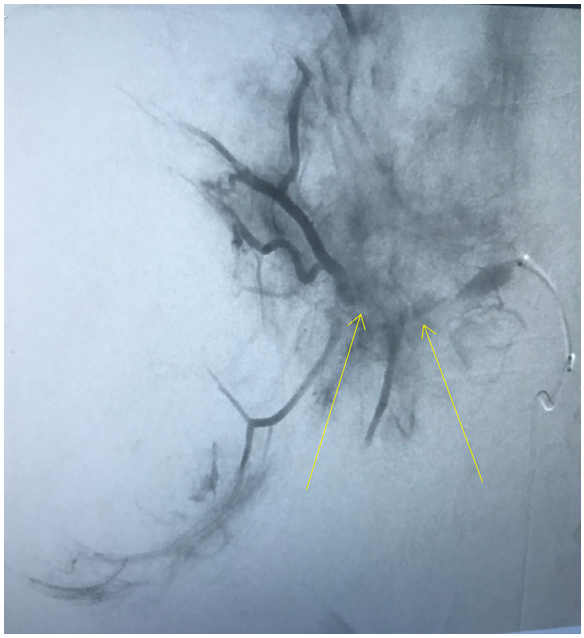

FIGURE 3

Postintervention catheter-directed angiography demonstrated avid enhancement and/or arterial bleeding surrounding the hepatic arterial vasculature. Embolization of the right hepatic artery was subsequently performed; postintervention angiography showed absent right hepatic arterial enhancement (arrows).

0.3 units/mL levels, which was successfully done throughout hospitalization. Hematology wanted the goal trough of H antigen expression per unit vWF activity to be at least 50% of normal FVII:C plasma levels. The general population has a H antigen expression per unit vWF normal range between 50 and 200 IU per dL. Results of the factor VIII level test performed during admission showed an increase in the level by more than 200%. Hematology coordinated with pharmacy to switch the patient to IV Vonvendi (VWF recombinant; Baxalta US Inc) for VWF replacement on hospital day 8. At that time, the hospital pharmacy had enough Vonvendi as nonformulary stock for the patient.[6] The hospital pharmacy added Vonvendi as stock formulary in December 2020. Vonvendi is a recombinant, which means it does not have human blood or plasma, only VWF concentrate, and it does not contain factor VIII.[6] It is approved for the control of bleeding and perioperative management in adults aged 18 years or older.[6] This patient was aged below 18 years, but her weight was 85 kg, which was considered an adult weight, and the need to decrease the risk of thrombosis from high factor VIII levels outweighed the risk concerning her age. The administration of Vonvendi infusions occurred every other day during hospitalization with a positive effect.

The enoxaparin therapy caused the factor VIII level to start coming down. The patient was eventually discharged home on lower doses of Vonvendi as well as enoxaparin. A repeat echocardiogram before discharge remained unchanged. Duplex abdominal ultrasonography showed resolution of hepatic adenomas before discharge. Before this admission, the patient had been on a hormonal implant to control menorrhagia. Discontinuation of the norethindrone acetate and etonorgestrel subdermal implant took place owing to the concern that these hormones caused hepatic adenomas.[7] An intrauterine device containing levonorgestrel, which limits systemic hormone exposure, was initially placed by the gynecology team but was displaced 2 days later. A single dose of medroxy PROGESTER one acetate was chosen as a short-term measure to control menorrhagia until another intrauterine device could be placed.

The patient was discharged home close to her baseline after 18 days. Visiting Nurse Association services administered Vonvendi infusion through a peripherally inserted central catheter every other day. The patient was eventually tapered off Vonvendi. Hematology followed outpatient echocardiograms that started to normalize, and enoxaparin was discontinued. The patient maintained close follow-up contact with hematology, gastroenterology, cardiology, and gynecology after discharge.

Humate-P (Antihemophilic Factor/VWF Complex [Human])

Humate-P[2-4] IV administration was approved for all types of VWD, the treatment of spontaneous or traumatic bleeding, and patients with VWD3 when desmopressin cannot be used. The Humate-P manufacturers included VWF:RCo and factor VIII when developing the medication.[3,4] Patients with VWD3 lack VWF, which made the treatment different from other types of VWD. Commercially available vials of Humate-P are manufactured with 3 different doses of VWF:RCo per vial: 600 units, 1200 units, and 2400 units; however, each lot was derived from human plasma, which contains varied amounts of VWF:RCo and factor VIII.[2-4]

Humate-P administration guidelines advise to not refrigerate the medication after reconstitution and administer within 3 hours of reconstitution.[2,3] To reconstitute, use the Mix2Vial filter transfer set provided with Humate-P to mix the warm dried concentrate and room temperature diluent. Health care providers who prepare Humate-P should only use plastic disposable syringes because the protein solution adheres to the ground glass surface of glass syringes. Gently swirl after adding diluent or rotate vial. Remove filter spike before administration. Infuse the solution at a rate not exceeding 4 mL/min. Discard any unused portion. See Humate-P[2,3] manufacturer administration instructions for complete administration guidelines at https://www.humate-p.com/hcp.

VWD

VWD was first described in 1926 by Dr Erik von Willebrand.[2] Hemophilia is a sex-linked recessive pattern disease, which is different from VWD.[2] An assay discovered in the 1950s demonstrated that patients with VWD had decreased levels of factor VIII in plasma that could be corrected with plasma transfusions of partially purified preparations of factor VIII. Now, these preparations also contain VWF. In the 1980s, advances in molecular genetics made it possible to distinguish VWF, which led to the classifications of different types of VWD.[8-10] The physiology of VWF is extremely complex and beyond the intent of this article.[4] Briefly, VWF is required to maintain hematologic homeostasis by binding both platelets and vascular endothelial components at the sites where endothelial injury occur[8-10] (Figure 4).

VWD clinical symptoms can present at any age, and the disease affects people from all ethnic backgrounds.[4,10] Individuals with VWD can be asymptomatic or have many varied bleeding symptom presentations.[4,8,9] Asymptomatic persons with VWD may only be diagnosed after a family

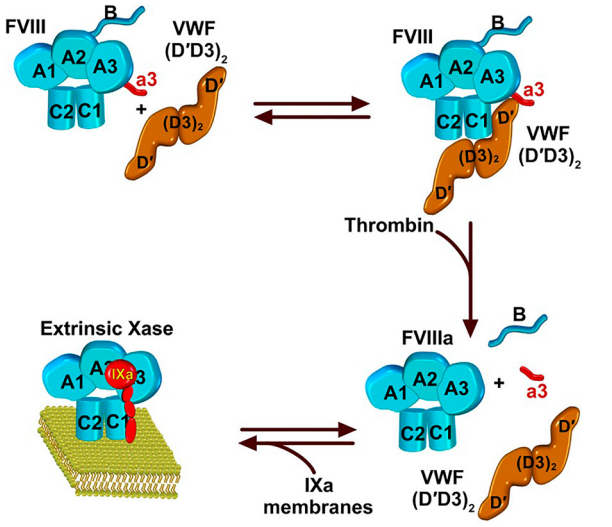

FIGURE 4

Interaction between factor VIII (FVIII) and von Willebrand factor (VWF). The binding of FVIII to VWF contributes in a major way to the regulation of hemostasis.Krishnaswamy S. FVIII-VWF dos-à-dos. *Blood*. 2015;126(8):923. https://doi.org/10.1182/blood-2015-06-652073. Republished with permission of the American Society of Hematology.

member is diagnosed.[4] Typical bleeding in VWD type 1 ranges from asymptomatic to serious bleeding, dependent on the degree of reduction in VWF levels. Most VWD type 1 cases involve mild to moderate mucocutaneous involvement.[4] Individuals with VWD type 2 and VWD3 commonly have severe bleeding.[4,8,9] Individuals with VWD3 have a combination of absent or very low VWF levels and reduced factor VIII levels, which results in significant bleeding when teeth erupt, minor childhood trauma when walking and crawling begin, or major life-threatening hemorrhage with menarche.[4]

Although acquired von Willebrand syndrome is rare, clinicians need to be aware that it occurs with some disease states and medications.[4,10] Conditions that commonly cause acquired von Willebrand syndrome in children are Wilms tumor, congenital heart disease, and autoimmunity.[4] Medications that have been linked to acquired von Willebrand syndrome include anticoagulants, antiplatelet agents, nonsteroidal anti-inflammatory drugs, glucocorticoids, antibiotics, alcohol, valproic acid, selective serotonin reuptake inhibitor medications, vitamin E, ciprofloxacin, hydroxyethyl starch, griseofulvin, and dextrans.[4]

Implications for Emergency Nurses

A gap in nursing education exists in the field of bleeding disorders and clotting disorders.[11] It is recommended that emergency nurse educators and administrators provide

TABLE 3
VWD patient and health care provider resources

Resource	Website address
Canadian Hemophilia Society	https://www.hemophilia.ca/von-willebrand-disease/
Centers for Disease Control and Prevention: Von Willebrand Disease	https://www.cdc.gov/ncbddd/vwd/index.html
A Guide for People Living with von Willebrand Disorder	https://www.haemophilia.org.au/HFA/media/Documents/von%20Willebrand%20Disorder/A-guide-for-people-living-with-von-Willebrand-disorder.pdf
Haemophilia Foundation Australia	http://www.haemophilia.org.au
The Haemophilia Society (United Kingdom)	http://www.haemophilia.org.uk
Humate-P health care professional site	https://www.humate-p.com/hcp
The National Organization for Rare Disorders	https://rarediseases.org/rare-diseases/von-willebrand-disease/
Vonvendi patient and health care provider resources	https://www/vonvendi.com/

VWD, von Willebrand disease.

evidence-based nursing education for all nurses to instill skills, knowledge, and confidence in treating bleeding disorders and clotting disorders.[11] Emergency nurses who have a gap in skills, knowledge, or confidence in the care of patients with bleeding disorders or clotting disorders should seek out evidence-based education themselves.

Emergency nurses who care for patients with VWD need to consider providing patient education before discharge. They must consider having an open dialogue with patients on their understanding of how to avoid known triggers for bleeding, treatment, and prevention measures. If any gaps in knowledge are identified, appropriate education should be provided. Medications to avoid that can affect blood clotting should be reviewed before discharge. Patients with VWD should avoid aspirin as well as medications that contain aspirin; blood-thinning medications that include warfarin and heparin; fish oil capsules with omega 3; and nonsteroidal anti-inflammatory medications (Centers for Disease Control and Prevention: Von Willebrand Disease Guidelines, Table 3). Encourage patients with VWD to consult their primary health provider to determine which vitamins are safe. The National Organization for Rare Disorders is an excellent resource for patients with VWD and their families (Table 3). Self-care educational recommendations to patients with VWD are to maintain adequate water intake, make healthy food choices, and keep an ideal body weight. Local and international resources provide information for health care providers and patients with VWD (Table 3).

Patients with VWD should be taught self-management strategies to promptly treat all bruises and bleeding. Standard first aid measures should be taught to patients and families with regard to any bleeding or bruising regarding applying pressure, elevation, or applying ice as indicated by their health care provider. The patient should be advised to sit upright, remain calm, and apply direct pressure on the bridge of the nose if a nosebleed occurs. Medical attention should be sought when patients with VWD have a nosebleed that is severe or one that does not stop after 20 to 30 minutes after applying pressure; blood in urine or stools; bleeding that lasts for hours or is excessive; broken bones; cuts that require stitches or will not stop bleeding; injury to the head; bleeding in joint or muscle; or severe pain (A Guide for People Living with von Willebrand Disorder, Table 3).

Conclusion

Every emergency health care organization should develop a multidisciplinary plan of care for patients who arrive with sudden atraumatic hemorrhage. Clinicians must consider undiagnosed, acquired, or inherited bleeding disorders and treat them accordingly. Health care providers who have access to appropriate intervention measures to control life-threatening hemorrhage would improve patient outcomes.[9,12] It should be standard practice for administrators of health care facilities to have Humate-P available in preparation for treatment for a life-threatening hemorrhagic event.[12]

Author Disclosures

Conflicts of interest: none to report.

Special thanks to Robert Strauss, DO, R2 Radiology Resident, Tufts Medical Center, who provided the descriptions for Figures 1, 2, and 3.

REFERENCES

1. Castaman G, Linari S. Diagnosis and treatment of von Willebrand disease and rare bleeding disorders. *J Clin Med*. 2017;6(4):45. https://doi.org/10.3390/jcm6040045
2. Gill JC, Castaman G, Windyga J, et al. Hemostatic efficacy, safety, and pharmacokinetics of a recombinant von Willebrand factor in severe von Willebrand disease. *Blood*. 2015;126(17):2038-2046. https://doi.org/10.1182/blood-2015-02-629873
3. *HUMATE-P. Package insert. Antihemophilic Factor/Von Willebrand Factor Complex (Human)*. Kankakee, IL: CSL Behring LLC; 2017.
4. Bharati KP, Prashanth UR. Von Willebrand disease: an overview. *Indian J Pharm Sci*. 2011;73(1):7-16. https://doi.org/10.4103/0250-474x.89751
5. Brady PC, Missmer SA, Laufer MR. Hepatic Adenomas in adolescents and young women with endometriosis treated with norethindrone acetate. *J Pediatr Adolesc Gynecol*. 2017;30(3):422-424. https://doi.org/10.1016/j.jpag.2016.12.002
6. Franchini M, Mannucci PM. Von Willebrand factor (Vonvendi©): the first recombinant product licensed for the treatment of von Willebrand disease. *Expert Rev Hematol*. 2016;9(9):825-830. https://doi.org/10.1080/17474086.2016.1214070
7. Topf HG, Strasser ER, Breuer G, Rascher W, Rauh M, Fahlbusch FB. Closing the gap – detection of clinically relevant von Willebrand disease in emergency settings through an improved algorithm based on rotational thromboelastometry. *BMC Anesthesiol*. 2019;19(1):10. https://doi.org/10.1186/s12871-018-0672-8
8. Ng C, Motto DG, Di Paola J. Diagnostic approach to von Willebrand disease. *Blood*. 2015;125(13):2029-2037. https://doi.org/10.1182/blood-2014-08-528398
9. Adjambri AE, Bouvier S, N'guessan R, et al. Discovery of Type 3 von Willebrand disease in a cohort of patients with suspected hemophilia A in Côte d'Ivoire. *Mediterr J Hematol Infect Dis*. 2020;12(1):e2020019. https://doi.org/10.4084/MJHID.2020.019. e2020019.
10. Kalot MA, Al-Khatib M, Connell NT, et al. For the VWD working group. An international survey to inform priorities for new guidelines on von Willebrand disease. *Haemophilia*. 2020;26(1):106-116. https://doi.org/10.1111/hae.13881
11. Lazure P, Munn J, Labbé S, et al. Education needs of nurses in thrombosis and hemostasis: an international, mixed-methods study. *Res Pract Thromb Haemost*. 2018;3(1):99-108. https://doi.org/10.1002/rth2.12155
12. Connell NT, Flood VH, Brignardello-Petersen R, et al. ASH ISTH NHF WFH 2021 guidelines on the management of von Willebrand disease. *Blood Adv*. 2021;5(1):301-325. https://doi.org/10.1182/bloodadvances.2020003264.

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Utility of the Emergency Severity Index by Accuracy of Interrater Agreement by Expert Triage Nurses in a Simulated Scenario in Japan: A Randomized Controlled Trial

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Abstract

Objective: The Emergency Severity Index (ESI) is a highly reliable and valid triage scale that is widely used in emergency departments in not only English language regions but also other countries. The Japan Triage and Acuity Scale (JTAS) is frequently used for emergency patients, and the ESI has not been evaluated against the JTAS in Japan. This study aimed to examine the decision accuracy of the ESI for simulated clinical scenarios among nursing specialists in Japan compared with the JTAS.

Method: A parallel group randomized trial was conducted. In total, 23 JTAS—trained triage nurses from 10 Japanese emergency departments were randomly assigned to the ESI or the JTAS group. Nurses independently assigned triage categories to 80 emergency cases for the assessment of interrater agreement.

Results: Interrater agreement between the expert and triage nurses was $\kappa = 0.82$ (excellent) in the ESI group and $\kappa = 0.74$ (substantial) in the JTAS group. In addition, interrater agreement by acuity was level 2 = 0.42 (moderate) in the ESI group and level 2 = 0.31 (fair) in the JTAS group. Interrater agreement for triage decisions was classified in a higher category in the ESI group than in the JTAS Scale group at level 2. Triage decisions based on the ESI in Japan maintained the same level of interrater agreement and sensitivity as those in other countries.

Conclusion: These findings suggest that the ESI can be introduced in Japan, despite its different emergency medical background compared with other countries.

Key words: Triage; Emergency department; Clinical decision rule; Nursing education; Vital signs

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J Emerg Nurs 2021;47:669–674.
Available online 27 April 2021
0099-1767

https://doi.org/10.1016/j.jen.2021.03.009

Introduction

BACKGROUND

In the field of emergency health care services, triage using a scale with reliability and validity is attracting attention to respond to the increasing number of emergency patients.[1-3] Among the existing triage scales, the Emergency Severity Index (ESI) is a highly reliable and valid system that is widely used in the emergency department in not only English language regions but also other countries.[4,5]

The advantages of using the ESI include the ability to assess patient acuity based on clinical reasoning and medical resources and to make decisions according to clear algorithms.[6,7] In addition, the ESI limits the acuity level for requesting vital signs, which reduces the time required for triage and contributes to prompt physician examinations.[8,9]

The Japan Triage and Acuity Scale (JTAS) was developed in Japan with reference to the Canadian Triage and

Acuity Scale.[10] However, the JTAS has not yet been widely adopted, and many emergency departments continue to use their own triage scale. In regard to the background of the emergency health care field in Japan, the concept of triage has a cultural connotation reminiscent of disasters, and ED triage has not yet become common.[11] In addition, the emergency health care system is also categorized into primary emergency (nonurgent, such as fever without medical history) to tertiary emergency (immediate, such as traffic injuries) according to the severity.[12] As a result, triage nurses have little chance to deal with patients of all acuities. Furthermore, the use of the JTAS requires specialized education, which takes effort in general hospitals. Few studies investigating triage scales, including the ESI, have been carried out in Japan.[13] Thus, emergency departments might not be interested in using a new triage scale. Therefore, it is important to discuss whether a triage scale more suitable for emergency clinical practice in Japan is needed.

OBJECTIVE

This study aimed to examine the decision accuracy of the ESI for simulated clinical scenarios among nursing specialists in Japan compared with the JTAS.

Methods

ETHICAL APPROVAL

This study was registered with the University Hospital Medical Information Network Clinical Trial Registry in Japan (000033519). The experimental protocol was approved by the ethics committee of the first author's university in Japan (approval no. 28-0314). All participants provided written, informed consent after receiving an explanation of the study purpose and procedures. The present study was conducted in accordance with the Consolidated Standards of Reporting Trials statement.

TRIAL DESIGN

This randomized, controlled trial was conducted using a parallel design. Randomization was carried out in a stratified manner. This study was conducted as a single-blind test in which the researcher was blinded to the group to which the participants were assigned. This study replicated the methods used by our previous study.[13]

Expert triage nurses were randomly assigned to the ESI or JTAS group according to a random allocation table prepared in advance in Microsoft Excel for Mac (version 16.44; Microsoft Japan Co Ltd, Tokyo, Japan).

PARTICIPANTS

The recruitment period for this study was 1 year from July 2018, and a request was sent to facilities with critical care centers in Japan. Sample size and power calculations were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan) software.[14] The sample size of 23 participants was identified to provide the study with power exceeding 80% to detect a noninferiority margin of 20% for levels of agreement between the ESI group and the JTAS group. This was based on an assumption of interrater agreement of 80% for our earlier study, allowing a 2-sided type 1 error rate of 5%.

OUTCOMES

Main Outcome

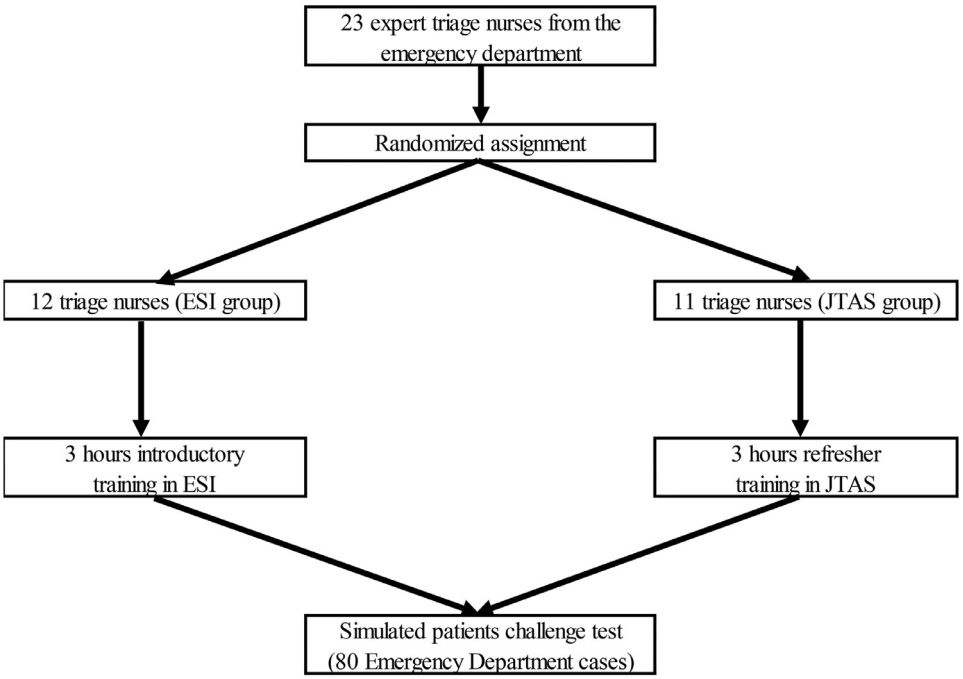
The main outcome in this study was interrater agreement regarding the accuracy of the ESI and the JTAS for triage decisions in simulated clinical scenarios based on the weighted kappa coefficient.

Subjective Evaluations in the Simulation Tasks

As a secondary outcome, subjective usability was evaluated using a 10-cm linear visual analog scale with no numerical range between not easy to use (0) and very easy to use (100).[15] The nurses assessed subjective usability by drawing a horizontal line on the visual analog scale. The time required to make a decision for the ESI and the JTAS was measured from the beginning to the end of each simulation task.

PROCEDURES

The intervention involved 23 nurses assigned to undergo 3 hours of clinical lectures and a simulated clinical test with 80 case scenarios collected prospectively from the ESI Handbook using either the ESI or the JTAS (Figure). Participants learned the triage tool in the 2 rooms, which were prepared for each of the 2 groups. They were instructed not to interact with each other until the test was completed. Regarding specific contents, the age, sex, chief complaint, vital signs, and pain scale were described for each patient, and the scenarios were selected in consideration of the degree of acuity and the characteristics of patients in Japan.[16] Regarding the response method for the task, the nurses were asked to rate the case from level 1 to level 5. The simulated patient task targeted all age groups and acuity levels. After answering all questions, the



FIGURE

The flowchart shows the flow of patient allocation and the research intervention in each group. ESI, Emergency Severity Index; JTAS, Japan Triage and Acuity Scale; ED, emergency department.

intervention was completed by filling out the survey form when returning the test.

STATISTICAL METHODS

All data were analyzed using SPSS (version 24.0; SPSS Japan, Inc, Tokyo, Japan). Interrater agreement was measured using the weighted kappa coefficient for multiple raters. The interrater agreement between expert triage nurses was evaluated using Cohen's kappa coefficient.[17] Many previous studies also used Cohen's weighted kappa coefficient, so this study's results could be compared more effectively using this as an index of interrater agreement.[7,10,13,18] Interrater agreement regarding categorization of acuity levels for the evaluation within each group was evaluated using Fleiss' kappa coefficient.[19] Each of the kappa coefficients was interpreted using conventional standards.[20] The 95% CIs and categories are shown for each measurement. Categorical data are shown as percentages in addition to the values used to calculate the percentages. All data are presented as mean (SD). The participants' characteristics were analyzed using descriptive statistics. In addition, the rates of over-triage (OT) and under-triage (UT) were calculated according to the results of interrater agreement. Sample characteristics, usability, and decision time were analyzed using the Mann-Whitney *U* test. The criterion for significance was set at 0.05.

Results

PARTICIPANTS AND GROUP DIFFERENCES

In total, 23 triage nurses were recruited from 10 emergency departments in Japan (ESI = 12, JTAS = 11). This study was limited to registered nurses with specialized knowledge to adjust for the background of the participants. All nurses were clinical specialists, such as a certified nursing specialists and nurse practitioners, who belonged to a hospital emergency department and routinely used the JTAS to assess ED patients in a clinical setting in Japan. All nurses had 10 to 20 years of work experience in the emergency department and 4 to 10 years of experience using the JTAS. No significant differences in age (mean (SD); ESI = 35.5 (5.4) years vs JTAS = 35.4 (4.6) years, $P = .75$), years of nursing (ESI = 13.8 (3.1) vs JTAS = 14.3 (2.7), $P = .69$), years working in the emergency department (ESI = 9.2 (3.9) vs JTAS = 6.8 (41.7), $P = .10$), or years of experience in triage (ESI = 4.7 (0.9) vs JTAS = 4.3 (1.1), $P = .32$) were found between the 2 groups.

INTERRATER AGREEMENT BETWEEN EXPERT TRIAGE NURSES

This study was conducted on 23 clinical specialist nurses. The interrater agreement between expert triage nurses was $\kappa = 0.82$ (excellent) in the ESI group and $\kappa = 0.74$ (substantial) in the JTAS group (Table 1). In addition, the UT and OT rates were 20.3% and 14.8%, respectively, in the ESI group and 30.3% and 16.7%, respectively, in the JTAS group.

INTERRATER AGREEMENT BY ACUITY CATEGORY

Interrater agreement by acuity is shown in Table 2. The results showed that the ESI scale was associated with higher agreement than the JTAS.

USABILITY AND DECISION TIME BY TRIAGE SCALE

No significant differences by triage scale were found between the 2 groups with respect to usability (mean ± SD; ESI = 6.6 ± 1.9 vs JTAS = 6.4 ± 2.0, $P = .95$) or decision time (ESI = 68.5 ± 22.6 seconds vs JTAS = 73.3 ± 26.1 seconds, $P = .67$).

TABLE 1
Cohen's kappa coefficient of interrater agreement between expert triage nurses for the evaluations in the 2 triage groups

Triage tool	Cohen's κ (95% CI)	Category
ESI group (n = 12)	0.82 (0.80-0.85)	Excellent
JTAS group (n = 11)	0.74 (0.70-0.77)	Substantial

ESI, Emergency Severity Index; JTAS, Japan Triage and Acuity Scale.

Discussion

This study investigated interrater agreement of the accuracy of decisions by expert triage nurses in simulated clinical scenarios for the ESI and the JTAS. The results showed that the ESI scale was associated with higher agreement than the JTAS. In addition, the interrater agreement for triage decisions was classified into a higher category in the ESI than in the JTAS group at level 2. Furthermore, significant differences were seen in the rates of UT and OT between the 2 groups ($P < .01$); this finding was in line with a previous study comparing the use of the ESI and the JTAS by competent nurses.[13] Similarly, another study of the ESI reported excellent interrater agreement between triage nurses in clinical patients.[18] A meta-analysis regarding the ESI also showed similar interrater agreement to that seen in the present study.[21]

In the concept of triage, level 2 is the most important criterion for identifying patients who require immediate medical attention.[6] In the case of level 2 or higher acuity, patients should enter the examination room without waiting, but in level 3 or lower, there is waiting time in the emergency department. Patients who are not correctly assigned by this criterion have to wait a long time for a medical examination despite having a high acuity, and there are risks that their condition might worsen, the waiting time might change suddenly, or the clinical outcome might be affected.[6] Compared with the JTAS, the ESI had superior overall interrater agreement, more accuracy in terms of patient acuity groups, and lower rates of UT and OT. UT causes patients to wait unnecessarily for a medical examination, which causes a worsening medical condition. OT causes patients with less urgent issues to occupy the examination area, which causes problems for the entire emergency outpatient department.[6] Therefore, the ESI has excellent interrater agreement for triage decisions for patients who require a prompt medical examination and

TABLE 2
Fleiss' kappa coefficient of the interrater agreement by acuity for the evaluation in the 2 triage groups

Rating category	ESI (n = 12)		JTAS (n = 11)	
	κ (95% CI)	Category	κ (95% CI)	Category
1	0.67 (0.65-0.70)	Substantial	0.68 (0.66-0.72)	Substantial
2	0.42 (0.39-0.45)	Moderate	0.31 (0.28-0.34)	Fair
3	0.38 (0.36-0.41)	Fair	0.25 (0.22-0.28)	Fair
4	0.31 (0.29-0.34)	Fair	0.25 (0.22-0.28)	Fair
5	0.57 (0.54-0.59)	Moderate	0.53 (0.50-0.56)	Moderate

ESI, Emergency Severity Index; JTAS, Japan Triage and Acuity Scale.

can accurately determine patients with high acuity. The ESI with its higher agreement could contribute to the prevention of a worsening medical condition for patients who are critically ill because it would not force patients with high acuity to wait unnecessarily.

The findings of this study also showed that triage decisions based on the ESI maintain the same levels of sensitivity and agreement among evaluators in Japan as those in countries that commonly use the ESI. The ESI has shown high interrater agreement among triage nurses and emergency physicians in clinical patients in Iran.[22] Grossmann et al[5] reported excellent interrater agreement for the ESI when translated into German. In addition, a study conducted in the Netherlands reported that ESI decisions accurately reflected patient acuity and were highly sensitive for identifying patients unlikely to require admission.[23] Therefore, the ESI can also be plausibly used in Japan, where English is not the official language.

Limitations

This study involved an educational intervention for nurses who already had knowledge of the triage system; it was conducted in a single-blind rather than a double-blind fashion. In addition, this study was limited to clinical specialist nurses, making it difficult to generalize the findings to all nurses. In addition, this was a simulation study, not with real patients, and the number of observers was small. The sample size was smaller than expected, but the number of people gathered was about the same as in previous studies.[7,13,18,22] Furthermore, no significant differences in usability or decision time were found between the 2 groups by triage tool. Because a simulated patient task was used in this study, it can be inferred that it was practically difficult to reflect the total time required for the procedure, including vital sign measurements and examinations/treatments. Therefore, future studies should carry out prospective research that more faithfully reproduces clinical triage scenes and the patient's duration of stay after presenting in the emergency department. The trial protocol was not registered.

Implications for Emergency Nursing

The ESI may be used in the Japanese emergency department. In addition, this triage scale has higher interrater agreement for level 2 than the JTAS currently in use, and this could lead to prompt medical examination. In addition, triage decisions made based on the ESI appear to contribute to the prevention of a worsening medical condition for patients who are critically ill. Thus, the ESI could be expected to lead to reliable triage decisions by emergency nurses.

Conclusions

The results of this study indicated that the ESI has good agreement at the most important triage level (level 2). In addition, this scale is less likely to generate OT/UT. Furthermore, the ESI can be used in Japan, despite the different background characteristics of the emergency health care system. Therefore, introducing the ESI to the triage system could be expected to contribute to a better understanding of triage decisions in Japanese clinical emergency departments.

Author Disclosures

Conflicts of interest: none to report.

This work was supported by Japan Society for the Promotion of Science Grant-in-Aid for Early- Career Scientists (grant no. JP 18K17541). The study sponsor did not have any role in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit the manuscript for publication.

REFERENCES

1. Iserson KV, Moskop JC. Triage in medicine, part I: concept, history, and types. *Ann Emerg Med*. 2007;49(3):275-281. https://doi.org/10.1016/j.annemergmed.2006.05.019
2. Rowe BH, Villa-Roel C, Guo X, et al. The role of triage nurse ordering on mitigating overcrowding in emergency departments: a systematic review. *Acad Emerg Med*. 2011;18(12):1349-1357. https://doi.org/10.1111/j.1553-2712.2011.01081.x
3. Christ M, Grossmann F, Winter D, Bingisser R, Platz E. Modern triage in the emergency department. *Dtsch Arztebl Int*. 2010;107(50):892-898. https://doi.org/10.3238/arztebl.2010.0892
4. Tanabe P, Gimbel R, Yarnold PR, Kyriacou DN, Adams JG. Reliability and validity of scores on the Emergency Severity Index version 3. *Acad Emerg Med*. 2004;11(1):59-65. https://doi.org/10.1197/j.aem.2003.06.013
5. Grossmann FF, Nickel CH, Christ M, Schneider K, Spirig R, Bingisser R. Transporting clinical tools to new settings: cultural adaptation and validation of the Emergency Severity Index in German. *Ann Emerg Med*. 2011;57(3):257-264. https://doi.org/10.1016/j.annemergmed.2010.07.021
6. Gilboy N, Tanabe P, Travers D, Rosenau AM. *Emergency Severity Index (ESI): A Triage Tool for Emergency Department.* Emergency Nurses Association. Published 2020. Accessed February 15, 2021; https://www.ena.org/docs/default-source/education-document-library/esi-implementation-handbook-2020.pdf?sfvrsn=fdc327df_2
7. Worster A, Gilboy N, Fernandes CM, et al. Assessment of inter-observer reliability of two five-level triage and acuity scales: a randomized

controlled trial. *CJEM*. 2004;6(4):240-245. https://doi.org/10.1017/s1481803500009192
8. Wuerz RC, Travers D, Gilboy N, Eitel DR, Rosenau A, Yazhari R. Implementation and refinement of the emergency severity index. *Acad Emerg Med*. 2001;8(2):170-176. https://doi.org/10.1111/j.1553-2712.2001.tb01283.x
9. Lauks J, Mramor B, Baumgartl K, Maier H, Nickel CH, Bingisser R. Medical team evaluation: effect on emergency department waiting time and length of stay. *PLoS One*. 2016;11(4):e0154372. https://doi.org/10.1371/journal.pone.0154372
10. Hamamoto J, Yamase H, Yamase Y. Impacts of the introduction of a triage system in Japan: a time series study. *Int Emerg Nurs*. 2014;22(3):153-158. https://doi.org/10.1016/j.ienj.2013.10.006
11. Japanese Society for Emergency Medicine. Urgency judgment support system. Accessed February 17, 2021. https://jsem.me/training/ctas.html
12. Kasagi M, Ohtomo Y, Kawahara K. Analysis of the diversity and problems of the emergency medical system in Japan: from the viewpoint of a comparison with the North American ER system. *Nihon Kyukyu Igakukai Zasshi*. 2009;20(7):349-360. https://doi.org/10.3893/jjaam.20.349
13. Takaoka K, Yamanaka Y, Yamana H, Matsunaga N, Ono M, Kakeda T. Utility of the Emergency Severity Index for urgent decision accuracy by triage nurses in a simulated scenario in Japan: a randomized controlled trial. *J Jpn Soc Emerg Med*. 2019;22(6):753-760. https://doi.org/10.11240/jsem.22.753
14. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. *Bone Marrow Transplant*. 2013;48(3):452-458. https://doi.org/10.1038/bmt.2012.244
15. Aitken RC. Measurement of feelings using visual analogue scales. *Proc R Soc Med*. 1969;62(10):989-993.
16. Japanese Society for Emergency Medicine. *Emergency Severity Index (ESI)* triage tool of emergency department. Version 4. Tokyo: Herusu Shuppan; 2017.
17. Sim J, Wright CC. The kappa statistic in reliability studies: use, interpretation, and sample size requirements. *Phys Ther*. 2005;85(3):257-268. https://doi.org/10.1093/ptj/85.3.257
18. Baumann MR, Strout TD. Evaluation of the Emergency Severity Index (version 3) triage algorithm in pediatric patients. *Acad Emerg Med*. 2005;12(3):219-224. https://doi.org/10.1197/j.aem.2004.09.023
19. Fleiss JL. Measuring nominal scale agreement among many raters. *Psychol Bull*. 1971;76(5):378-382. https://doi.org/10.1037/h0031619
20. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159-174. https://doi.org/10.2307/2529310
21. Mirhaghi A, Heydari A, Mazlom R, Hasanzadeh F. Reliability of the emergency severity index: meta-analysis. *Sultan Qaboos Univ Med J*. 2015;15(1):e71-e77. PMID: 25685389; PMCID: PMC4318610.
22. Jafari-Rouhi AH, Sardashti S, Taghizadieh A, Soleimanpour H, Barzegar M. The Emergency Severity Index, version 4, for pediatric triage: a reliability study in Tabriz Children's Hospital, Tabriz, Iran. *Int J Emerg Med*. 2013;6(1):36. https://doi.org/10.1186/1865-1380-6-36
23. Elshove-Bolk J, Mencl F, van Rijswijck BTF, Simons MP, van Vugt AB. Validation of the Emergency Severity Index (ESI) in self-referred patients in a European emergency department. *Emerg Med J*. 2007;24(3):170-174. https://doi.org/10.1136/emj.2006.039883

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