

advancing the art & science of medicine in the midwest

**WMMJ**

2024 • volume 123 • issue 2

*Silent Generation*  
Baby Boomers  
Generation X  
Generation Z  
Millennials



**caring for patients through  
the lens of generational understanding**

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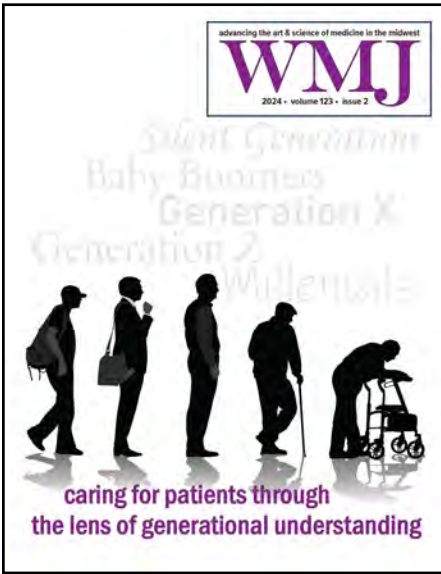
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Volume 123 • Issue 2 • 2024

# WMJ

advancing the art & science  
of medicine in the midwest

## COVER THEME

### Caring for Patients Through the Lens of Generational Understanding

*From the Silent Generation to Generation Z and each generation in between, patients have unique preferences, communication styles, and health beliefs. The editorial in this issue of WMJ breaks down these generational attributes and suggests that understanding them is essential for patient satisfaction and improved health outcomes.*

Cover design by Kendi Neff-Parvin

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The mission of WMJ is to provide an opportunity to publish original research, case reports, review articles, and essays about current medical and public health issues. WMJ is published through a partnership between the Medical College of Wisconsin and the University of Wisconsin School of Medicine and Public Health.

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## Caution Urged Regarding Role of Free Clinics in US

Dear Editor:

The commentary in the latest issue of the *WMJ* by Zellmer et al<sup>1</sup> discussing the possible role of free clinics in health care in the United States should raise a number of cautions. There are certainly free clinics, such as the St Clare Health Mission, which are staffed, designed for continuity of care and partnering with health systems in the region to provide referrals and follow-up. They do serve a useful, but limited role in health care. However, experience with free clinics, particularly those run or staffed by medical and other health sciences students who change frequently, may represent a failure of good intentions unless the clinic leadership takes responsibility to assure continuity of care and have guaranteed arrangements to get patients additional care as needed.

As the authors point out, chronic disease is a burden for many low-income Americans, and free clinics are often not helpful in treating chronic illnesses. They have records that are not available when patients show up in emergency departments or urgent care centers, and often confuse patients more than help them. A few centers, such as Bread of Life and Walker's Point Health Center sponsored by Aurora Health Care in Milwaukee are examples of clinics that provide chronic care management and social services for uninsured patients. But they also strive to get patients insurance access and assignment to a primary care medical home as part of their mission.

Well-meaning free clinics that cannot assure continuity and arrange secure handoffs to community health centers or other sources of care or guarantee access to consultants and testing as needed do not help the safety net or patients. I worked as a student and resident in free clinics in Chicago, but the community itself ran the clinic and took responsibility for the process of care. We as volunteers played specific roles.

Many services for unhoused people, immigrants and refugees, and the working poor are embedded in public health or teaching programs but remain the responsibility of all health systems in a state as well-endowed as Wisconsin. In the end, working for universal coverage in our state and country is what is needed.

—John J. Frey, III, MD

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## Mitigating Burnout Imperative for Retention of Hospitalists

Dear Editor:

We were interested to read the article by Vazirnia et al, "Perception of Burnout and Its Impact on Academic Hospitalists During COVID-19 and Institutional Strategies to Combat Burnout and Improve Wellness."<sup>1</sup> The authors surveyed academic hospitalists on their perceived contributions to burnout, strategies to mitigate burnout in academic medicine, and the impact of COVID-19. Some of the perceived contributions to burnout for hospitalists included high workload, bureaucratic hurdles, extensive documentation, and lack of control over administrative decisions. Suggestions to mitigate burnout included improving open communication between leaders and clinicians and providing opportunities for social gatherings within and outside of work. One of the most important strategies was "to increase social interactions to foster a sense of community."<sup>1</sup>

Survey participants' focus on community building highlights their need for belonging. Belonging has been defined as, "everyone is treated and feels like a full member of the larger community and can thrive."<sup>2</sup> In medicine, belonging has been associated with increased physician retention.<sup>2</sup> In one study, women clinicians who reported a higher sense of belonging were less likely to leave their institution within 2 years.<sup>2</sup> Retention is critical for the sustainability of the physician workforce and the financial health of the institution. Attrition is costly; the direct and indirect costs have been estimated to range from \$250,000 to \$1 million, where the variability is dependent on specialty and other factors.<sup>2</sup> If creating a work environment that fosters belonging increases physician retention, then hospitals and other health care organizations have a compelling reason to invest in efforts that improve physician belonging.

Solutions are imperative—especially given the high levels of burnout in hospital medicine and the current inpatient workforce shortages<sup>1</sup>—and should focus on mitigating burnout, enhancing community, and facilitating communication. Previous suggestions to foster workplace belonging include empowering professional thriving.<sup>2</sup> For academic hospitalists, this may include streamlined clinical care, support for career advancement, and promoting open, effective, and safe communication.<sup>3</sup> These strategies are aligned with the initiatives suggested by Vazirnia et al, which may not only decrease burnout but also promote belonging and retention. As we continue to evaluate burnout, we should consider the topic of belonging and its potential benefits on physician burnout and hospital retention.

—Amarilis A. Martin, MD; Adaira Landry, MD, MEd; Meridith Englander, MD; Jessica M. Allan, MD

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Fahad Aziz, MD, FASN

## Compassionate Care Through the Lens of Generational Understanding

Fahad Aziz, MD, FASN; *WMJ* Editor-in-Chief

The bond between a patient and their clinician is a crucial aspect of effective medical care. It goes beyond just the medical information in patient records and requires a deep understanding and empathy for the person behind the patient. In the world of health care, this understanding is the key to forming a partnership that not only prioritizes top-notch care but also values the human connection.

In previous editorials, I have discussed the essential principles that make up the patient-provider relationship.<sup>1-3</sup> Building on that foundation, I want to emphasize the significance of being sensitive to different generations when it comes to establishing meaningful connections with patients. Recognizing the unique preferences, communication styles, and health beliefs of each generation—from the Silent Generation to the Zoomers—is not only a professional courtesy but also a key factor in achieving exceptional patient satisfaction and health outcomes. Let's take a quick look at the different generations (Figure) and how medical providers can adapt to each one.

• • •

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### Silent Generation

The Silent Generation, born during 1928 to 1945, is known for its cautiousness, adherence to tradition, and discipline. Growing up during times of conflict and financial hardship, these patients were taught to be observant but reserved. As a result, they highly value hard

work, loyalty, and respect for authority. When it comes to communication, they prefer direct, face-to-face interactions and the formality of written letters. While they have adapted to digital communication, they still prefer traditional methods.<sup>4</sup> For clinicians, effectively engaging with this generation means using respectful and personal communication, addressing them by formal titles, and providing detailed and easy-to-understand medical explanations. It is important to be patient, as this group may need more time to process information and make health care decisions. A respectful and authoritative approach can help build trust and rapport with patients from the Silent Generation.

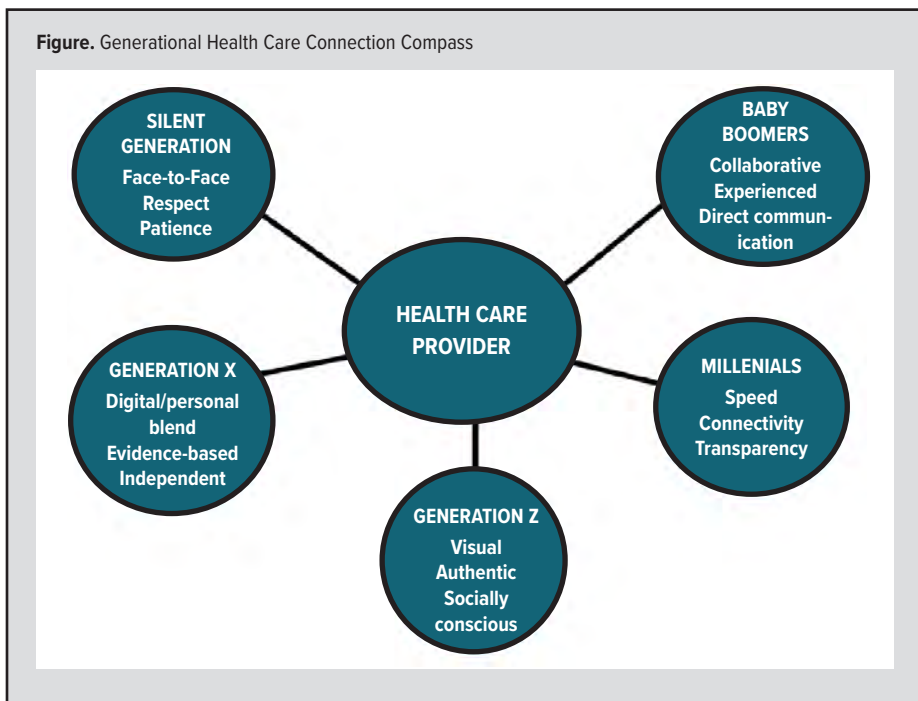
### Baby Boomers

The generation of Baby Boomers, born during 1946 to 1964, grew up during a time of great social change and economic prosperity. They are known for their strong work ethic and independence, and they highly value self-fulfillment. Compared to previous gen-

erations, they are more open to change and appreciate clear and direct communication. They enjoy in-depth discussions that allow for their input and questions. While they are comfortable with technology and use email and other digital methods of communication, they also value personal interaction and the reassurance that comes with face-to-face conversations.<sup>5</sup> For clinicians, it is important to recognize the Baby Boomers' desire for collaboration in their health care decisions. It is crucial to offer them detailed information and options, while also showing respect for their experience and knowledge. Maintaining a personal and engaging approach can help foster a collaborative and trusting relationship between patient and doctor.

We don't just treat illnesses; we care  
for individuals, each with their own personal  
stories and backgrounds that shape their  
approach to health and well-being.

Figure. Generational Health Care Connection Compass



## Generation X

The generation known as Generation X, born from 1965 through 1980, grew up during a time of new technology and changes in the economy. They are known for being adaptable, independent, and skeptical, with a do-it-yourself mindset shaped by the shift from traditional to digital media. Gen Xers are practical and resourceful, having experienced both economic booms and downturns. In communication, they value honesty and efficiency and are comfortable with both digital and face-to-face interactions.<sup>6</sup> When interacting with Gen X patients, clinicians should be ready to give evidence-based explanations and respect these patients' tendencies to do their own research. Combining a personal touch with the convenience of modern technology—like online health portals—is likely to resonate with this self-sufficient but tech-savvy generation, promoting a cooperative and well-informed health care experience.

## Millennials

Millennials, those born between 1981 and 1996, are the first generation to grow up with technology at their fingertips. They value a healthy work-life balance, prioritize social responsibility, and are known for their positive outlook and desire for collaborative experiences. When

it comes to health care, Millennials expect convenience, quick service, and transparency. They prefer to communicate through digital channels, such as email, text messaging, or online patient portals, and appreciate the ability to access health information and services electronically.<sup>7</sup> Health care providers should offer a combination of technology-based solutions and personal engagement to ensure easy access to health resources and maintain open, two-way communication. By recognizing their desire for active involvement in their health decisions, clinicians can build trust with Millennials by involving them in the treatment process and respecting their informed perspectives and research.

## Generation Z

Generation Z, typically recognized as those born from 1997 to 2010, is the most internet-fluent generation, having been exposed to advanced technology and social media from a young age. They prioritize individuality, diversity, and inclusivity, and they are known for their entrepreneurial spirit and pragmatic outlook, shaped by growing up during a time of global unrest and economic instability. In terms of communication, Gen Z favors quick and visual methods, such as messaging apps and video content, and expects on-demand

access to information.<sup>8</sup> For health care providers to effectively connect with Gen Z, it is important to offer a tech-forward approach that respects their digital savvy and preference for self-service options, like online appointment scheduling and telehealth consultations. Clinicians also should recognize Gen Z's desire for authentic, transparent communication and social consciousness in their health care choices, ensuring engagement strategies are as modern and forward-thinking as they are.

In summary, understanding the differences between generations goes beyond just engaging with patients—it is a journey towards providing compassionate care. By embracing the unique ways each generation communicates, their beliefs, and expectations, health care professionals can break through traditional boundaries in medicine. We don't just treat illnesses; we care for individuals, each with their own personal stories and backgrounds that shape their approach to health and well-being. As clinicians become more aware of generational sensitivity, we can create a health care system that is not only effective but also deeply empathetic and in tune with the human heart. Let's continue to listen, learn, and connect across all ages, because it is in the symphony of generational voices that true healing harmony can be found.

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# The Art of Peer Review

David C. Mallinson, PhD; Corlin Jewell, MD; Fahad Aziz, MD

The main purpose of a scientific journal is to share research findings, progress in the field, and general information with the public. This means that journals have a responsibility to vet manuscripts for their accuracy, thoroughness, and significance. Consequently, academic peer reviewers play a vital role in this process by evaluating the suitability of manuscripts for publication.

Being a peer reviewer is a shared responsibility in the academic community. However, there is often a lack of formal guidance or training on how to review a manuscript.<sup>1,2</sup> Sometimes, reviewers are unsure how to evaluate a manuscript or write their feedback. This can lead to authors receiving unhelpful or biased feedback, and journal editors may struggle with deciding whether to publish a manuscript with inadequate or unreliable

• • •

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reviews. This means that a manuscript might be published despite significant shortcomings that undermine the manuscript's integrity. On the other hand, high quality papers may be unjustly rejected for insufficient reasons. Thus, it is important to give reviewers guidance on

committing to reviewing a manuscript, there are 3 criteria that you should meet (Figure).

First, it is critical to assess whether you have a conflict of interest, which can compromise the objectivity of your evaluation. The International Committee of Medical Journal Editors defines

**Being a peer reviewer is a shared responsibility in the academic community. However, there is often a lack of formal guidance or training on how to review a manuscript.**

evaluating manuscripts for publication.

This editorial is a brief manual on peer-reviewing a manuscript for scientific journals. It consists of 5 sections: (1) making the decision to review a manuscript, (2) evaluating the manuscript, (3) composing the review report, (4) handling revisions, and (5) additional essential considerations. While we designed this guide explicitly for reviewing original research articles and brief reports for the *Wisconsin Medical Journal (WMJ)*, the principles can be broadly applied.

## How to Decide if You Should Review a Manuscript

The initial stage of the peer review process may seem obvious, but it is still crucial: determining whether to review a manuscript. Before you

a conflict of interest as a situation where your professional judgment on a primary interest, like reviewing a manuscript, might be swayed by a secondary interest.<sup>3</sup> This could be a financial interest, such as owning stock in a company whose product is being studied, or a non-financial one, like a close association with one of the authors. Remember, even the perception of a conflict is significant, as it can compromise the reviewer's impartiality.

Next, ensure that you possess the expertise to critique the manuscript. A peer reviewer should be able to understand, evaluate, and provide well-founded feedback on a manuscript. Someone not versed in the specific topic or the broader academic context is unlikely to perform effectively in this role. However, being an expert in every aspect of the research isn't



**Table 1.** Examples of Possible Major or Minor Comments for a Hypothetical Manuscript Under Review at the *Wisconsin Medical Journal*

Consider a hypothetical study that estimates the effect of a Medicaid-funded pregnancy care coordination program on the risk of having a low birth weight infant (<2500 grams). This is a retrospective cohort study with linked birth records and Medicaid insurance claims from Wisconsin. The authors hypothesized that the program would significantly reduce the risk of low birth weight. Correspondingly, results from a regression analysis indicate that program participation is associated with a reduced risk of low birth weight. In this scenario, assume that all comments accurately reflect the manuscript.

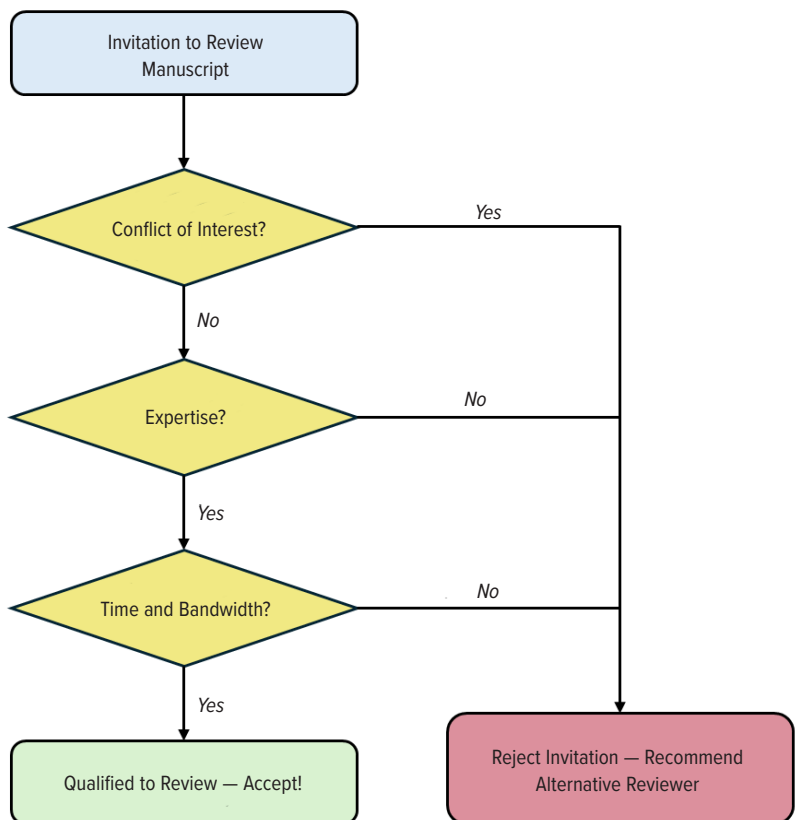
Comment	Major or Minor?	Rationale
“The authors do not describe the specific services in the pregnancy care coordination program, so it is uncertain how the program would affect the infant’s birth weight.”	Major (reconcilable)	The authors cannot sufficiently justify their study hypothesis without a description of program services. The authors can reasonably correct this weakness by describing the program’s services and how those services intervene in risk factors for low birth weight. This also may require reading and citing additional literature.
“The sample excludes infants who are born with very low birth weight (<1500 grams).”	Major (not reconcilable)	The estimates are prone to selection bias because the authors restricted their sample on the outcome (birth weight). <sup>4</sup> Thus, we cannot reasonably assume that the study’s results are valid.
“There was a recent published study of a pregnancy care coordination program in another state, and the results suggest that program participation reduced the risk of preterm birth (gestational age <37 weeks). This study is not cited in the manuscript.”	Minor	This is a potentially relevant study, and the authors can quickly read the study and decide whether to cite it in their manuscript.
“The sample only includes singleton-born infants, so it is uncertain if the results apply to deliveries that result in plural-born infants (eg, twins).”	Minor	The results in their current state are likely sound, as plural births account for a small percentage of deliveries. Nonetheless, the point is salient, and the authors can easily address this by re-running the regression analysis with plural births.
“The study does not consider infant mortality (death within the first year of life) as an outcome, which may be a more relevant metric for assessing maternal and infant health in a population.”	Not applicable	Whether infant mortality is a more relevant metric than low birth weight is subjective. Regardless, this does not undermine the validity, generalizability, or usefulness of the study. This comment should not be included in the review.

required. For instance, some reviewers bring deep knowledge of the subject matter, while others contribute as methodologists or statisticians.

Lastly, you should have the time and attention to devote to review a manuscript. Reviewing thoroughly and providing constructive feedback is a time-consuming task. The *WMJ* allows a generous 21-day period for completing a review. This ensures that reviewers can be meticulous without rushing, and authors receive timely feedback on their submissions.

Suppose that you are invited to review a manuscript and meet the criteria: no conflicts of interest, the right expertise, and sufficient time. In that case, you are well-positioned to be a peer reviewer, and we encourage you to accept the task. If not, it is best to decline the invitation. Remember that your suitability as a reviewer may differ from one case to another. If you decline, the editors will appreciate suggestions for other potential reviewers and their contact information.

**Figure.** Flow Diagram on Deciding Whether to Review a Manuscript for a Scientific Journal



**Table 2.** Examples of Possible Reviewer Recommendations for a Hypothetical Manuscript Under Review at the *Wisconsin Medical Journal*

Reconsider a hypothetical study that estimates the effect of a Medicaid-funded pregnancy care coordination program on the risk of having a low birth weight infant (<2500 grams). This is a retrospective cohort study with linked birth records and Medicaid insurance claims from Wisconsin, and results from a regression analysis indicate that program participation is associated with a reduced risk of low birth weight. In this scenario, assume that the only problem with the manuscript is that the regression model may require additional control variables.

Recommendation	Actionable or Specific?	Rationale
“The authors should modify the regression model to improve the validity of the estimate.”	Neither actionable nor specific	This recommendation is not specific because it does not provide clear guidance on altering the regression model, nor does it explain why the model is invalid. Further, this recommendation is not actionable, as regressions can be modified in several ways (eg, regression type, control variables, modelling specification, sample stratification, etc).
“The authors should control for birth record variables that confound the causal pathway between pregnancy care coordination and the infant’s birth weight.”	Actionable but not specific	This recommendation is actionable because regression analysis permits controlling for variables and because the authors have birth record data. However, the recommendation is not specific because it does not suggest candidate variables for regression controls, nor does it state why authors should control for these variables.
“The authors should control for maternal polygenic risk scores of health risk behaviors, which are likely associated with the likelihood of participating in pregnancy care coordination programs and with the risk of delivering a low birth weight infant. This will reduce confounding bias in regression estimates.”	Specific but not actionable	This recommendation is specific because it clearly states that the authors should control for polygenic risk scores and that controlling for polygenic risk scores will reduce confounding bias in estimates. However, the recommendation is not actionable as birth records and Medicaid claims do not include genetic data.
“The authors should control for maternal age in their regressions, as maternal age is likely associated with pregnancy care coordination receipt and the risk of low birth weight delivery. Controlling for maternal age will yield more valid estimates by preventing bias from confounding.”	Actionable and specific	This recommendation is specific because it clearly states and justifies controlling for maternal age in the regression, and the recommendation is actionable because maternal age is available on birth records.

### How to Evaluate a Manuscript

After agreeing to review a manuscript, you will receive the entire manuscript, including any additional materials. Reading and evaluating the manuscript is a demanding but crucial process. We offer guidelines to help you prepare for a detailed and practical review.

Begin by reading the manuscript multiple times, paying close attention to every section, from the title and abstract to the appendices. Academic journals like the *WMJ* often feature complex studies that require in-depth reading for complete comprehension. As you read, take notes on critical aspects of the paper: the research question’s clarity, the thoroughness and relevance of the literature review, the description of data acquisition and analytical methods, and the interpretation of results within the broader context of research, practice, and policy. Additionally, consider attributes that are missing from the paper (eg, an undetailed description of the methods that would preclude a replication of the study). Your insights into these omissions will contribute to a more constructive review.

Next, classify your notes as either “major” or “minor” comments. Major comments are essen-

tial queries or critiques that address the manuscript’s readiness for publication or point out fundamental flaws that might prevent publication as it currently stands. These could relate to unclear elements that could be clarified within a short timeframe or to deep-seated issues requiring substantial modification to the study. On the other hand, minor comments suggest improvements that, while helpful, are not critical to the manuscript’s readiness for publication and its contribution to the scientific literature. These might include expanding on a study procedure or adding a pertinent reference. Ensure your feedback aligns with the manuscript’s goals, avoiding suggestions that would alter the research question or fundamental methodology. Your comments should enhance the authors’ work rather than reflect a different vision for the study.

The distinction between “major” and “minor” comments and the significance of each relies on the expert opinion of the reviewers. These assessments determine how much a comment impacts the manuscript’s overall integrity and suitability for publication. For illustration, Table 1 lists examples of major and minor comments using a hypothetical study

investigating the effects of a pregnancy care coordination program on birth weight.

### How to Write the Review

You can compose your review after carefully reading the manuscript and preparing your feedback. Start with a summary paragraph: first, describe the manuscript and its key findings or messages in 1 to 3 sentences. Then, in another 1 to 3 sentences, outline your general assessment and any major concerns, including a publication recommendation if the journal’s policy allows it—as the *WMJ* does.

Structure the main part of your review with 2 clearly defined sections: major comments and minor comments. Use headers for clarity and present each point separately, possibly as bullet points or individual paragraphs, to enhance readability. When referencing specific parts of the manuscript, include page and line numbers. A clear and concise rationale should accompany each comment.

Consider a hypothetical trial on the medication Drug X for reducing blood pressure among adults with chronic hypertension. Let us assume that the manuscript omits the inclusion and exclusion criteria for participants. This is a

significant oversight and should be highlighted as a major comment. A weak comment would simply identify the omission. A good comment would explain how this lack of detail hampers the study's external validity and replication, for example:

"Page 4, Lines 11-17: The authors did not list their inclusion and exclusion criteria. This makes it difficult to evaluate the generalizability of the findings, as we do not know the characteristics of the study sample, and the estimated effect of Drug X on blood pressure may not apply to other patient populations. Additionally, this omission hinders study replication, so other researchers cannot build upon these results."

If you suggest a revision, your recommendation should be actionable and specific. Reconsidering the hypothetical study on Drug X and blood pressure, an example of an actionable and specific recommendation follows:

"The authors should outline their inclusion and exclusion criteria sequentially, detailing the number of potential participants excluded at each step. Additionally, the authors should justify each inclusion or exclusion criterion. A flow diagram could effectively illustrate the selection process."

Table 2 provides example recommendations of varying quality alongside explanations of what makes them (or does not make them) specific or actionable. For confidential concerns such as ethical considerations or suggestions for accompanying commentary, use the confidential report to the editors, which remains unseen by the authors. This section allows you to communicate sensitive issues or ideas that are best handled between reviewers and editors.

### How to Respond to Revisions

After you submit your review, you might be asked to evaluate a revised version of the manuscript. This will come with a response letter from the authors that addresses your feedback and outlines their changes. As you review the revised manuscript, ask the following questions:

1. Did the authors adequately address each of my comments through their revisions, or did

they provide reasonable explanations for any comments that did not elicit a revision?

2. Can I find the changes mentioned in the authors' letter in the revised manuscript?

The depth of your second review depends on the extent of the revisions. If the manuscript has been significantly altered, reviewing it as thoroughly as before is advisable, reassessing both major and minor points. For minor revisions, focus on the sections that have been updated. However, reevaluating the entire manuscript will best ensure that nothing is missed.

As you assess the revised manuscript, clearly state whether the authors have successfully addressed your concerns. If specific comments have not been sufficiently resolved, highlight this in your review, explaining its significance for your overall evaluation, especially if it influences a recommendation against publication.

### Other Important Considerations

This editorial aims to be a helpful resource, but you may still have questions during the peer review process. Here are additional tips and considerations to keep in mind.

- Focus your review on the research's substance and methodology rather than the manuscript's grammar and formatting. While it is your role to assess the study's validity, not to proofread, do mention any grammatical or formatting issues that hinder your evaluation as minor points. However, if such errors are pervasive, making assessing the study's content difficult, you should report these to the editors confidentially.
- While a manuscript's literature review should be comprehensive, it does not need to be exhaustive. Authors should include enough references to provide context but need not cite every related source. Only recommend additional references if they add significant value. Refrain from suggesting your work unless it's directly relevant; insisting on citing it without necessity can be inappropriate and unethical.
- If you suspect plagiarism or other ethical concerns, promptly communicate these to the journal's managing editor and detail your concerns in your confidential report to the editors.
- Be selective with your comments and recommendations. Each should offer substan-

tial help or point out critical issues. Avoid overloading your review with minor criticisms—remember, the goal is to enhance the manuscript's informative value, not to nitpick for the sake of it. No manuscript is without flaws, but we can guide authors towards meaningful improvements.

### Conclusion

Our aim with this editorial was to offer a concise and valuable manual for peer review in academic journals, such as the *WMJ*. While we could not cover every aspect of the process, we hope our instructions and advice are helpful for both new and experienced reviewers. Our guide is designed to enhance your experience with peer reviewing and the overall publication of scientific manuscripts.

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# WMJ

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# Early Access Physical Therapy: Utilizing Physical Therapists in Urgent Care and Emergency Settings

Jeff Hartman PT, DPT, MPH; Sarah Nechvatal, PT, DPT; Bringa Johnson, PT, DPT, OCS, GCS

During the 1990s and into the 2000s, emergency departments (ED) in Wisconsin were burdened with increasing numbers of annual visits and rising wait times to see a physician. Similar to other states, patient satisfaction was decreasing, and patient safety was a concern.<sup>1</sup> Conditions such as acute or severe musculoskeletal pain and dizziness were treated with medications, and it was not unusual for patients to return for symptom management while they waited for an appointment with their primary care physician.<sup>2</sup> This costly and inefficient use of health care forced hospitals to explore creative solutions, such as utilizing nurse practitioners and physician assistants.<sup>3</sup> These physician extenders provided much-needed answers to some of these challenges, but it wasn't enough.

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Similar challenges existed in other parts of the world, and countries such as Australia and the United Kingdom (UK) began utilizing physiotherapists as first-contact providers in

In 2010, SSM St Mary's Hospital in Madison, Wisconsin, was one of the first early adopters of this model in the state. It is now estimated that Wisconsin has approximately 30 EDs and

**Providing physical therapy services  
in the emergency department not only helps  
the patient and family, but research has demonstrated  
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cost of care for symptom management.**

their EDs and urgent care centers. This novel idea was successful, and researchers began to produce evidence demonstrating the benefit of providing physical therapy in the ED. For example, they demonstrated that physiotherapists could reduce wait and treatment times compared to other providers when addressing musculoskeletal conditions.<sup>4</sup>

The practice of utilizing physical therapy in the ED came to the United States in 1998, and by 2010, it was estimated that 15 facilities had full-time physical therapists working in the ED. Researchers were able to demonstrate high physician, physician extender, and patient satisfaction,<sup>5</sup> and they were able to repeat clinical findings similar to those found in Australia and the UK. This evidence acted as a catalyst for more EDs and urgent care centers to adopt the practice. By 2020, it was estimated that the total number of EDs that staffed physical therapists had tripled. Many believe this number continues to rise at a similar rate today.

urgent care centers that have physical therapy consultation services (APTA Wisconsin, unpublished data, 2023). Additionally, the Wisconsin Chapter of the American Physical Therapy Association (APTA) has a formal committee called the "Early Access PT Coalition" that is advocating for physical therapists in EDs and urgent care centers throughout the state, making Wisconsin a leader within the United States for this area of practice.

## **The Role and Benefit of Early Access Physical Therapy**

With the transition to the entry-level doctoral degree in the mid-1990s, the physical therapist's scope of practice within the United States expanded. The addition of pharmacology, radiology, and advanced pathology to the standard curriculum has allowed physical therapists to screen for life-threatening "red flags," which increases their utility in early-access emergency and urgent-care settings.<sup>6</sup> In the ED,

**Table.** Conditions Often Seen by Physical Therapists

Condition	Potential Physical Therapy Intervention
Musculoskeletal pain <ul style="list-style-type: none"><li>• Spine pain (most common)</li><li>• Limb pain</li><li>• Noncardiac chest pain</li></ul>	<ul style="list-style-type: none"><li>• Patient education</li><li>• Manual therapy</li><li>• Modalities</li><li>• Functional mobility training</li><li>• Dry needling</li><li>• Neuromuscular re-education</li></ul>
Vertigo/vestibular dysfunction	<ul style="list-style-type: none"><li>• Canalith repositioning maneuvers</li><li>• Vestibular exercises</li><li>• Balance and functional training</li></ul>
Nonsurgical fractures	<ul style="list-style-type: none"><li>• Splinting</li><li>• Mobility recommendations/training and durable medical equipment assignment</li><li>• Patient education</li></ul>
Falls/gait instability	<ul style="list-style-type: none"><li>• Mobility/fall risk assessment</li><li>• Durable medical equipment</li><li>• Set up with community resources</li></ul>
Failure to thrive/frailty	<ul style="list-style-type: none"><li>• Mobility recommendations and set up with community resources</li></ul>
Chronic and persistent pain	<ul style="list-style-type: none"><li>• Patient education</li><li>• Functional training</li></ul>
Migraines	<ul style="list-style-type: none"><li>• Patient education</li><li>• Dry needling</li><li>• Manual therapy</li></ul>
Concussion and mild traumatic brain injury	<ul style="list-style-type: none"><li>• Patient education</li></ul>
Wounds and burns	<ul style="list-style-type: none"><li>• Wound care and debridement</li><li>• Patient education</li></ul>
Potential malingering	<ul style="list-style-type: none"><li>• Assist care team in differential diagnosing and offering a second opinion</li></ul>

physical therapists typically see level III to level V patients and can be called for a level I or level II to assist the care team with splinting or other procedures before transportation to surgery. A physical therapist in these settings provides immediate access to a physical therapy evaluation and treatment for a large spectrum of conditions and situations (Table). The goals of providing physical therapy services include collaborating with the medical team for diagnostic clarity, plan of care development, and direct intervention aimed at symptom management and mobilization.<sup>7</sup> Additionally, physical therapists can offer education to the patient and family, assist the care team in discharge planning, and assist in the coordination of community resources. A significant contribution of physical therapists is the ability to provide the patient and family with a better understanding of the situation and offer reassurance, often aiding in the reduction of stress and anxiety.<sup>7</sup> Providing physical therapy services in the ED not only helps the patient and family, but research has demonstrated it helps the entire

care team<sup>5</sup> and decreases the overall cost of care for symptom management.<sup>8</sup>

Additional benefits of emergent and urgent access to physical therapy are as follows:

- Increases patient and care team satisfaction<sup>5</sup>
- Reduces unnecessary hospital admissions<sup>9</sup>
- Reduces outpatient observation patients in the hospital<sup>9</sup>
- Decreases risk of fall-related revisits to EDs<sup>10</sup>
- Decreases the burden of primary care physician care/follow-up<sup>11</sup>
- Decreases unnecessary referrals to specialists<sup>8</sup>
- Reduces the need for imaging<sup>12</sup>
- Reduces use of medications<sup>12,13</sup>

Various staffing models exist across the country, including full-time physical therapists who spend most of their day—8 to 12 hours—in the ED, including weekends. Physical therapists working either in the acute care or outpatient settings within the same hospital systems also can provide on-call physical therapy services in the ED. Other models that have been utilized

are diagnosis-specific, in which the physical therapists are only consulted for one or two diagnoses, such as acute neck and back pain, wound care, vestibular disorders, or falls. Other models focus more on people groups, such as the geriatric population.<sup>14</sup> The type of model used often depends on ED patient volume and mix and the priorities established by department leadership.

## CONCLUSIONS

Emergency departments and urgent care centers in Wisconsin face many of the same challenges as 2 decades ago and are trying to find alternative solutions to situations such as opioid distribution and pain management, falls, and clinician burnout. Some have found creative solutions to these challenges, while others have been slow to adopt evidence-based solutions, such as early access to physical therapy services. For over 20 years, it has been shown that physical therapists can work effectively and efficiently within the health care team to assist with the diagnosis, treatment, and discharge planning for a wide variety of pathologies and situations, yet having a physical therapist as a part of the interdisciplinary emergency team is recognized only in a small percentage of Wisconsin facilities. The vision of the APTA Wisconsin is for early access to physical therapy to become the standard of care throughout the state. To achieve this, the APTA Wisconsin Early Access Coalition is poised to partner with leaders within the ED and urgent care center community to advocate for this new standard and provide resources and consultation upon request. Growing the interprofessional emergency and urgent care environments to routinely include physical therapy would further establish Wisconsin as a leader in health care and benefit all who are involved in emergent and urgent care—especially the patients.

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*Continued on on page 77*



# Increased Incidence of Retinoblastoma in Wisconsin: Coincidence or Public Health Concern?

Sudarshawn Damodharan, DO; Eric Monroe, MD

**R**etinoblastoma is the most common intraocular malignancy in children, with an estimated 300 new cases in the United States each year.<sup>1,2</sup> Its cause is related to germline or sporadic mutations of the *RB1* gene—a tumor suppressor gene,<sup>3</sup> and it can form in one or both eyes. It typically presents early in childhood, with the majority of patients presenting before 5 years of age, and the median age of diagnoses is just shy of 2 years. It should be considered for any child who presents with leukocoria or strabismus, and the patient should be referred to an ophthalmologist for further evaluation.

The earlier a patient is diagnosed with retinoblastoma, the better the outcome from a vision and survival perspective. Treatment for retinoblastoma has evolved over time, from surgical removal of the affected eye, to local radiation and cryo and laser therapies, along with systemic chemotherapy.<sup>3</sup> Unfortunately, many side effects were seen from conventional, sys-

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temic retinoblastoma therapy, which led to the emergence of intra-arterial chemotherapy (IAC) as a treatment option. Retinoblastoma contains itself to the eye in its early stages, which makes it amenable to localized therapy with fewer side effects compared to systemic therapy.

offered at a select number of institutions that have an experienced team capable of providing this therapy.

Since starting the IAC program at the University of Wisconsin American Family Children's Hospital in 2022, 4 new patients

...it may be possible that an environmental stimulus could play a role in causing an alteration in the *RB1* gene responsible for tumor development.

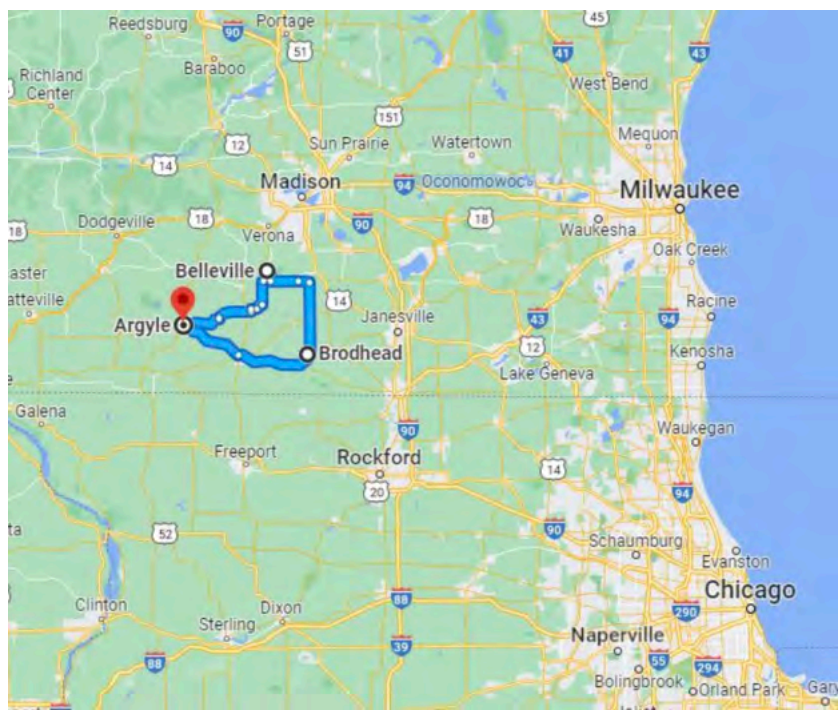
Ongoing research studies have demonstrated that IAC for retinoblastoma is efficacious, with improved quality of life and overall survival.

IAC and retinoblastoma treatment involves a multidisciplinary team that includes ophthalmologists, oncologists, and interventional radiologists. The procedure involves putting the child under anesthesia, then introducing a small catheter into the femoral artery. This catheter is then navigated until the ophthalmic artery is reached. Once this occurs, the chemotherapy can be delivered directly to the tumor area. Since the concentration of the chemotherapy given locally is higher, the amount is significantly decreased (~5%) to what would have been given systemically.<sup>4</sup> This treatment is repeated about monthly for at least 3 courses, with interval eye examinations performed in between for further assessment and local therapy (ie, cryo and laser therapies) provided by ophthalmologists as needed. Because of the intricacy of the IAC procedure, it is only

have presented with retinoblastoma: one with a germline and three with sporadic mutations of the *RB1* gene. When looking closer at the geographical location of these patients, it was noticed that the three sporadic retinoblastoma patients all lived within close proximity to one another (Figure). Given the rarity of this disease and with nearly 1% of all instances of retinoblastoma found in such a small area, it raises the question of a possible environmental cause that should be explored.

The genetic basis for the development of retinoblastoma has been well described, but it may be possible that an environmental stimulus could play a role in causing an alteration in the *RB1* gene responsible for tumor development. When scouring the literature, there does not seem to be any known environmental cause that related to the development of retinoblastoma in children. However, toxins and other environmental stimuli have been linked to the development of different types of can-

**Figure.** Enclosed Area Shows Where Three Instances of Sporadic Retinoblastoma Were Diagnosed in Wisconsin Over a 12-Month Period in 2022-2023



Cases shown account for nearly 1% of all diagnoses seen annually in the United States.

cers more commonly seen in adults, which does make the basis of this possible. With such a high proportion of sporadic retinoblastoma diagnosis in a short period and seen in a small geographical area within Wisconsin, further investigation is warranted prior to determining coincidental causation for the health of the patients we care for.

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# Same People, Different Results: Categorizing Cancer Registry Cases Across the Rural-Urban Continuum

Andrea M. Schiefelbein, MSPH; John K. Krebsbach, BS; Amy K. Taylor, MD; Chloe E. Haimson, PhD; Patrick R. Varley, MD; Melissa C. Skala, PhD; John M. Eason, PhD; Noelle K. LoConte, MD

## ABSTRACT

**Background:** Many rural-urban indexes are utilized in cancer research. This variation introduces inconsistencies between studies. Recommendations on index use have prioritized geographical unit over feasibility of inclusion in analysis. We evaluated rural-urban indexes and recommend one for use to increase comparability across studies.

**Methods:** We assessed 9 US rural-urban indexes regarding their respective rural and urban code ranges; geographical unit, land area, and population distributions; percent agreement; suitability for analysis; and integration feasibility for national, state, and local cancer research. We referenced 1569 Wisconsin Pancreatic Cancer Registry patients to demonstrate how index choice affects patient categorization.

**Results:** Six indexes categorized rural and urban areas. Indexes agreed on binary rural-urban designation for 88.8% of the US population. As ternary variables, they agreed for 83.4%. For cancer registry patients, this decreased to 73.4% and 60.4% agreement, respectively. Rural-Urban Continuum Codes (RUCC) performed the best in differentiating metropolitan, micropolitan, and rural counties; availability for retrospective and prospective studies; and continuous coding for analysis.

**Conclusions:** Urban/rural patient categorization changed with index selection. We conclude that RUCC is an appropriate and feasible rural-urban index to include in cancer research, as it is standardly available in national cancer registries, can be matched to patient's county of residence for local research, and it had the least amount of fluctuation of the indices analyzed. Utilizing RUCC as a continuous variable across studies with a rural-urban component will increase reproducibility and comparability of results and eliminate rural-urban index choice as a potential source of discrepancy between studies.

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## BACKGROUND

Rurality predicts later stages of cancer diagnosis,<sup>1</sup> lower rates of therapies,<sup>2</sup> less effective therapies,<sup>3</sup> shorter survival,<sup>4</sup> and higher mortality.<sup>5</sup> Stage at diagnosis is an important indicator of cancer patient outcomes and survival, and studies have shown that rural patients are diagnosed at a later stage than their metro counterparts.<sup>1,4,5</sup> Rurality may impact patients' access to specific or specialist therapies, such as access to radiation therapy for breast cancer<sup>2</sup> or definitive surgical treatment for prostate cancer.<sup>3</sup> Rurality also may delay access to treatments, including for rural patients with gastric cancers where they waited longer receive surgery and had a higher percentage of positive surgical margins than their metro counterparts.<sup>4</sup> Rural pancreatic cancer patients were less likely to undergo pancreatectomy<sup>5</sup> and have poorer overall survival<sup>6,7</sup> and 1-year

mortality.<sup>5</sup> These trends persist across geographical regions and cancer types.<sup>3,8</sup> However, variation in treatment and outcomes between rural and urban patients also exist,<sup>2,9</sup> resulting from community,<sup>10</sup> demographic,<sup>11</sup> and health care differences.<sup>12</sup>

Differences in identifying rurality produce inconsistencies in disparities.<sup>9</sup> More than 9 rural-urban indexes are used and based on differing geographic units, including census tract, ZIP code, and county. Indexes differ in their inclusion criteria, incorporating factors like population, commuting percentage, and adjacency to urban areas. Additionally, there is confusion over terms equating urban and metropolitan, despite being distinct terms. Furthermore, in reviewing rural cancer studies, we identified gaps in rural-urban index deployment, including incorrect index identification, omis-

**Table 1.** Agreement Between Binary and Ternary Rural-Urban Indexes at the US Population and UW Health Pancreatic Cancer Registry (n=1539 Patients) Levels

Variable Type	Indexes Included	Agreement/Disagreement	Rural–Urban Category	US Population			Registry Patients <sup>a</sup>		
				Count	%	% Agreement/Disagreement	Count	%	% Agreement/Disagreement
Binary	RUCC, UIC, NCHS, IRR <sup>b</sup> , RUCA	Agree	Metropolitan	247 994 082	80.3	88.8	908	59.0	73.4
			Nonmetropolitan	26 248 722	8.5		222	14.4	
		Disagree	Metropolitan and nonmetropolitan	34 347 840	11.1	11.1	408	26.5	26.5
Binary	RUCC, RUCA	Agree	Metropolitan	252 306 164	81.7	94.9	920	59.8	91.0
			Nonmetropolitan	40 789 077	13.2		480	31.2	
		Disagree	Metropolitan and nonmetropolitan	15 650 297	5.1	5.1	138	9.0	9.0
Ternary	RUCC, UIC, NCHS, IRR, <sup>b</sup> RUCA	Agree	Metropolitan	247 994 082	80.3	83.4	908	59.0	60.4
			Micropolitan	8 722 475	2.8		21	1.4	
			Rural/Noncore	886 289	0.3		1	0.1	
		Disagree – 1 level	Metropolitan and micropolitan	24 208 656	7.8	13.2	244	15.9	28.8
			Micropolitan and rural/noncore	16 639 958	5.4		200	13.0	
		Disagree – 2 levels	Metropolitan and rural/noncore	4 639 840	1.5	1.5	28	1.8	1.8
		Disagree – all levels	Metropolitan, micropolitan, and rural/noncore	5 499 314	1.8	1.8	136	8.8	8.8
Ternary	RUCC, RUCA	Agree	Metropolitan	252 306 164	88.4	88.8	920	59.8	74.9
			Micropolitan	405 347	0.1		184	12.0	
			Rural/Noncore	827 415	0.3		49	3.2	
		Disagree – 1 level	Metropolitan and micropolitan	10 777 424	3.8	9.5	87	5.7	21.7
			Micropolitan and rural/noncore	16 270 060	5.7		247	16.0	
		Disagree – 2 levels	Metropolitan and rural/noncore	4 872 873	1.7	1.7	51	3.3	3.3

<sup>a</sup>RUCA(z) was used in place of RUCA for the Registry patients since patient ZIP codes were available in the registry and census tracts were not.

<sup>b</sup>The Index of Relative Rurality (IRR) was missing data for 0.1% of the US population and Registry patients.

sion of index,<sup>13</sup> and outdated indexes.<sup>14</sup> Researchers often focus on geographical community measures—specifically census tract-based indexes, the smallest area measurement. This is detrimental to index availability in data sources.<sup>1,9</sup>

We evaluated indexes on their categorization across the rural-urban continuum. We examined indexes across their rural and urban code ranges; geographical unit, land area, and population distributions; suitability as continuous variables in analysis; and feasibility for integration into cancer research. We utilized the UW Health Pancreatic Cancer Registry patient cohort to demonstrate how index choice influences patient categorization. Pancreas cancer was chosen for study because it is one of the few cancers in Wisconsin that is increasing in frequency, its urgency in treatment, and the known effect of access to higher volume centers on outcomes.

## METHODS

### Rural-Urban Indexes

We identified 9 rural-urban indexes between 2000-2020: Urban Rural Classification of Urban Areas and Urban Clusters (UACE);<sup>15</sup>

### Box. Terms and Abbreviations

UACE	Urban Rural Classification of Urban Areas and Urban Clusters
CBSA	Core Based Statistical Areas
FAR	Frontier and Remote Area Codes
RUCA	Rural-Urban Commuting Area Codes
RUCA(z)	Aging, Independence, and Disability Rural-Urban Commuting Area Codes at the ZIP Code Tabulation Area Level
RUCC	Rural-Urban Continuum Codes
UIC	Urban Influence Codes
NCHS	National Center for Health Statistics Urban-Rural Classification Scheme for Counties
IRR	Index of Relative Rurality
ZCTA	ZIP Code Tabulation Area

Core Based Statistical Areas (CBSA);<sup>16</sup> Frontier and Remote Area Codes (FAR);<sup>17</sup> Rural-Urban Commuting Area Codes (RUCA);<sup>18</sup> Aging, Independence, and Disability Rural-Urban Commuting Area Codes at the ZIP Code Tabulation Area level (RUCA[z]);<sup>19,20</sup> Rural-Urban Continuum Codes (RUCC);<sup>21</sup> Urban Influence Codes (UIC);<sup>22</sup> National Center for Health Statistics (NCHS)



Urban-Rural Classification Scheme for Counties;<sup>23</sup> and the Index of Relative Rurality (IRR).<sup>24</sup> We retrieved indexes spanning 1980-2013 from publishers' websites. Each index is described elsewhere.<sup>1,9,10,25</sup>

### Land Area and Population Data

We acquired land area and population at the geographical unit of each index to compare land area and population distributions. Geographical units included census block (UACE), census tract (RUCA), ZIP Code Tabulation Area (FAR, RUCA[z]), and county (RUCC, UIC, NCHS, IRR, CBSA). UACE, RUCA, and FAR indexes included 2010 population and land area variables in their source files. We obtained 2010 county-level population and land area data from the 2010 Census of Population Summary File 1 for RUCC, UIC, NCHS, IRR, and CBSA. The RUCA(z) index is based on approximate boundaries of 2013 ZIP Code Tabulation Areas (ZCTA).<sup>24</sup> Since these boundaries fluctuate over time, we were unable to obtain the 2013 ZCTA population or land area on which RUCA(z) was based. Therefore, we excluded this index from parts of our analysis.

To demonstrate how index choice may affect categorization, 1569 patients from the UWHealth pancreatic cancer registry diagnosed during 2004-2016 with pancreatic ductal adenocarcinoma (PDAC) served as a reference population. This includes all patients diagnosed with PDAC at UW Health during this timeframe. Mean age at diagnosis was 66.7 years (SD 10.8 years); 54.4% of patients were male; and 86% of patients identified as non-Hispanic White. Patients presented with the following: local disease 10.9%, regional disease 45.7%, and distant disease 38.6%.

We evaluated differences in rurality via percent agreement across county and ZCTA-based binary and ternary indexes. We compared the change in each index's median and interquartile range and mean over time.

### Comparing Rural-Urban Indexes

In comparing indexes, we evaluated the extent to which rural and urban communities are differentiated—and the extent to which distinctions are made within communities. Supplemental Table 1 shows the 9 indexes by geographical unit, classification of urban/rural, the amount and percentage of land area, geographical units, and population each index classifies as urban/rural (2010 versions) for the US, midwestern states, and Wisconsin.

We excluded indexes that simply distinguished rural from urban communities (UACE, CBSA, and FAR) (Supplemental Table 1). We included the remaining indexes in the full analysis. We transformed these to binary indexes (metropolitan and non-metropolitan) and to ternary indexes (metropolitan, micropolitan/urban, and noncore/small town/rural). Because IRR is a continuous variable, we established divisions between metropolitan and nonmetropolitan counties at IRR=0.50 and further subdivided nonmetropolitan counties into micropolitan/urban and rural counties at IRR=0.60.<sup>25</sup>

**Figure 1.** Comparison of Rural-Urban Index Distributions (A) Across the US Population, (B) Wisconsin Population, and (C) UW Health Pancreatic Cancer Registry Patients



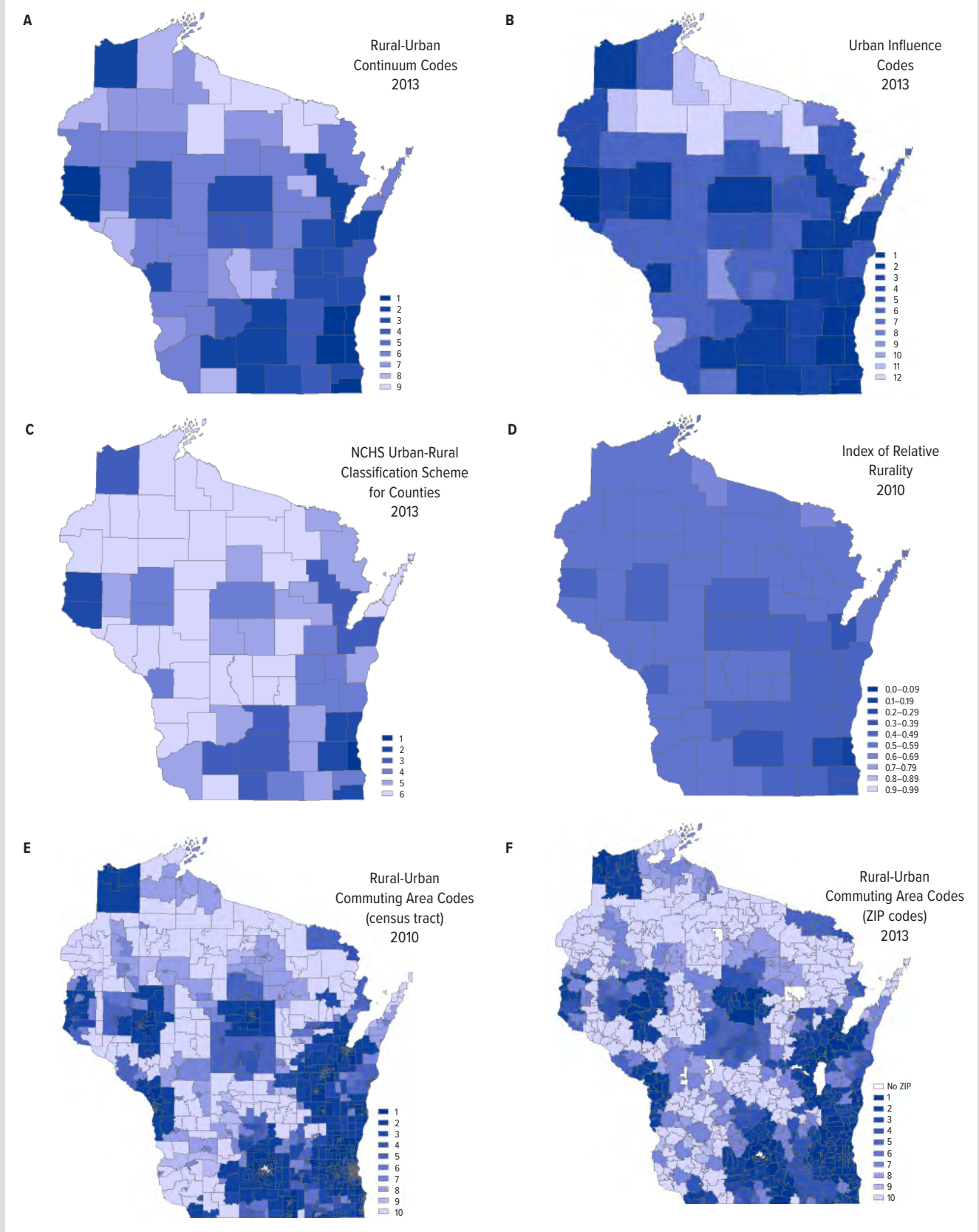
Each index is standardized such that the “Rural-Urban Interface” line lies between those values that the index designated as urban (left of line) and rural (right of line). Center points indicate the median of the index, boxes indicate the interquartile range, and spikes indicate the upper- and lower-adjacent values (1.5 times the interquartile range).

<sup>a</sup>RUCA(z) is based on 2013 ZCTAs. US and Wisconsin population data are not available at the ZCTA level for 2013; therefore, those distributions are excluded from the Figure.

We calculated Cohen's kappa, with an ordinal weight, to evaluate the level of agreement across indexes in their binary and ternary forms by geographical units, land area, and population. We also compared the percentage agreement of geographical units, land area, and population (Table 1, Supplemental Table 2). We compared the distribution via median, interquartile range, mean,



**Figure 2.** Maps of Wisconsin Rurality by Six Different Rural-Urban Indexes



Darker colors indicate more urban areas, and lighter colors indicate more rural areas. Rural-Urban Continuum Codes (A), Urban Influence Codes (B), National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties (C), and Index of Relative Rurality (D) maps are at the county level. Rural-Urban Commuting Area map (E) is at the census tract level. ZIP Code Tabulation Area (ZCTA) Rural-Urban Commuting Area (F) map is at the ZCTA level.

and standard deviation. We examined these trends visually via violin plots, with indexes standardized to illustrate transitions along a rural-urban interface (Figure 1, Supplemental Figure 1).

We used STATA Version 16.1 (StataCorp LLC, College Station, Texas) to complete the analysis and ArcGIS Version 10.7 (Environmental Systems Research Institute, Redlands, California) to create maps.

## RESULTS

### Inconsistency and Agreement Across Binary Rural-Urban Designations

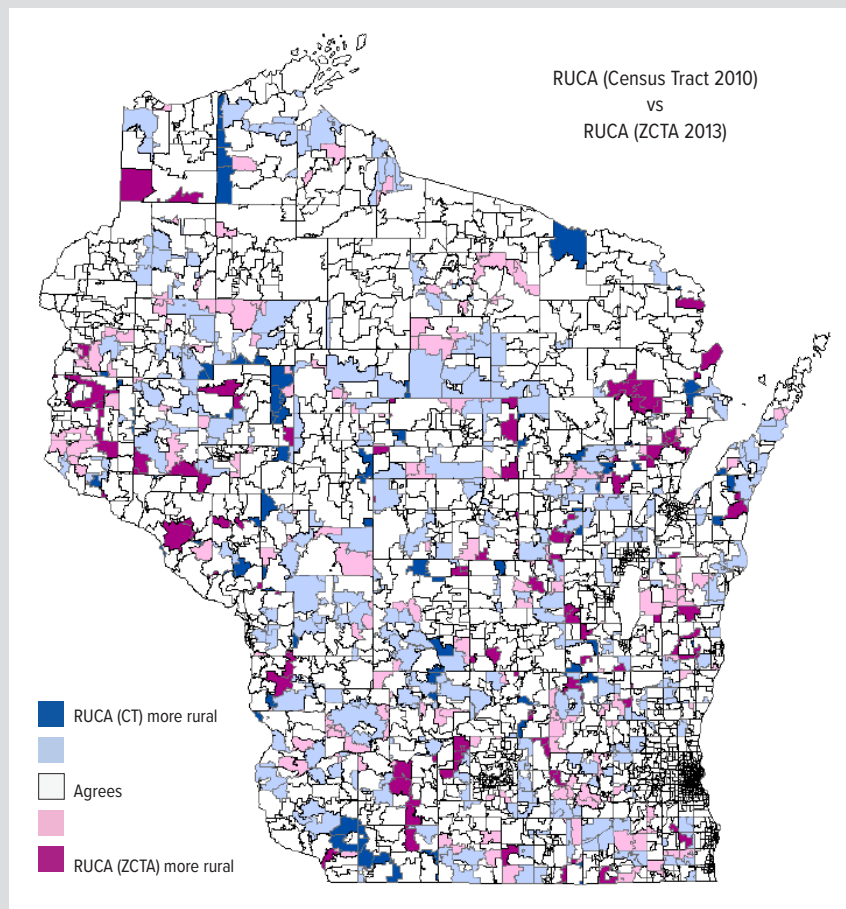
Supplemental Table 1 displays the geographical unit, rural-urban delineation, and rural-urban categorization of land area, geographical units, and total population for each index. Two methods exist to designate between rural or urban in RUCA and RUCA(z), both shown in Figures 2 and 3.

Accompanied by a difference across rural/urban communities, there is also a distribution within rural areas across indexes. The percentage of rural communities (by geographical unit) in the US ranged from 17.5% of ZCTAs (RUCA [option 2]) to 63.0% of counties (IRR) (Supplemental Table 1). By comparison, the difference in percentage of rural communities is even larger across Wisconsin communities (13.2% to 63.9%). The percentage of rural land area ranged from 52% (FAR) to 97% (UACE). Variation in land area was smaller across indexes categorizing both rural and urban areas. Similarly, the rural US population in indexes categorizing rural or urban areas is 3.9% (FAR) to 19.3% (UA) of the US population compared to indexes categorizing rural and urban areas allocating 11.5% (IRR) to 16.5% (RUCA [option 1]).

Binary rural or urban designations agreed across RUCA, RUCC, UIC, NCHS, and IRR indexes for 88.8% of the US population (Table 1, Supplemental Table 2). RUCC and RUCA—the 2 most employed indexes in cancer research—agreed on 94.9% of the population. Of Registry patients classifications, 73.4% agreed across binary RUCC, UIC, NCHS, IRR, and RUCA(z) indexes. This increased to 91.0% when comparing RUCC and RUCA(z) only. We included RUCA(z) as patient ZIP codes were known.

Cohen's kappa ranged from 0.60 when comparing IRR with

**Figure 3.** Comparing Rural Urban Commuting Area (RUCA) Indexes (primary codes only) Based on Census Tract (CT) and ZIP Code Tabulated Area (ZCTA) Across Wisconsin



Dark blue indicates Census Tract-based RUCA (RUCA [CT]) categorized areas as more rural than ZCTA-based RUCA (RUCA [ZCTA]) by a code difference of 5 to 9 (2.6% of land area). Light blue indicates RUCA (CT) categorized areas as more rural than RUCA (ZCTA) by a code difference of 1 to 4 (16.3% of land area). Deep pink indicates RUCA (ZCTA) categorized areas as more rural than RUCA (CT) by a code difference of 5 to 9 (3.9% of land area). Light pink indicates RUCA (ZCTA) categorized areas as more rural than RUCA (CT) by a code difference of 1 to 4 (6.2% of land area). RUCA (CT) and RUCA (ZCTA) agreed for white areas (71.1% of land area).

RUCC, UIC, and NCHS to 0.81 when comparing RUCA with RUCC, UIC, and NCHS, indicating moderate-to-very good agreement between indexes. We excluded RUCA(z) from this analysis as ZCTAs cannot be matched one-to-one with census tracts or counties.

### Agreement Decreased Across Ternary Metropolitan, Micropolitan, and Rural Designations

RUCA, RUCC, UIC, NCHS, and IRR indexes agreed on ternary metropolitan, micropolitan, and rural designations for 83.4% of the US population (Table 1, Supplemental Table 2). These indexes simultaneously designate 6.0% of land area and 1.8% of US population as rural, micropolitan, and metropolitan depending on the index used. Adding further confusion, while some indexes designate 5.3% of land area and 1.5% of total population

as rural, other indexes designate these same areas and people as metropolitan. Again, there is higher agreement across designation among RUCC and RUCA indexes, with 88.8% of US population in agreement. Within the Registry patients, 60.4% agreed across these indexes for ternary metropolitan, micropolitan, or rural communities, increasing to 74.9% when limited to RUCC and RUCA(z). RUCA(z) was included in the Registry patient analysis since patient ZIP codes were known. Cohen's kappa ranged across indexes from 0.53 for IRR compared to UIC and NCHS to 0.77 for RUCC and RUCA compared to UIC and NCHS, indicating moderate-to-good agreement as ternary indexes.

### Differences in Discrete or Continuous Index Geographical Units, Land Area, and Population Distributions

Figure 1 and Supplemental Figure 1 show RUCC, UIC, NCHS, IRR, RUCA, and RUCA(z) total population, geographical units, and land area distributions across the US and Wisconsin. Maps of Wisconsin based on each index are shown in Figure 2; the discrepancy between RUCA and RUCA(z) in Wisconsin is shown in Figure 3. The median geographical unit across the US is urban for RUCA and RUCA(z); conversely, the median is rural for RUCC, UIC, NCHS, and IRR. The median land area distribution is rural for the 5 county and census tract-based indexes, and the median population distribution is urban for the same indexes. RUCA(z) was excluded from the land area and population distribution analysis since 2013 ZCTA-based land area and population totals were unavailable. The rural-urban distribution of Registry patients followed Wisconsin population distribution trends.

### Changes in Discrete or Continuous Index Distributions Over Time

RUCC, RUCA, UIC, NCHS, and RUCA(z) indexes captured changes in rural-urban community designations over time (Figure 4, Supplemental Figure 2). RUCC changes on a per-county basis are mapped in Figure 5. The mean rural-urban value across counties, ZCTAs, and census tracts for each index decreased over time. The distributions highlight where indexes underwent methodological changes (Figure 4, Supplemental Figure 2).

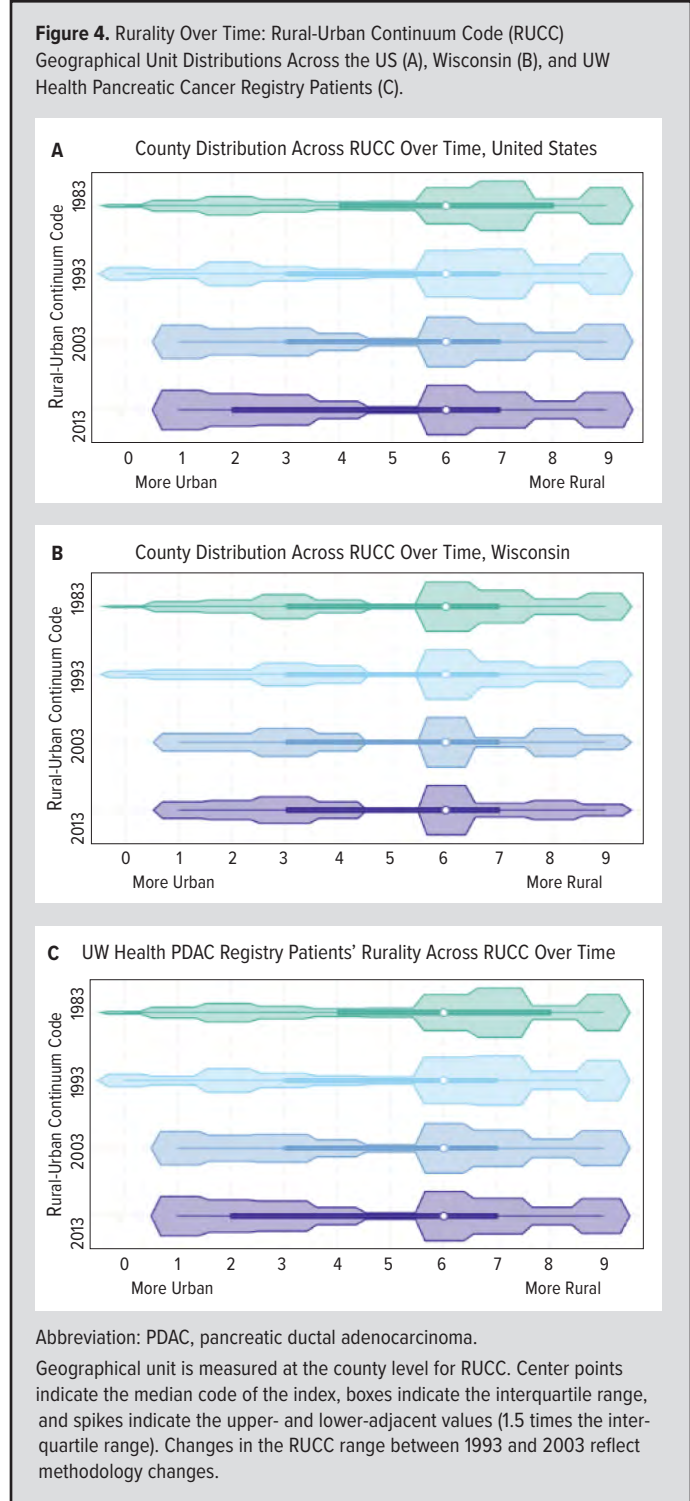
## DISCUSSION

### Categorizing Rural and Urban Communities

Indexes must categorize both rural and urban areas to accurately study the rural-urban continuum. UACE and CBSA (urban) and FAR (rural) only categorize one or the other, making them unsuitable. The remaining 6 indexes categorize across metropolitan, micropolitan, and rural areas.

### Comparability of Research Based on Different Indexes

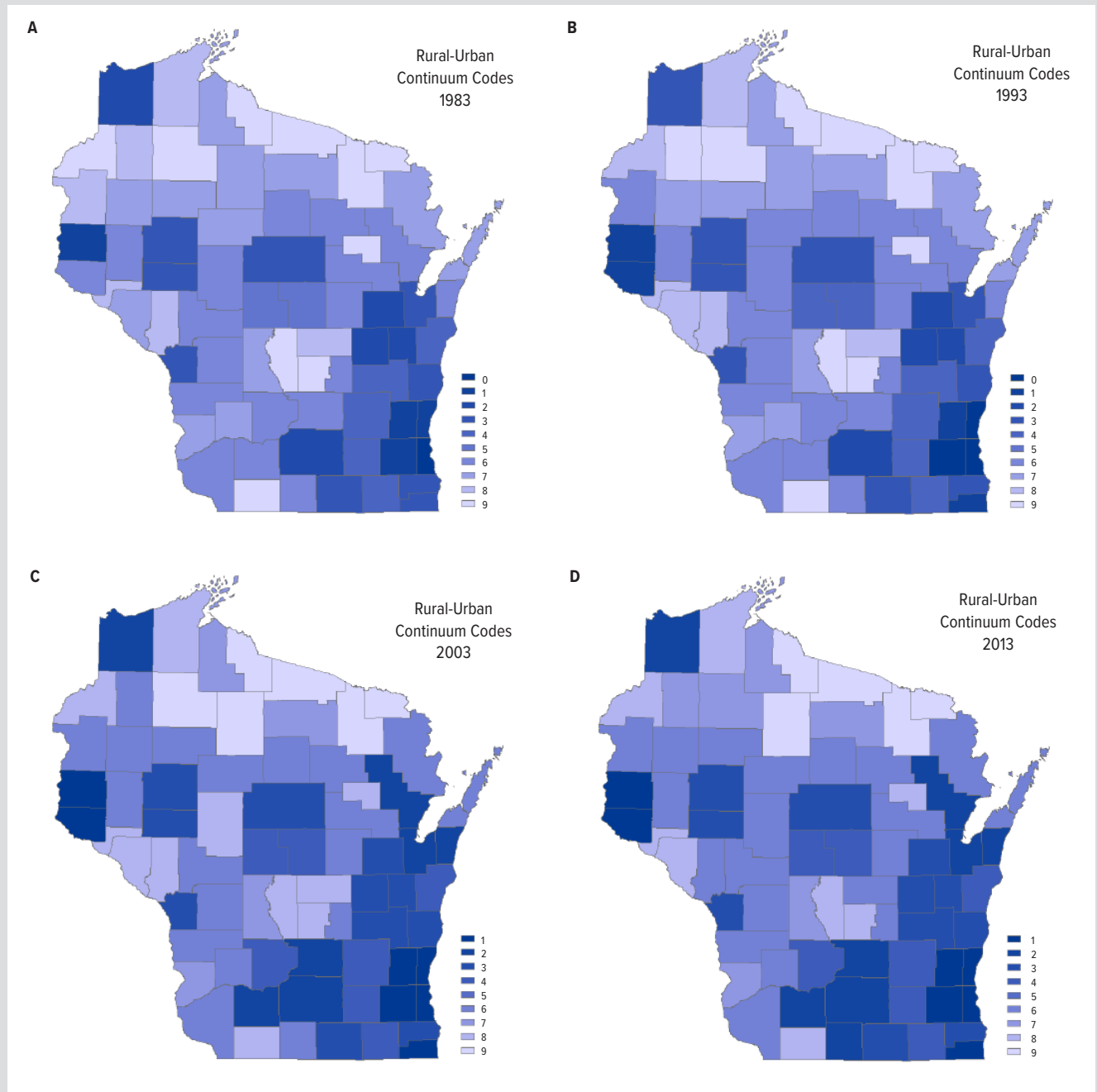
RUCC, UIC, and NCHS are county-level indexes based on OMB metropolitan and non-metropolitan definitions,<sup>21-23</sup> making them comparable in terms of rurality research (Supplemental Table 1). UIC and NCHS further divide nonmetropolitan counties into



micropolitan and rural. These 3 indexes employ different methodologies to subdivide counties within 3 categories. They also emphasize different subsets of counties; RUCC identifies 3 metropolitan levels, 4 urban levels, and 2 rural levels;<sup>21</sup> UIC designates 7 of 12 codes as rural;<sup>22</sup> and NCHS designates 4 of 6 codes as metropolitan.<sup>23</sup>

RUCA and RUCA(z) also stem from OMB metropolitan and nonmetropolitan categories<sup>18,20</sup> subdivided into 2 to 4 categories

**Figure 5.** Rural-Urban Continuum Code (RUCC) Changes Across Wisconsin Over Time



Darker colors indicate more urban areas, and lighter colors indicate more rural areas. Maps are at the county level.

across 10 primary codes and 21 secondary codes (2010 index). Some researchers create a binary variable based on the primary codes (option 1) and others group counties with a secondary code of x.1 with metropolitan counties to create a different binary variable (option 2). Due to these different methodologies, research based on binary RUCA or RUCA(z) variables may not be directly comparable. This problem is exacerbated when researchers do not disclose their method of creating a binary RUCA variable.<sup>27</sup>

The high population percent agreement between RUCC and

RUCA at binary (94.9%) and ternary (88.8%) levels suggests less variability than expected. However, the percent agreement between RUCC and RUCA(z) decreased to 91.0% (binary) and 74.9% (ternary) when compared for the Registry patients (Table 2). This may be specific to this patient population or may be further evidence of RUCA(z) being a poor RUCA approximation (Figure 3). Patient-specific census tract, ZIP code, and county is necessary to further explore this question. The differences in percent agreement between national and local populations highlight that national trends may not replicate local health-system trends.



Local health system geographical population trends will be highly dependent on the immediate population and area under study. Areas that match national geographical distributions more closely will be better aligned with national population data, and areas that trend more rural or urban than national geographical distributions will differ more from the national trends. Similarly, the smaller the population studied, the more variation with national trends one can expect. In our case, our relatively small catchment area may contribute to the difference in percent agreement found between indexes at the registry patient level versus the national level.

### **Comparing Indexes by Geographical Unit, Land Area, and Population Distributions**

Indexes varied in the number of their individual codes used. Counties and land area were distributed across RUCC, though few counties are categorized as RUCC 5 (Supplemental Figures 1A and 1B), creating a natural binary division that does not follow the index's other designations. UIC counties clustered within the urban group (Supplemental Figure 1A) and cannot be interpreted across a continuum since micropolitan (codes 3, 5, and 8) and rural categories (codes 4, 6, 7, 9, 10, 11, 12) are not sequential.<sup>22</sup> NCHS counties clustered by its only rural category (Supplemental Figures 1A and 1C). IRR showed normal distributions across all factors considered, as it is a relative measure (Figure 1A, Supplemental Figures 1A and 1C).

Census tract and population distributions clustered in RUCA's most urban code, due to smaller and denser tracts in more populated areas (Figure 1A, Figure 2E, Supplemental Figure 1A). Inversely, RUCA land area clustered in its most rural code (Figure 2E, Supplemental Figure 1C). RUCA(z) separated to its most urban and rural ZCTAs. Differences between the RUCA and RUCA(z) distribution suggest that RUCA(z) may not approximate RUCA (Figure 3, Supplemental Figure 1A).

National trends were magnified when viewed for Wisconsin (Figure 1B). The population distribution was spread more evenly across RUCC and UIC metropolitan codes for Wisconsin than for the US. Population distribution was almost consistent across all NCHS codes. IRR showed an urban cluster (Milwaukee metropolitan area) separating itself from the rest of Wisconsin and remained similar for RUCA in Wisconsin compared to the US. Within the Registry, patients were divided into 2 populations by RUCC and UIC and 4 populations by RUCA(z) (Figure 1C). These differences highlight how the rural-urban composition of participants may differ based on a study's geographical reach.

Maps of Wisconsin by RUCC, UIC, NCHS, IRR, RUCA, and RUCA(z) compare across multiple land units (Figure 2). IRR and NCHS tended to homogenize rurality. IRR designated most counties as micropolitan and used few values for Wisconsin counties (Figure 2D). Due to its normal distribution, IRR draws a large distinction between the most urban and rural counties, homogenizing between those extremes. NCHS classified 32 of 72 counties

into its 1 rural code, preventing distinction between patients who live in different rural communities (Figure 2C). In terms of cancer care, this homogenization of rural counties masks differences in access to care between patients who live in rural counties that are more or less densely populated or further or closer to metropolitan counties. Differences include distances patients are required to travel to receive oncology and surgical consultations, receive specialty care, and access second opinions. UIC showed divergence in rurality, though recall its codes do not sequentially identify metropolitan, micropolitan, and rural counties (Figure 2B). RUCC, RUCA, and RUCA(z) showed divergences in rurality across their respective code ranges, depicting their utility in measuring rurality across a continuum (Figures 2A, 2E, and 2F).

### **Index Suitability as a Continuous Variable**

In moving away from binary rural-urban designations towards a rural-urban continuum, indexes must be conducive to continuous or multilevel ordinal coding. Binary rural-urban designations may mask outcome variation within groups, while continuous variables may expose nonlinear trends across the rural-urban continuum.<sup>12</sup> As continuums become more commonly employed, a consensus index becomes important for research congruity (Table 2).

RUCC, NCHS, IRR, RUCA (option 1), and RUCA(z) (option 1) are ordinal indexes that may be coded as continuous variables. UIC does not divide its nonmetropolitan codes sequentially,<sup>22</sup> and NCHS only designates 1 code for micropolitan counties and rural/noncore counties, respectively, restricting distinction between rurality levels.<sup>23</sup> IRR effectively homogenizes rurality status, blurring the line between counties of different rurality on regional or local scales.

RUCA (option 2) and RUCA(z) (option 2), which includes the x.1 secondary code as metropolitan, blur the most appropriate way to order codes continuously. If RUCA and RUCA(z) are used as continuous variables, it should be based on primary RUCA codes only. RUCC includes multiple sequential codes for metropolitan, micropolitan, and rural designations, making it conducive to use as a continuous variable in analysis.

### **Index Feasibility to be Used in Cancer Research**

The National Cancer Database, North American Association of Central Cancer Registries, and Surveillance, Epidemiology, and End Results Program registries include RUCC and RUCA indexes. RUCC is included in its original 9-code form, and RUCA is included as a binary rural-urban variable. Registry inclusion makes RUCC and RUCA accessible to researchers, though recoding RUCA into a binary variable limits its use. This recoding is to prevent case identification. Therefore, RUCC is the most accessible and specific index available for registry-based cancer research.

Counties and ZIP codes are standard fields in electronic health records; thus, researchers use county or ZIP code-based indexes.



However, ZIP codes change frequently, and RUCA(z) versions are only available for noncensus years (1998, 2004, 2006, 2013).<sup>26</sup> Researchers risk excluding cases if a patient's ZIP code is unmatched in the chosen file. Thus, it is preferable to avoid ZIP code and ZCTA-based indexes.<sup>28</sup> County-based indexes (RUCC) are preferred for health system and local level research.

### Indexes Over Time

The hypothesized role of rurality should determine the index studied. Rurality as an exposure is calculated on a past version of an index, whereas rurality as an enabler/barrier to care should be calculated from a relevant version to the year(s) of study. When rurality is investigated as an exposure, patients may be misclassified as they move. This may obstruct the rurality designation of interest.

Absolute changes in rurality are masked by IRR's relative nature, making this index inappropriate for longitudinal studies.

### Considerations for RUCA(z) and ZCTAs

RUCA(z) is a RUCA approximation. ZCTAs approximate ZIP codes, and it is possible for a patient's ZIP code and ZCTA to differ. ZIP codes are subject to change, as evidenced by the regular updates released by the US Postal Service, so a patient's ZIP code at diagnosis versus year of study may differ despite not moving. The difference between RUCA and RUCA(z) geographical unit distributions across the US and Wisconsin show RUCA(z) may not approximate RUCA (Figure 3, Supplemental Figure 1A and 1B). The RUCA(z) map shows irregular ZCTA boundaries, affirming caution over using ZCTAs as a geographical unit (Figure 2F).<sup>28</sup> Furthermore, RUCA(z) is not published by a government agency, making its ongoing availability less assured.

### Limitations

We evaluated indexes for their categorization of cancer patients across the rural-urban continuum. However, we did not have access to patient-specific ZIP codes, census tracts, and counties. County, ZCTA, and census tract land area varies by state; thus, we did not evaluate land area on a per-state level. This is especially important for states with fewer and larger counties.

### CONCLUSIONS

Utilizing the Rural-Urban Continuum Code (RUCC) index across cancer research will increase comparability of results. Counties are a stable geographic unit and are readily available within many data sources. RUCC includes codes across metropolitan, micropolitan, and rural communities and can be grouped into a binary or ternary variable. RUCC indexes for 1993, 2003, and 2013 are available in several national registries at a discrete level, enabling residence study across a continuum. ZCTA-based indexes should be avoided as ZCTAs approximate actual ZIP code boundaries and change frequently. Government agencies should procure a census block measure of rurality without compromising patient confidentiality. The precise unit of geographical analysis, thus minimizing mask-

ing trends. Finally, researchers should include social, economic, and health-related variables alongside rurality to understand the many factors affecting cancer disparities.

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**Ethics Approval:** The pancreas cancer registry data use was exempt as human subjects research by the University of Wisconsin Health Sciences IRB, ID # 2019-0155, expiration April 26, 2024.

**Availability of Data and Materials:** The datasets generated and/or analyzed during the current study are not publicly available due to HIPAA restrictions with personal health information for the registry patients but are available from the corresponding author on reasonable request. The other datasets analyzed are publicly available and are referenced as such in the manuscript.

**Appendix:** Supplemental Tables and Figures are available at [www.wmjonline.org](http://www.wmjonline.org)

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# Interfacility Ambulance Versus Helicopter Transport of Traumatic Spinal Cord Injury Patients: Outcomes, Observations, and Utilization

Robert C. Sterner, BS, BA; Nathaniel P. Brooks, MD

## ABSTRACT

**Introduction:** Traumatic spinal cord injury (tSCI) is a devastating event that can cause permanent loss of function or disability. Time to surgical decompression of the spinal cord affects outcomes and is a critical principle in management of tSCI. One of the major determinants of time to decompression is transport time. To date, no study has compared the neurological outcomes of tSCI patients transported via ground/ambulance versus air/helicopter.

**Objective:** This retrospective cohort study sought to assess the association of the mode of transport on the neurological outcomes of tSCI patients.

**Methods:** Data from 46 ground transport and 29 air transport patients with tSCI requiring surgical decompression were collected. Outcomes were assessed by the change in American Spinal Injury Association Impairment Scale (AIS) grade from admission to discharge. Additionally, the utilization of air versus ground transport was assessed based on the distance from the admitting institution.

**Results:** Among the transport groups, there were no significant differences ( $P > 0.05$ ) in patient demographics. Helicopter transport patients demonstrated higher rates of AIS grade improvement ( $P = 0.004$ ), especially among AIS grade A/grade B patients ( $P = 0.02$ ;  $P = 0.02$ , respectively), compared to the ambulance transport group. Additionally, within the cohort of patients undergoing decompression within 0 to 12 hours, helicopter transport was associated with higher AIS grade improvement ( $P = 0.04$ ) versus the ambulance transport group. Helicopter transport was used more frequently at distances greater than 80 miles from the admitting institution ( $P = 0.01$ ).

**Conclusions:** This study suggests that helicopter transport of tSCI patients requiring surgical decompression was associated with improved neurological outcomes compared to patients transported via ambulance.

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## INTRODUCTION

Every year, over 12 000 patients in the United States sustain traumatic spinal cord injury (tSCI) resulting in significant loss of neurological function and permanent disability.<sup>1-5</sup> One critical factor in the surgical management of tSCI is the timing of surgical decompression.<sup>6-9</sup> Over the past 2 decades, several studies have suggested improvement of neurological outcomes measured by conversion of American Spinal Injury Association Impairment Scale (AIS) grades to less severe states in patients undergoing surgical decompression in less than 12 hours or from 12 to 24 hours after tSCI.<sup>6,10-13</sup> The most likely explanation of improved neurological outcomes in patients undergoing rapid surgical decompression is likely due to reversal of secondary injury mechanisms, such as ischemia, edema, and lipid peroxidation that are triggered by the initial cord lesion or primary mechanism of injury.<sup>9-11,14-26</sup>

One of the most critical determinants of time to decompression and, thus, potentially neurological outcomes is the time a patient spends in transport with emergency medical service (EMS) personnel.<sup>27</sup> Transport time is affected by the mode of transport, and, ultimately, the decision to transport trauma patients via ambulance/ground versus helicopter/air is at the discretion of the clinician.<sup>28-30</sup> This decision not only has the potential to affect clinical outcomes but also has significant financial implications. Among medical personnel, it is widely believed that interfacility

helicopter transport results in decreased transfer time compared to ground transport, allowing for the potential of expedited intervention at the admitting institution.<sup>31,32</sup> Although the benefits of helicopter transport are widely held, currently there is no randomized, controlled trial to address whether ambulance or helicopter transport is faster or whether there is a meaningful difference in clinical outcomes among these modes of transport.<sup>31,32</sup> However, retrospective studies examining the outcomes of patients with other types of traumatic injuries, including traumatic brain injury, have suggested that helicopter transport decreases mortality and enhances outcomes compared to ground transport.<sup>33-36</sup>

To date, no study has examined the association of mode of transport with the neurological outcomes of tSCI patients requiring surgical decompression. Thus, this study aimed to (1) determine the association of mode of transport (ambulance vs helicopter) on neurological outcomes, (2) assess the association of mode of transport (ambulance vs helicopter) and time to surgical decompression on neurological outcomes, and (3) determine the utilization patterns of air versus ground transport for tSCI patients requiring surgical decompression.

## METHODS

This retrospective cohort study was performed in accordance with the following guidelines: Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and Enhancing the Quality and Transparency of Health Research (EQUATOR).<sup>37,38</sup>

### Patient Population

This study was reviewed and approved at the academic university hospital and level I trauma center of the corresponding author. It underwent minimal risk institutional review board review at the University of Wisconsin-Madison (2020-0175) and was determined to meet criteria for exempt human subjects' research. We collected data from all interfacility acute tSCI trauma patients with imaging-confirmed spinal cord compression requiring surgical decompression from January 2013 through March 2020. Consent from patients was deemed unnecessary for this study as all data was extracted and stored in a deidentified database. Prior to study enrollment, strict inclusion and exclusion criteria were defined as previously described.<sup>12</sup> Briefly, inclusion criteria included adult patients age 18 or older, trauma patients requiring interfacility transport, patients with tSCI with spinal cord compression requiring surgical decompression, and imaging-confirmed spinal cord compression. Exclusion criteria included the following: patients who did not undergo interfacility transport, incomplete or neurological examinations that were not performed according to the standards established by the American Spinal Injury Association, patients with lumbar injuries below L2, no recorded EMS transport times or mode of transport, and patients who did not have tSCI.

Interfacility trauma patients requiring transport to a single level I trauma center were screened prior to enrollment through examination of the Trauma Base database. Trained trauma registrars enrolled patients into this registry at the time of their initial encounter in accordance with the National Trauma Data Bank guidelines and Trauma Quality Improvement National Standard supported by the American College of Surgeons. From January 2013 to March 2020 "spinal cord compression" and "tSCI" records were queried. Of the 203 patients screened from the Trauma Base database, 75 met inclusion criteria, 97 patients were excluded due to not having tSCI, 18 patients were excluded due to incomplete transport time/time to decompression records, 9 patients were excluded due to lumbar injuries below L2, and 4 patients were excluded due to incomplete neurological examinations/spinal cord decompression without imaging confirmation.

### Statistical Analysis

All statistical analysis was performed as previously described.<sup>12</sup> Briefly, deidentified patient data were extracted from the medical record, including gender, age, injury severity score (ISS), admission/discharge AIS grades, length of stay (LOS), intensive care unit (ICU) length of stay, and discharge disposition. The Mann-Whitney U test for numerical variables and the Fischer exact test for categorical variables were utilized to analyze the differences in patient demographics, such as age, gender, ICU length of stay, and LOS, among cohorts.

Patients were divided into either the ambulance/ground transport group or the helicopter/air transport group. Changes in neurological outcomes were assessed based on the change in AIS score from admission to discharge following surgical decompression as previously described.<sup>7,12</sup> In order to examine the association of mode of transport on the neurological outcomes of tSCI patients, change in AIS score as a function of mode of transport groups was assessed via analysis of variance (ANOVA) with correction for multiple comparisons and subsequent posthoc analysis. From a clinical perspective, conversion of AIS grade A patients to higher AIS scores represents a major clinical change. Thus, in order to assess the association of transport modality on neurological outcomes, transport mode groups were further divided into subgroups based on their AIS grade on admission (grade A, B, C, or D), and the change in AIS grade following decompression as a function of transport modality was compared utilizing ANOVA.

Previous studies have suggested that time to surgical decompression following tSCI is associated with improved neurological outcomes.<sup>6,10-12</sup> Next, we assessed the association of time to surgical decompression and mode of transport on neurological outcomes. Time to decompression was extracted from the medical record and throughout this study was defined as the time from EMS dispatch to the time of surgical decompression, including time associated with intubation, exposure, case set-up, and instrumentation. The ambulance transport group and helicopter transport group were



**Table 1.** Patient Demographics of Association of Mode of Transport on Neurological Outcomes

	Ambulance N=46	Helicopter N=29	P value
No. of cervical/thoracic/lumbar SCI	42/4/0	24/4/1	
No. of male/female patients	33/13	22/7	
Average age (SEM)	51.6 (3.21)	52.4 (3.58)	0.84
Average Injury Severity Score (SEM)	22.4 (1.45)	22.8 (2.05)	0.76
Average ICU LOS (SEM)	4.02 (0.74)	6.21 (1.61)	0.15
LOS (SEM)	9.96 (1.40)	12.1 (2.32)	0.74
No. of AIS A <sup>a</sup> patients on admission	11	9	
No. of AIS B <sup>a</sup> patients on admission	4	4	
No. of AIS C <sup>a</sup> patients on admission	12	7	
No. of AIS D <sup>a</sup> patients on admission	19	9	
Average AIS on admission (SEM)	2.85 (0.18)	2.55 (0.23)	0.31

Abbreviations: AIS, American Spinal Injury Association Impairment Scale; ICU, intensive care unit; LOS, length of stay; SCI, spinal cord injury; SEM, standard error of the mean.  
<sup>a</sup>Indicates AIS impairment grade.

subdivided into one of two time to decompression subgroups: 0 to 12 hours or >12 hours. These subgroups were constructed based on logistic regression analysis of AIS score as a function of time to decompression as described previously.<sup>12</sup> For each mode of transport group, change in AIS score as a function of time to decompression subgroup was assessed via ANOVA with correction for multiple comparisons and subsequent posthoc analysis to assess the association of time to surgical decompression and transport modality on neurological outcomes.

The outcomes of patients transported via ambulance versus helicopter also were assessed based on discharge disposition. Discharge dispositions were assigned the following numeric values: (1) expired, (2) long-term care, (3) skilled nursing facility, (4) rehabilitation unit, or (5) home. In order to assess transport resource utilization and practice patterns, the distance between the referring medical institution and the academic university hospital and level I trauma center of the corresponding author was determined. Longitudes, latitudes, distance, and nautical miles were determined using Great Circle Mapper and Google Maps software (Google Inc, Mountain View, California). Differences in discharge disposition and resource utilization among modes of transport were compared with ANOVA with subsequent posthoc analysis. All analyses in this study were performed using Graphpad Prism 8 and Microsoft Excel software.

**RESULTS**

**Association of Mode of Transport with Neurological Outcomes**  
 Over the course of the 7-year study period, 75 tSCI patients met inclusion criteria and required interfacility transport via ambulance or helicopter for surgical decompression. In total, 46 patients were transported via ambulance while 29 patients were transported via helicopter. Table 1 shows patient demographic data and injury characteristics of both transport groups. Among

**Table 2.** Patient Demographics and Injury Characteristics of Ambulance and Helicopter Transport Groups Subdivided into Time to Surgical Decompression Subgroups

Ambulance Transport Group	0–12 Hours	>12 Hours	P value 0–12 vs >12 Hours
No. of patients	18	28	
No. of cervical/thoracic/lumbar SCI	17/1/0	25/3/0	
No. of male/female patients	12/6	21/7	
Average age (SEM)	47.0 (4.63)	54.6 (7.06)	0.29
Average Injury Severity Score (SEM)	20.4 (1.52)	23.7 (2.17)	0.43
Average ICU LOS (SEM)	3.33 (1.13)	4.46 (0.98)	0.45
Average LOS (SEM)	8.39 (1.06)	11.0 (2.19)	0.99
No. of AISA A <sup>a</sup> patients on admission	2	9	
No. of AISA B <sup>a</sup> patients on admission	3	1	
No. of AISA C <sup>a</sup> patients on admission	5	4	
No. of AISA D <sup>a</sup> patients on admission	8	11	
Average AISA <sup>a</sup> patients on admission	2.71	3.06	0.36

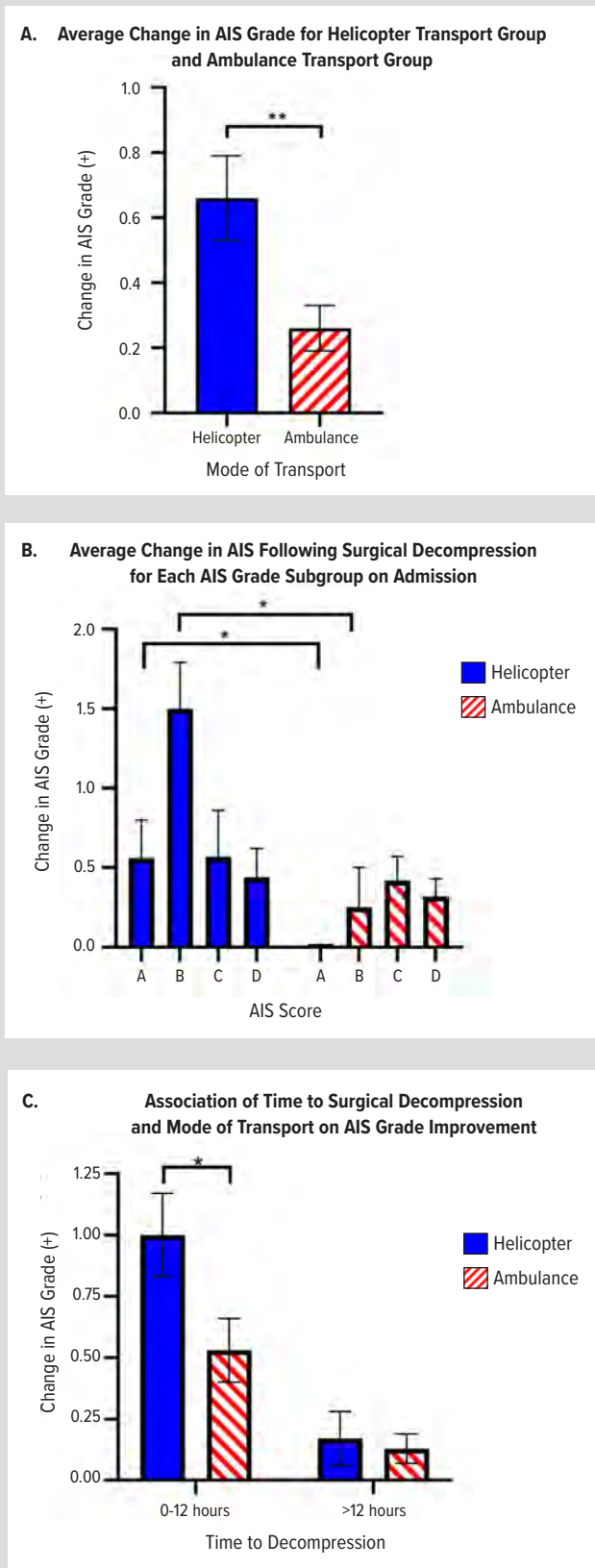
  

Helicopter Transport Group	0–12 Hours	>12 Hours	P value
No. of patients	19	10	
No. of cervical/thoracic/lumbar SCI	16/2/1	8/2/0	
No. of male/female patients	14/5	8/2	
Age (SEM)	52.3 (4.95)	52.7 (4.70)	0.84
Average Injury Severity Score (SEM)	21.32 (2.38)	25.7 (3.88)	0.34
Average ICU LOS (SEM)	7.47 (2.38)	3.50 (0.95)	0.33
Average LOS (SEM)	12.0 (2.51)	12.3 (4.94)	0.76
No. of AISA A <sup>a</sup> patients on admission	4	5	
No. of AISA B <sup>a</sup> patients on admission	4	0	
No. of AISA C <sup>a</sup> patients on admission	6	1	
No. of AISA D <sup>a</sup> patients on admission	5	4	
Average AISA patients on admission	2.63 (0.27)	2.40 (0.48)	0.64

Abbreviations: AISA, American Spinal Injury Association; ICU, intensive care unit stay; LOS, length of stay; SCI, spinal cord injury; SEM, standard error of the mean.  
<sup>a</sup>Indicates ASIA impairment grade.

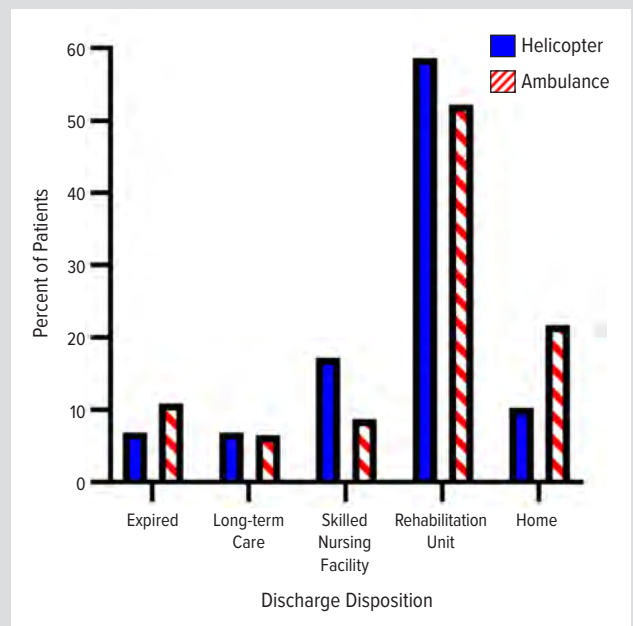
the ambulance and helicopter transport groups, there was no statistically significant difference ( $P>0.05$ ) in age, gender, ISS, LOS, and ICU length of stay. Additionally, there was no statistically significant preoperative difference in AIS grade ( $P=0.31$ ) among the transport groups. The association of mode of transport with neurological outcomes was assessed. First, the change in AIS grade from admission to discharge as a function of the mode of transport was compared using ANOVA with subsequent posthoc analysis. From this analysis, patients who were transported via helicopter had higher rates of average AIS grade improvement ( $0.66 \pm 0.13$ ,  $0.26 \pm 0.065$ ;  $P=0.004$ ) compared to patients transported via ambulance (Figure 1A). Next, transport mode groups were stratified into subgroups based on their AIS grade on admission (ASIA A, B, C, or D), and the change in AIS grade following decompression as a function of transport modality was compared utilizing ANOVA. We were especially interested in the outcomes of AIS grade A patients on admission as conversion of AIS grade A patients to higher AIS grades represents a significant clinical change. AIS grade A patients transported via helicopter had higher

**Figure 1.** Neurological Outcomes of Traumatic Spinal Cord Injury Patients Transported via Ambulance vs Helicopter



Abbreviation: AIS, American Spinal Injury Association Impairment Scale. Error bars are the standard error of the mean. Lines with a single asterisk above mark a statistically significant ( $P < 0.05$ ) comparison via *t* test.

**Figure 2.** Discharge Dispositions of Traumatic Spinal Cord Injury Patients Transported via Ambulance vs Helicopter



rates of AIS grade conversion compared to AIS grade A patients transported via ambulance ( $P=0.02$ , Figure 1B). AIS grade B patients transported via helicopter also were found to have higher rates of AIS score improvement compared to AIS B patients transported via ambulance ( $P=0.02$ ). Among AIS grade C and AIS grade D patients, there was no statistically significant difference in patients transported via helicopter versus ambulance ( $P=0.5$ ,  $P=0.6$ , respectively; Figure 1B).

Recently, studies have suggested that early surgical decompression of tSCI is associated with improved neurological outcomes. Thus, we sought to assess whether the association of helicopter versus ambulance transport on neurological outcomes persisted in patients who were decompressed within 0 to 12 hours versus >12 hours. Time to surgical decompression subgroup cutoffs were defined as described above and in prior publication.<sup>12</sup> Ambulance and helicopter transport groups were subdivided into 2 surgical decompression subgroups: 0 to 12 hours and >12 hours. Table 2 shows the patient demographic and injury characteristics of the ambulance and helicopter transport groups, which have been subdivided into time to surgical decompression subgroups. Among the time to decompression and mode of transport subgroup, there was no statistically significant difference ( $P > 0.05$ ) in patient demographics, such as age, gender, ISS, LOS, or ICU stay. In the case of both patients transported via helicopter and ambulance (Figure 1C), patients who underwent surgical decompression within 0 to 12 hours had higher rates of AIS score improvement ( $P < 0.05$ ) via ANOVA and subsequent posthoc analysis compared to patients who were transported via helicopter or ambulance and were decompressed at >12 hours. Importantly, patients decom-

pressed within 0 to 12 hours and transported via helicopter had significantly higher rates of AIS grade improvement compared to patients decompressed within 0 to 12 hours and transported via ambulance ( $1.00 \pm 0.17$ ;  $0.53 \pm 0.13$ ;  $P=0.04$ ). There was no statistical difference in change in AIS grade among patients transported via helicopter versus ambulance who underwent decompression at >12 hours ( $P>0.05$ ). The discharge disposition of tSCI patients undergoing surgical decompression transported via ambulance compared to those transported via helicopter is shown in Figure 2.

### Utilization of Ambulance Versus Helicopter Transport

Next, the utilization of transport resources was assessed by subdividing the ambulance/helicopter transport groups based on the estimated transport distance into the following categories: (1) <45 miles, (2) 45-59 miles, (3) 60-80 miles, and (4) >80 miles. Helicopter transport was used more frequently ( $P<0.05$ ) than ambulance transport (Figure 3) in situations where the transport distance was relatively long (>80 miles). On the other hand, ambulance transport was utilized more frequently ( $P<0.05$ ) than helicopter transport in cases where transport distance was relatively short (<45 miles).

## DISCUSSION

### Key Results

This retrospective cohort study investigates (1) the association of mode of transport on neurological outcomes, (2) the association of mode of transport and time to surgical decompression on neurological outcomes, and (3) patterns of utilization of air versus ground transport for tSCI patients requiring surgical decompression. This study suggests that tSCI patients transported via helicopter have improved outcomes relative to patients transported via ambulance as overall patients transported via helicopter had higher rates of AIS grade improvement compared to patients transported via ambulance. Furthermore, patients with more severe spinal cord injuries (AIS A and B patients) had higher rates of AIS conversion when transported via helicopter compared to ambulance. In both the helicopter and ambulance transport groups, tSCI patients who underwent surgical decompression within 0 to 12 hours had higher rates of AIS score conversion compared to patients undergoing decompression >12 hours. Importantly, however, patients who underwent decompression within 0 to 12 hours and were transported via helicopter had statistically significantly higher rates of AIS grade improvement compared to patients undergoing decompression within 0 to 12 hours who were transported via ambulance. Therefore, this study suggests an association of helicopter transport with improved neurological outcomes in tSCI patients undergoing decompression within 12 hours, especially in the case of AIS grade A and B patients. This study also showed that a significantly higher number of patients were transported via helicopter from distances greater than 80 miles, while an ambulance

was used more frequently for relatively short distances of less than 45 miles. These patterns of utilization are in line with previous helicopter utilization studies and practice patterns.<sup>39</sup>

### Interpretation and Generalizability

Transport time is a critical determinant of time to surgical decompression and, thus, is a major barrier to potential improvements in neurological outcomes. To our knowledge, this is the first study that examines the association of mode of transport on neurological outcomes of tSCI patients requiring surgical decompression. Although no studies examine tSCI specifically, several studies—including a retrospective cohort study of nearly 75 000 patients comparing the outcomes of helicopter transport versus ground transport—suggested that helicopter transport significantly improved outcomes in patients with more severe injuries as defined by an Injury Survival Score.<sup>31-34,36</sup> In studies of traumatic brain injury patients, helicopter transport compared to ambulance transport significantly decreased mortality and enhanced neurological outcomes.<sup>35,36</sup> Thus, the present study is in agreement with previous work as helicopter transport was associated with higher rates of AIS score conversion and improved outcomes among AIS grade A and B patients compared to patients transported via ambulance.

Recent studies also have suggested the importance of time to decompression on the neurological outcomes of tSCI patients. The present study supports this idea as patients undergoing surgical decompression within 0 to 12 hours who were transported via ambulance or helicopter had improved outcomes relative to patients undergoing decompression at >12 hours. However, this study suggests that helicopter transport has higher rates of improvement in patients undergoing decompression within 0 to 12 hours than patients transported via ambulance undergoing decompression within 0 to 12 hours. Therefore, although helicopter transport theoretically has the potential to be more rapid than ambulance transport, it is unlikely that improvement in the outcomes of patients transported via helicopter in the present study are due to helicopter transport being faster than ambulance transport, as there was no significant difference in transport time among patients transported via ambulance versus helicopter ( $3.94 \pm 0.49$  hours,  $8.48 \pm 2.5$  hours;  $P=0.17$ ). Previous studies have suggested that a possible explanation requiring further study is that air EMS personnel may have an enhanced skill level and more experience or training than ground EMS personnel. Other possible explanations for the improved outcomes of patients transported via helicopter could be an enhanced sense of urgency or differences in stabilization prior to air transport. Regardless, the present study suggests that the improvement in outcomes in patients transported via helicopter versus ambulance transport is not due primarily to the differences in the speed of transport modality but instead is likely due to other factors that require further study.

The question of when utilization of helicopter transport

results in clinically meaningful improvements in outcomes remains unknown. To date, there is no randomized controlled trial comparing air versus ground patient transport. The present study suggests that helicopter transport is beneficial for transport of tSCI patients requiring surgical decompression, especially for AIS grade A and B patients who could undergo surgical decompression within 12 hours. A previous study suggested that ambulance transport is more rapid for distances less than 10 miles, while helicopter transport is faster at distances greater than 10 miles when simultaneously dispatched or greater than 45 miles in cases of non-simultaneous dispatch.<sup>39</sup> Although evidence-based guidelines for triage of air transport patients were generated recently, the decision of whether to transport a trauma patient via helicopter or ambulance is ultimately at the discretion of the clinician.<sup>28</sup> Selection of a mode of transport not only has a significant association with clinical outcomes but also has important financial consequences for the patient and institution. Cost analysis has demonstrated that the median cost of a helicopter is approximately \$36 000, while the cost of ambulance transport is between \$800 and \$2000.<sup>28,29,40</sup> Although the utilization patterns described in this study are in line with previous helicopter utilization studies, further studies examining cost effectiveness are necessary in order to determine what constitutes “appropriate” use. Further expansion of telemedicine and dissemination of guidelines to rural hospitals are both factors that could be important in the future to continue to streamline transport and potentially improve neurological outcomes.

### Limitations

The fact that this study is retrospective is limiting as retrospective studies can be subject to bias and have the potential to be limited by the exclusion of patients due to missing values or incomplete datasets. In the future, a randomized clinical trial would be optimal in order to more directly explore the associations of mode of transport on the neurological outcomes of tSCI patients. However, a randomized trial would be ethically challenging and, thus, an intermediary option would be a multicenter prospective cohort study using the thresholds and outcome measures described in this manuscript. Additionally, AIS grade is less precise than the International Standards for Neurological Classification of Spinal Cord Injury motor and sensory scores, which are now being utilized at our institution. Although this study was adequately powered to detect a statistical difference in the neurological outcomes among transport groups, the sample size of this study is a relative limitation.

### CONCLUSIONS

This retrospective cohort study suggests that helicopter transport of tSCI patients requiring surgical decompression was associated with improved neurological outcomes compared to patients transported via ambulance.

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# Review of Cutaneous Blastomycosis Seen in Wisconsin

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## ABSTRACT

**Introduction:** Blastomycosis is a fungal infection caused by *Blastomyces dermatitidis* that is hyperendemic in Wisconsin. It commonly presents as a pulmonary infection and frequently disseminates to the skin. Studies evaluating the presentation and diagnosis of blastomycosis with skin as a presenting sign have not been thoroughly evaluated, and understanding the most accurate way to diagnose this infection is important for earlier therapeutic intervention.

**Methods:** This is a retrospective chart review study of a single institution. Subjects were identified through a search of ICD-9 (*International Classification of Diseases, Ninth Revision*) and ICD-10 (*International Classification of Diseases, Tenth Revision*) codes for blastomycosis in the clinical record and pathology database. Patients were included if diagnosed with cutaneous blastomycosis infection or involvement of the skin from systemic infection from January 1, 2009, to June 1, 2021.

**Results:** Twenty patients with a diagnosis of cutaneous involvement of blastomycosis were identified; 65% (n=13) were male. Median age of diagnosis was 55.5 years. Fifty-five percent of patients were White, 35% were Black or African American. In addition to residence in an endemic area, 50% (n=10) had exposure risk factors. Fifty percent of patients (n=10) initially presented with a skin concern; 65% (n=13) had extracutaneous involvement. Diagnosis was made by histopathology alone in 55% (n=11), culture plus histopathology in 35% (n=7), and culture alone in 5% (n=1) of cases.

**Conclusions:** Our study highlighted similarities to those previously performed. Half of the patients (n=10) who had cutaneous involvement of blastomycosis did not demonstrate clinically significant pulmonary involvement. Histopathology and culture remain critical in diagnosing cutaneous blastomycosis.

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## INTRODUCTION

Blastomycosis is a fungal infection caused by *Blastomyces dermatitidis*. This dimorphic fungus is endemic in the Ohio and Mississippi River valleys, Great Lakes region, and southeastern United States and hyperendemic in several areas in northern Wisconsin and Michigan.<sup>1</sup> It most commonly presents as a pulmonary infection caused by the inhalation of spores found in soil. After inhalation, the mold converts to the yeast form and multiplies in the lungs. Up to 50% of infected individuals remain asymptomatic,<sup>2</sup> and both immunocompetent and immunosuppressed hosts can develop severe pulmonary infection progressing to acute respiratory distress syndrome.<sup>1</sup> Dissemination of *Blastomyces* species to other organs can occur, with the skin being the most common site involved (up to 59% of cases),<sup>3</sup> followed by osteoarticular involvement (25%), the genitourinary tract (<10%),<sup>4</sup> and central nervous system (5%-10%).<sup>3-5</sup> The skin lesions seen in blastomycosis can have variable presentations,

including crusted verrucous lesions, thick plaques, painful ulcers, and tender subcutaneous nodules. Lesions are most commonly described on exposed areas on the head and extremities but can occur anywhere on the body.<sup>1</sup> Cutaneous infection caused by direct inoculation of the skin is also possible, though only reported in a small number of cases.<sup>6</sup>

Studies evaluating the presentation and diagnosis of blastomycosis with skin as a presenting sign are lacking, and understanding the spectrum of cutaneous manifestations and most

accurate way to diagnose this infection are important for earlier therapeutic intervention.

## METHODS

This is a retrospective chart review study of a single institution approved by the Institutional Review Board. Subjects were identified through a search of ICD-9 (*International Classification of Diseases, Ninth Revision*) and ICD-10 (*International Classification of Diseases, Tenth Revision*) codes for blastomycosis in the clinical record and pathology database. Eligible charts were then reviewed for inclusion and exclusion criteria. Patients were included if diagnosed with cutaneous blastomycosis infection or involvement of the skin from systemic blastomycosis infection and had confirmation of diagnosis through histopathology or microbiological confirmation from January 1, 2009 to June 1, 2021. Data collected included demographic information (age, gender, ethnicity), specimen site, other organ involvement, organism type, comorbid medical conditions, past medical history, immunosuppression status, medications, travel history, relevant exposures, history of smoking, occupation, hobbies, general disease presentation, constitutional symptoms, medical or surgical treatment, treatment duration, time to resolution of infection, and whether histopathology and culture were obtained. Descriptive analyses were used in Excel to examine demographic characteristics and risk factors.

## RESULTS

Twenty patients with a diagnosis of cutaneous involvement of blastomycosis were identified. The gender distribution was 65% male (n = 13). The mean age at time of diagnosis was 52.25 years, and the median age was 55.5 years (age range 19-88). Fifty-five percent of patients were White, 35% were Black or African American, and 10% were unknown or not reported (Table 1). All of the patients lived in Wisconsin. In addition to residence in an endemic area, 50% (n = 10) had exposure risk factors, including proximity to construction, hunting, fishing, or other outdoor leisure activities (Table 2). Fifty percent of patients (n = 10) initially presented with a skin concern. The morphology of cutaneous lesions was variable, with 40% (n = 8) of patients presenting with verrucous or crusted papules and plaques, 25% (n = 5) with violaceous papules or nodules, and 20% (n = 4) with an ulcerated lesion. Pustules and abscesses also were present in a minority of patients (n = 3). Forty percent (n = 8) of patients presented with pulmonary symptoms, including cough, hemoptysis, or shortness of breath. One patient first sought medical care for headaches, dizziness, and falls, and another presented initially for arthralgias. At time of presentation, 45% (n = 9) of patients also had constitutional symptoms of fever, chills, or weight loss. A majority of patients (65%, n = 13) had extracutaneous involvement. Organ systems involved included the lung (50%, n = 10), osteoarticular involvement (25%, n = 5), and central nervous system (10%,

**Table 1.** Patient Demographics, N = 20

Patient Variable	% (n)
Age and sex	
Median age	55.5 years
Male	65 (13)
Female	35 (7)
Race and ethnicity	
White	55 (11)
African American	35 (7)
Unknown	10 (2)

**Table 2.** Patients With Blastomycosis, N = 20

Patient Variable	% (n)
Other organ involvement	
Pulmonary	50 (10)
Osteoarticular	25 (5)
Central nervous system	10 (2)
At least 1 environmental exposure listed below	50 (10)
Outdoor leisure activity	25 (5)
Hunting/fishing	5 (1)
Proximity to construction	5 (1)
Diagnostic method	
Histopathology alone	55 (11)
Culture and histopathology	35 (7)
Culture alone	5 (1)
Bronchoalveolar lavage with culture	5 (1)

n = 2). Diagnosis was made by histopathology of skin biopsy alone in 55% (n = 11), culture plus histopathology in 35% (n = 7), and culture alone in 5% (n = 1) of cases (Table 2). In 4 of the cases in which diagnosis was made by histopathology alone, culture was obtained and did not demonstrate fungal organisms; in the other cases, culture was not performed. One patient was diagnosed with disseminated blastomycosis through bronchoalveolar lavage with culture alone and had resolution of cutaneous symptoms after starting antifungal therapy.

Twenty percent (n = 4) of patients with cutaneous blastomycosis were immunosuppressed. One patient had a history of kidney transplant, 1 with autologous stem cell transplant, and 2 with sarcoidosis and on systemic immunosuppressants (prednisone and/or mycophenolate mofetil). All 20 patients received antifungal therapy with a triazole. Itraconazole was used most (80%, n = 16), followed by voriconazole (25%, n = 5). Two patients were started initially on itraconazole and later switched to either voriconazole or posaconazole. Additionally, 35% (n = 7) of patients also received amphotericin B. Surgical debridement was utilized in 30% (n = 6) of patients. Seventy percent (n = 14) of patients had complete resolution of infection, while the remaining patients were either lost to follow-up or died due to unrelated causes before confirmation of infection resolution. There was no evidence of disease sequelae in any of the cases.

## DISCUSSION

Our study highlighted several similarities to those previously performed. Interestingly, 75% of the patients in this study did not have an underlying source of immunosuppression, which is similar to prior studies where disseminated blastomycosis is commonly seen in those who are immunocompetent. This is in stark contrast to histoplasmosis and coccidioidomycosis in which immunosuppression is often a prerequisite for disseminated disease.<sup>7</sup> This difference may be due to the risk of systemic dissemination being determined by pathogen-related factors in blastomycosis, rather than host immune defenses as with other organisms.<sup>7</sup> Our patients had similar lung and cutaneous involvement, and half of the patients (n=10) in this study did not demonstrate clinically obvious pulmonary involvement. As pulmonary involvement is the most common source of infection, we hypothesize that even if not being the cause for presentation, patients have subclinical pulmonary involvement. The rate of osteoarticular and central nervous system involvement in this study were also similar to those in previous reports.<sup>7</sup> Interestingly, 3 patients in this study had a history of incarceration, though this may be related to environmental exposure of the site rather than incarceration itself.

Cutaneous lesions in disseminated blastomycosis are classically reported as verrucous or ulcerative.<sup>8</sup> The verrucous lesions begin as papules and progress into plaques, often with heaped up borders. The ulcerative form, in contrast, begins as erythematous nodules or pustules that then ulcerate and heal over and may reulcerate. While we do not have data on lesion morphology for 3 of the patients, the remainder of patients in our subset had typical presentations of blastomycosis (Figures 1 and 2).

Histopathology and culture remain critical in diagnosing cutaneous blastomycosis, along with a high degree of clinical suspicion. In this study, culture had an overall yield of 63.6% for growth of fungal organisms; however, for the specimens that did not grow fungal organisms, histopathology allowed for diagnosis with the presence of broad-based budding yeast. While previous studies have demonstrated that culture is the most sensitive diagnostic method for blastomycosis,<sup>9</sup> our study highlights scenarios where histopathology was required for diagnosis as culture did not grow. Histopathology and bedside diagnostics, such as performing microscopy using potassium hydroxide and exfoliative cytology, also remain crucial in earlier diagnosis as this can be visualized before the culture has resulted in growth.<sup>10</sup> When evaluating a patient with clinical concern of cutaneous blastomycosis, performing both culture and histopathology on tissue specimens is essential. This study demonstrates that both culture and histopathology should be utilized to aid in timely diagnosis if blastomycosis is

**Figure 1.** Verrucous Plaques on the Face (A) and Lower Extremity of the Same Person



**Figure 2.** Numerous Pustules, Superficial Erosions, and Ulcers with Fibrinous Tissue Involving Nearly the Entire Right Lower Leg



suspected. Limitations of the study include small sample size, retrospective nature, and partial or incomplete data for patients lost to follow-up.

## CONCLUSIONS

This study highlights the most common presentations of blastomycosis infection of the skin seen in Wisconsin, which is similar to that demonstrated by previous studies. Diagnosis of this systemic infection can be achieved through skin histopathology, bedside diagnostics, and culture. As the complications of invasive



blastomycosis can result in hospitalizations, surgery, bacteremia, and even death, understanding demographic information of these patients and methods of early detection allow us to better understand and treat these types of infections.

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# Perspectives on Electronic Nicotine Delivery System Use Cessation Among Adults in Rural Areas: Implications for Future Studies

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## ABSTRACT

**Introduction:** More young adults (age 18-24 years) in rural areas versus urban areas use electronic nicotine delivery systems (ENDS)—also known as e-cigarettes. Little is known about young adults' perceptions toward ENDS use and cessation. The objective of this study was to examine barriers and facilitators to ENDS use cessation among young adults living in rural areas, as well as their perceptions about ENDS use and cessation and to determine implications for future cessation studies.

**Methods:** We administered cross-sectional online surveys to young adults living in rural Midwestern counties. A total of 100 individuals responded to the surveys. Descriptive statistics were used to report their perceptions of ENDS use as well as barriers and facilitators to ENDS use cessation. The content analysis method was used to analyze the answers to an open-ended question regarding perceptions about the ENDS use cessation in the context of rural areas.

**Results:** Barriers to ENDS use cessation included perceived advantages to ENDS use, high nicotine dependence, and the perception that ENDS use was less harmful cigarettes. Facilitators to ENDS use cessation included cost of ENDS use, perceived harm, and high confidence in ability to quit. Participants' perceptions about ENDS use cessation in the context of rural areas were conceptualized under the themes of (1) exposure to and initiation of ENDS use, (2) continuation of ENDS use, and (3) prevention and cessation of ENDS use.

**Conclusions:** Health care providers, tobacco control researchers, and public health advocates should be aware of barriers and facilitators to ENDS use cessation among young adults for future cessation intervention studies relevant specifically to rural areas.

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## INTRODUCTION

Electronic nicotine delivery systems (ENDS)—also known as e-cigarettes—are the most popular tobacco products among young adults (age 18-24 years) in the United States.<sup>1-3</sup> Nicotine, a primary concern of ENDS use, facilitates physiological changes in neuronal nicotine acetylcholine receptors in the brain, thereby maintaining addiction.<sup>4,5</sup> ENDS use by young adults is associated with other health risk behaviors, including alcohol intake and the use of marijuana and other drugs.<sup>6-8</sup> The literature supports relationships between ENDS use and cardiovascular disease,<sup>9,10</sup> cancer,<sup>11</sup> chronic respiratory disease,<sup>12</sup> diabetes,<sup>13</sup> and psychiatric conditions.<sup>13,14</sup> Liquids and aerosols in ENDS also contain harmful ingredients that are known to cause severe disease or cancer, including formaldehyde, toluene, acetaldehyde, acrolein, heavy metals, nitrosamines, and other tiny particles of matter.<sup>15,16</sup> Another major concern is that ENDS use in young adults serves as a gateway to later use of combustible tobacco.<sup>17-19</sup>

A recent study reported that the prevalence of current ENDS use among young adults in rural areas increased from 13.3% in 2018 to 15.9% in 2020, despite the urban prevalence remaining constant at 11% from 2018 to 2020.<sup>20</sup> In urban areas, the prevalence of exclusive ENDS use (not combining with other tobacco) and exclusive ENDS use without having ever smoked among young adults increased slightly from 7.5% to 7.8% and 5.7% to 5.9%, respectively, from 2018 to 2020.<sup>20</sup> However, its prevalence among the young adult population in rural areas exhibited greater

increases over the same period, from 8.6% to 12.6% and 6.7% to 9.9%, respectively.<sup>20</sup>

Research on ENDS has been widely reported over the past decade, including a significant number of studies focused on health effects, relationships with other tobacco products or health-risk behaviors, and the socioeconomic characteristics of ENDS users.<sup>21</sup> Historically, rural communities in the United States have higher smoking rates, less access to cessation support, a more smoking-friendly culture, and lower tobacco taxes compared to urban communities.<sup>22-24</sup> However, there has been a serious gap in knowledge of the perceptions about young adults' ENDS use and cessation as well as barriers and facilitators associated with cessation in rural areas. Thus, the objectives of this paper were to understand perceived barriers and facilitators to ENDS use cessation among young adults in rural areas and to examine their perceptions about ENDS use and cessation.

## METHODS

We conducted a cross-sectional survey with young adults residing in Wisconsin, Minnesota, and South Dakota. We recruited participants using multiple channels, including distributing study advertisements online to college students, advertising the study using regional public health and tobacco-free networks, and displaying study recruitment flyers at local events in rural areas of these states. Inclusion criteria were (1) English speaking, (2) age 18 to 24 years, (c) daily ENDS use in the past month, and (4) address in a rural county as defined by a Rural-Urban Continuum Code (RUCC) of 4 to 9. Individuals who reported use of other tobacco products (eg, cigarettes and smokeless tobacco) in the past month were excluded.

The RUCC is a classification number that distinguishes metropolitan counties by the population size of their metro area and nonmetropolitan counties by degree of urbanization and adjacency to a metro area.<sup>25</sup> RUCCs range from 1 to 10. Counties with RUCCs from 1 to 3 are classified as metro areas, and counties with RUCCs from 4 through 10 are classified as nonmetro areas. No counties in the United States are classified as 10.<sup>26</sup> In our study, counties with RUCCs from 4 through 9 were defined as rural areas. This rural classification method has been used in other rural tobacco studies.<sup>27-29</sup>

Individuals interested in participating in the study accessed the online screening survey via Qualtrics. They were asked to answer questions regarding inclusion and exclusion criteria and to enter their email address. Then, a personalized link for the main survey was delivered to the respondent's email address. The main survey took approximately 20 minutes to complete. Participants who completed the survey were provided an opportunity to win a \$100 electronic gift card.

## Measures

### *Demographics and ENDS Use Cessation*

The survey asked participants' age, gender, race, ethnicity, and

**Table 1.** Characteristics of Survey Participants (N=91)

Variable	N (%) or mean (±SD)
Age	20.4 (± 1.6)
Sex	
Man	16 (17.6)
Woman	72 (79.1)
Other	3 (3.3)
Race	
White	87 (95.6)
Other <sup>a</sup>	4 (4.4)
Ethnicity (Hispanic, Latino/a, or Spanish origin)	
Yes	5 (5.5)
No	86 (94.5)
State (n=81)	
Wisconsin	64 (79.0)
Minnesota	16 (19.8)
South Dakota	1 (1.2)
Nicotine dependence score	11.9 (± 4.0)
Perceived proportion of ENDS users	6.6 (± 2.4)
Perception of ENDS (n=90)	
Very good vs very bad	6.3 (± 2.6)
Very safe vs very dangerous	6.0 (± 2.8)
Very nice vs very awful	5.3 (± 2.7)
Readiness to quit ENDS (n=90)	
Within next month	12 (13.3)
Within next 6 months	33 (36.7)
At some point	42 (46.7)
Not thinking about it	3 (3.3)
Confidence in ENDS cessation	2.9 (± 1.3)
Talked about ENDS use with health care providers (n=89)	
Yes	28 (31.5)
No	61 (68.5)
Delivery preferences for cessation treatment <sup>b</sup>	
Text message	34 (37.4)
Social media	19 (20.9)
Smartphone application	16 (17.6)
Voice phone call	5 (5.5)
Office visit	7 (7.7)
Web (Internet)	12 (13.2)
Virtual meeting	5 (5.5)
Other	1 (1.1)
Not sure	41 (45.1)

Abbreviation: ENDS, electronic nicotine delivery system.

<sup>a</sup>Other includes Asian (n=2) and multicultural (n=2).

<sup>b</sup>Multiple responses allowed.

state, as well as ENDS use cessation-related questions including nicotine dependence, perceived proportion of ENDS users in their age group (18-24 years), perceptions of ENDS use, readiness to quit using ENDS, confidence in their ability to stop using ENDS, and delivery preferences for cessation treatment. Nicotine dependence level was measured by the Penn State Electronic Cigarette Dependence Index (PS-ECDI), a reliable and validated instrument to measure nicotine dependence among adult ENDS users. It comprises 10 items to measure nicotine dependence covering frequency of use, time until first use of the day, awakening at night to use, difficulty quitting, cravings, urges, and withdrawal

symptoms.<sup>30,31</sup> Total scoring of PS-ECDI ranges from 0 to 20 (0-3 = no dependence, 4-8 = low dependence, 9-12 = medium dependence,  $\geq 13$  = high dependence).

The perceived proportion of similarly aged ENDS users was assessed with the question, “Out of every 10 people in your age group, how many do you think use e-cigarettes?” with answers ranging from 0 to 10. Perceptions about ENDS were measured with three 10-point semantic differential scale items assessing how good or bad, how safe or dangerous, and how nice or awful it is. Readiness to quit using ENDS was measured with the question, “Are you planning to quit e-cigarettes?” Options were “thinking of it within the next month,” “within the next 6 months,” at some point, but not within the next 6 months,” or “absolutely not thinking of quitting.” Participants also were asked, “How confident are you that you can quit e-cigarettes completely?” with options ranging from 1 to 5 (“not at all” to “very confident,” respectively).

The survey asked if participants had been asked about ENDS use by a health care provider in the past year (yes/no) and about their preferred delivery method for cessation treatment (ie, “What are your delivery preferences of an e-cigarette cessation [quitting] treatment program?”). Options were “text message,” “social media,” “smartphone application,” “voice phone call,” “office visit,” “Web,” “virtual meeting,” and “other.” Participants were allowed to select multiple answers to this question.

### Barriers and Facilitators to ENDS Use Cessation

The following questions and response categories were created based on a report by Dyson et al on the barriers and facilitators to END use cessation.<sup>32</sup> For barriers, participants were asked, “What makes it difficult for you to quit e-cigarettes?” and to rate the following categories on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree: (1) low confidence of quitting, (2) high nicotine dependence, (3) many advantages of e-cigarettes (eg, stress relief, flavor), (4) social influence toward maintaining e-cigarette use, (5) environmental influence toward maintaining e-cigarette use (eg, permissive culture), (6) thoughts that e-cigarettes are less harmful than cigarettes, (7) lack of information about how to start quitting, and (8) cost for cessation treatment.

**Table 2.** Barriers and Facilitators to ENDS Use Cessation (N = 86)

Barrier	Mean ( $\pm$ SD)	Facilitator	Mean ( $\pm$ SD)
Low confidence in ability to quit	3.2 ( $\pm$ 1.3)	High confidence in ability to quit	2.88 ( $\pm$ 1.3)
High nicotine dependence	3.8 ( $\pm$ 1.1)	Low nicotine dependence	2.84 ( $\pm$ 1.4)
Many advantages of ENDS	3.9 ( $\pm$ 1.1)	Few advantages of ENDS	2.69 ( $\pm$ 1.3)
Social influence toward maintenance	3.0 ( $\pm$ 1.5)	Social influence toward cessation	2.59 ( $\pm$ 1.3)
Environmental influence toward maintenance	3.0 ( $\pm$ 1.3)	Environmental influence toward cessation	2.52 ( $\pm$ 1.1)
Perception ENDS is less harmful than cigarettes	3.2 ( $\pm$ 1.2)	Perception ENDS is still harmful	3.79 ( $\pm$ 1.2)
Lack of information about cessation	2.9 ( $\pm$ 1.3)	Information about cessation	2.85 ( $\pm$ 1.2)
Cost for cessation	2.8 ( $\pm$ 1.4)	Cost for ENDS use	4.15 ( $\pm$ 1.1)

Abbreviation: ENDS, electronic nicotine delivery systems.

**Table 3.** Perceptions of ENDS Use Cessation (N = 57)

Themes	Categories	N (%)
Exposure to and subsequent initiation of ENDS use	Informal sources (eg, family members, and friends)	2 (3.5)
	Public sources (eg, retail stores, bars, and gas stations)	3 (5.3)
Continuation of ENDS use	Social norms towards ENDS use	6 (10.5)
	Accessibility to ENDS products	3 (5.3)
	Marketing of ENDS products	2 (3.5)
	Limited entertainment resources in rural areas	4 (7.0)
Prevention and cessation of ENDS use	Suggested prevention strategies for rural areas	
	• Limit access to ENDS products	5 (9.3)
	• Denormalize ENDS use	3 (5.3)
	Recommended treatment programs for rural areas	
	• Implement or expand access to tailored quality programs and helpful resources	10 (17.5)
	• Provide alternative activities, social skill training, and support groups	9 (15.8)
	• Offer low cost and affordable treatment options	5 (9.3)
	• Emphasize harms of ENDS use and health benefits of quitting	2 (3.5)
	• Destigmatize seeking treatment	1 (1.8)
	Opposite views regarding cessation treatment targeting rural areas	2 (3.5)

Abbreviation: ENDS, electronic nicotine delivery systems.

For facilitators to ENDS use cessation, participants were asked, “What motivates you to quit e-cigarettes?” Using the same 5-point Likert scale, response categories were (1) high confidence in quitting, (2) low nicotine dependence, (3) few advantages of e-cigarettes, (4) social influence toward quitting e-cigarette use, (5) environmental influence toward quitting e-cigarette use, (6) thoughts that e-cigarettes are still harmful, (7) information about how to start quitting, and (8) cost for e-cigarette use.

### Perceptions About ENDS Use Cessation

At the end of the survey, participants were asked an open-ended question: “What would you like us to consider for e-cigarette cessation treatment in terms of your residential or community area?”

### Analytic Strategies

Descriptive statistics analysis using frequencies, percentages, and mean values was used to summarize survey responses. Data were



analyzed using IBM SPSS Statistics, version 26 (IBM Corp, Armonk, New York). Responses to the open-ended question were analyzed using a descriptive content analysis method<sup>33</sup> with assistance of NVivo 12 (Lumivero, Denver, Colorado). This method transcends free text, delving into a deeper understanding of the responses, to organize large amounts of text into categories and themes that reflect a shared meaning.<sup>33</sup> Three coders were oriented to the entire nature of the study, study objectives, data structure, and approach to coding. Subsequently, they coded the free-text responses by (a) identifying the meaning of the texts, (b) creating primary codes, (c) sorting texts into categories, and (d) formulating content into themes. A codebook to provide definitions and example quotes was drafted based on the primary codes and updated throughout the coding process as new codes were identified. This detailed codebook and achievement of the 80% inter-coder reliability were critical to ensure validation.

The study protocol was approved by the Institutional Review Board (IRB) at the first author's institution prior to data collection. Additional IRB reviews and discussions were made at some institutions where data were collected.

## RESULTS

### Characteristics of Survey Participants

Due to incomplete answers from 9 survey respondents, demographic characteristics were analyzed for 91 out of 100 total respondents (Table 1). The mean age of the participants was 20.4 years. Nearly 80% of respondents were women, and a majority (94.5%) of respondents were non-Hispanic White. Nearly 80% were from Wisconsin, followed by Minnesota (19.8%) and South Dakota (1%). The mean nicotine dependence score of participants was 11.9 ( $\pm 4.0$ ; range 1-19), indicating medium dependence. The perceived proportion of similarly aged ENDS users was 6.6 (range 1-12), indicating participants perceived that approximately 60% to 70% of young adults are ENDS users. Slightly more participants perceived ENDS use to be bad (vs good), dangerous (vs safe), and awful (vs nice). Half of the participants reported a readiness to quit using ENDS within 6 months, including 13.3% reporting a readiness to quit within 1 month. Participants reported a moderate level of confidence (2.9, range 1-5) in their ability to quit. Approximately one third reported being asked about ENDS use by a health care provider in the past year. The cessation treatment delivery method most preferred was text message, followed by social media, smartphone application, and Web (internet) (Table 1).

### Barriers and Facilitators to ENDS Use Cessation

Eighty-six participants answered questions about ENDS use cessation barriers and facilitators. The highest barriers were advantages of ENDS use ( $3.9 \pm 1.1$ ), followed by high nicotine dependence ( $3.9 \pm 1.1$ ), low confidence ( $3.2 \pm 1.3$ ), and the perception that ENDS are less harmful than cigarettes ( $3.2 \pm 1.2$ ). The greatest

facilitators were the cost ( $4.2 \pm 1.1$ ), associate harm ( $3.8 \pm 1.2$ ), confidence in ability to quit ( $2.9 \pm 1.3$ ), and low nicotine dependence ( $2.8 \pm 1.4$ ). See Table 2.

### Perceptions About ENDS Use Cessation

In response to the open-ended question regarding perceptions about ENDS use cessation, 43 respondents left it blank or reported "N/A," or "I don't know." Responses from the remaining 57 participants were analyzed, and 3 key themes emerged: (1) exposure to and subsequent initiation of ENDS use, (2) continuation of ENDS use, and (3) prevention and cessation of ENDS use (Table 3).

### Exposure to and Subsequent Initiation of ENDS Use

Five respondents (8.8%) indicated that exposure to ENDS products through informal sources (eg, friends and family members) and public sources (eg, retail stores, bars, gas stations) led to the initiation of ENDS use. Comments included the following:

*"(The) majority of the students in high schools are getting nicotine products from parents, siblings, or friends; I started because my brother's friend let me try and then I ended up getting addicted."*

*"Vaping is allowed at the bars. They even have chargers available for people to charge their vapes at the bars if they (ENDS) die there."*

### Continued ENDS Use

The primary reasons for continued ENDS use in rural areas included social norms (10.5%) and easy access to ENDS products (5.3%). Comments included the following:

*"It's really hard in small towns because it seems like everyone does it [vapes]. Even if you quit, if you see your friends, they will likely offer you some nicotine products and it's really hard to say no. It's also illegal to get them (nicotine products) under 21, but it's pretty easy to get them anyways."*

*"...how easy access can be and how long people have been doing it. Also, here vaping is actually done with its intended use of quitting cigarettes. That is...what I have noticed."*

Some respondents (7.0%) cited limited entertainment options in rural areas as a reason for their ENDS use:

*"It is ridiculously boring having to live in the middle of nowhere. ...there is nothing else to do" and "...there's nothing for us to do in rural areas."*

A few respondents (3.5%) indicated that marketing strategies related to sales of ENDS products (eg, kits and e-liquids) contributed to continued ENDS use:

*"I think the best way to help people quit is by stopping the brands from being able to make different flavors [because] if there was only tobacco [flavor] I would never vape."*

### ENDS Use Prevention and Cessation

The theme of ENDS use prevention and cessation consisted of 3

categories: (1) suggested prevention strategies, (2) recommended treatment programs for rural areas, and (3) opposing views regarding cessation treatment.

### **Suggested Prevention Strategies for Rural Areas**

Respondents identified several ENDS use prevention strategies relevant to the rural context, such as limiting the availability of ENDS products (9.3%) and denormalizing ENDS use (5.3%) in rural communities. Responses included the following comments: “ban them;” “make it harder for those underaged to receive e-cigarettes;” and “try to make it harder to access; it’s so easy to go buy it.” Denormalization comments included, “make it less socially cool” and “not normalizing it.”

### **Recommended Treatment Programs for Rural Areas**

Respondents offered various suggestions regarding treatment programs appropriate for rural settings. The need to implement or expand access to tailored programs and helpful resources (17.5%) was identified by 9 respondents. Comments included, “there’s not a lot of cessation options in smaller towns” and “make getting information and help on quitting easier than going to the gas station or smoke [vape] shop closest to you.” Two respondents specifically identified the need for online treatment programs. Their suggestions included, “more online options” and “maybe easier access for people who live far away from it [treatment] and don’t have reliable internet.”

Several respondents (15.8%) suggested providing alternative activities, social skill training, and support groups to avoid temptations. Examples included:

*“Try and have a local group to help quit. I think if others see people that are the same age and trying to do the same thing (such as quitting nicotine), it would be a great way for people to see they aren’t alone in trying to quit.”*

*“How to avoid temptation around friends, family, and community members who do smoke [vape] and what to do when you have the urge to smoke [vape] from those people that [are] around you.”*

*“Something to be able to honk [sic] about all day would help me take my mind off of cravings.”*

Respondents (9.3%) also noted the high cost of treatment and suggested making treatment options low cost and affordable:

*“Make it more cost efficient (for nicotine patches and the care required for withdrawal). I think what turns me away mostly is the cost of being able to seek help for vaping.”*

*“Offering low-income, friendly, in-person treatments/advocates/meetings.”*

A few respondents (3.5%) raised concerns about the lack of knowledge related to harm caused by ENDS use and the health benefits of quitting, evidenced through comments such as “most of the [people in] rural areas do not know the harm of smoking [vap-

ing], so we should publicize it and let everyone know its harm;” and “[provide] more information on what it does to you—information on the negative side effects (drowsiness, appetite issues, sleep issues).”

### **Differing Views for Cessation Treatment in Rural Areas**

Two responses reflected opposite views regarding the need for treatment programs targeting rural areas. One respondent said, “I don’t think that the rural setting really matters that much when it comes to quitting vaping. It’s mostly just based on the individual.” The other emphasized an individual’s ability to quit: “I mean thinking about it really just kind of makes me look like a loser. I don’t know if there are many quitting methods besides holding yourself accountable.”

## **DISCUSSION**

To our knowledge, this is the first study to report the barriers and facilitators to ENDS use cessation, as well as perceptions about ENDS use and cessation among young adult ENDS users in rural areas. Barriers to cessation reported by respondents included advantages of ENDS use, high nicotine dependence, low confidence in ability to quit using ENDS, the perception that using ENDS is less harmful than cigarettes, and social/environmental influences. The survey did not ask for specific details regarding advantages of ENDS use, but use as an aid for stress reduction, enjoyment/satisfaction,<sup>34</sup> flavors,<sup>35,36</sup> and aesthetic device designs<sup>37,38</sup> may attract young generations to consumption and discourage cessation. Like other tobacco products, high nicotine dependence was still a huge barrier to ENDS use cessation, and most ENDS products contain nicotine with a controllable option for its concentration levels.<sup>21,39</sup>

Survey respondents also indicated that the cost of ENDS use was highly associated with cessation—a finding that differs from—another recent study that reported health concerns as the top reason for cessation.<sup>40</sup> Rural communities in the United States are characterized by fewer employment opportunities<sup>22</sup> and more prevalent poverty than urban areas.<sup>41</sup> Thus, providing more affordable or free cessation programs for young adults in rural areas is an important consideration.

Further, among our study participants, cognitive factors (eg, thoughts on ENDS’ harmful effects and cessation) and psychosocial factors (eg, confidence, social and environmental influences) were associated with barriers or facilitators to ENDS use. Improving social and cognitive skills (eg, enhancing self-efficacy), establish perceived social norms, and social support to grow behavioral capability<sup>42</sup> need to be considered in future ENDS cessation treatment programs.

Study participants also shared feedback regarding ENDS use cessation specifically in rural settings. Findings indicate that young adults in rural settings experienced strong and even unavoidable social and environmental influences that contributed to the initiation and continued use of ENDS in various situations, and structural and cultural factors in rural communities appear to enhance this. For example, rural areas lack many of the entertain-

ment options young adults prefer for stress relief, and ENDS use may be related to boredom or the lack of other social activities. Additionally, rural residents may share permissive cultural attitudes toward vaping<sup>24</sup> and stigma toward cessation.<sup>43</sup>

### Implications for Future Cessation Study

Given our findings, we present a call to action for increased efforts toward ENDS use cessation and prevention for young adults in rural areas. First, educating health care providers about the dangers of ENDS and making sure all clinicians are addressing ENDS use prevention and cessation with young adults is critical. Clinicians in rural communities should engage with ENDS or comprehensive tobacco control coalitions and public health advocates to monitor ENDS use-related health disparities (ie, differences in prevalence between urban and rural areas) and to plan and implement strategies to reduce ENDS use. Policies toward ENDS use cessation and prevention among this population (eg, the adoption of comprehensive tobacco-free policies including ENDS) are urgently needed in places frequented by young adults in rural areas, such as restaurants and bars.

Researchers and clinicians should continue to examine ENDS use among young adults in rural areas, including their motivations and barriers to ENDS use cessation, as a foundational knowledge base for effective treatment strategies and future studies. Given the potentially unique contextual and environmental factors associated with ENDS use in rural areas, these data can be used to develop tailored ENDS use cessation intervention studies for young adults. Because a majority of young adult ENDS users in rural areas are now consuming ENDS exclusively (ie, not combining with other tobacco products) and have never been cigarette smokers, cessation interventions for these users should be prioritized and consider ENDS-specific details (eg, device, flavor, nicotine strength, battery, vape-free policy). The good news is most of the participants in our study were interested in cessation, with half indicating a desire to quit within 6 months.

Rural residents have limited access to effective tobacco cessation resources.<sup>24</sup> Thus, as indicated by our survey respondents, remotely delivered interventions may increase reach in this population. Short messaging service (SMS)-based interventions may offer a promising approach to help rural young adults quit using ENDS. Text messaging is inexpensive, easy, and anonymous. A recent empirical study documented the effectiveness of the text message-based approach in ENDS cessation for entire young adults population in the United States.<sup>44</sup> Text messaging interventions have been shown to be feasible, acceptable, and efficacious for smokeless tobacco cessation among rural youths<sup>45</sup> and other rural populations,<sup>29,46</sup> and effective in general for young adults.<sup>47,48</sup>

### Study Limitations

While this paper presents important findings and implications for clinicians, tobacco control researchers, and public health

advocates regarding ENDS use control and cessation, there are limitations. The study's sample size was relatively small, which could potentially limit the generalizability of the findings. Data on participants' socioeconomic status (eg, education) were not collected, even though these factors could offer pertinent insights into barriers and facilitators to ENDS use and cessation. Although participants were recruited through multiple channels, the sample was skewed toward females and respondents from Wisconsin, and reliance on self-report surveys may cause response bias. The study was conducted in 1 regional location, thus curbing its broader applicability. In our survey, we drew potential facilitators and barriers from a previous report by Dyson et al,<sup>32</sup> which used a synthesis of various types of research designs from different populations (eg, adolescents, adults, dual users, and combustible cigarettes). However, the current study's sample differed from that of Dyson et al. Contextual factors were not considered. We did not evaluate the effectiveness of specific cessation interventions. Given the study's specific focus on rural environments, the findings may not be generalizable to urban or suburban areas of the nation.

### CONCLUSIONS

Clinicians, researchers, and public health advocates in rural areas should prioritize ENDS use among young adults in rural areas. Cessation programs for this population should take into account the barriers and facilitators to cessation found in this study, including decreasing the benefits of ENDS use, alternative stress relief activities in rural areas, cost savings associated with use and cessation or affordable cessation treatment options, management of nicotine craving and withdrawal symptoms, and rural-relevant social, environmental, and cultural factors associated with use and cessation. Strong social norms, acceptability and accessibility to ENDS, lack of access to cessation treatment programs, and stigma toward cessation also need to be addressed for this rural population who want to quit ENDS use.

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# Critical Reflection to Investigate Medical Student Attitudes Toward Skin Tone in Their Preclinical Years

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## ABSTRACT

**Introduction:** Implicit racial bias, defined as unreasoned judgement based solely on an individual's skin color, is a persistent barrier to quality medical care for people of color in the United States. Early, learner-centered intervention is crucial to establish cultural competence within health professional training programs.

**Methods:** Over 3 academic years, preclinical, second-year medical students were asked to submit an anonymous critical reflection regarding skin tone in medicine (n=794). Critical reflection is an instructional approach that encourages students to investigate their own thoughts and actions. Course credit was given based on the honor system. Reflection submission content and student feedback were analyzed quantitatively and qualitatively using constructivist thematic analysis.

**Results:** Most students completed the assignment (93.0%) and reported feeling comfortable expressing themselves honestly in the anonymous format (84.6%). Students' comfort level with honesty declined if they would have had to identify themselves (50.8%). Student comments indicated relief to have a place to process experiences and emphasized the importance of anonymity for value of this assignment. Thematic analysis identified 2 themes and 13 subthemes among student submissions. Submissions varied in format and typically contained multiple codes ( $4.08 \pm 1.77$  subthemes), indicating that students participated meaningfully in the assignment.

**Conclusions:** Although some educators may hesitate to address these topics, students at our institution appreciated having a space to process their thoughts. This assignment structure is an effective way for educators to address a difficult, sensitive, and important topic in a meaningful way with students.

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## INTRODUCTION

Racism and implicit bias remain barriers to equitable care for people of color in the United States.<sup>1</sup> However, addressing bias during training is an internal process requiring significant learner buy-in.<sup>2</sup> Educators often struggle to understand how learners feel about emotionally intense issues like racism, making it difficult to design curricula that adequately supports student growth. In this study, we describe a critical reflection paradigm to explore learner attitudes toward health care discrepancies based on skin color.

In 2021, the American Medical Association defined racism as a public health threat.<sup>1</sup> Race-based inequities are so intertwined with social determinants of health that they must be addressed through comprehensive governmental and social policy reform, but the medical care and educational systems must play a central role, in part by addressing gaps such as the current impact of skin color

on medical decision-making.<sup>3,4</sup>

Despite the acceptance that race is a social construct rather than a biological category,<sup>1,5-8</sup> it remains common to discuss race as a purely biological characteristic in preclinical science curriculum.<sup>5,9</sup> While genetic differences may relate to disease risk or treatment efficacy, describing race as an essential consideration for epidemiology and diagnosis without presenting relevant social context can perpetuate bias in future physicians.<sup>9-11</sup> Furthermore, clinician use of skin tone as a proxy for race often leads to inaccurate assumptions.<sup>9</sup>

Comparatively, bias exists when assumptions—even unconscious ones—are likely to have negative impacts for a marginalized group.<sup>12</sup> Multiple studies have shown implicit bias in health care workers,<sup>12,13</sup> some having found that increased bias was correlated with poorer quality of care.<sup>12</sup>

With this in mind, it is important for physicians-in-training to recognize personal behaviors and how those behaviors may affect others.<sup>14,15</sup> Critical reflection is a useful tool to develop this understanding, which requires thought about the influence of external factors, how actions may be viewed from multiple perspectives, setting goals for the future, and exploring benefits of change.<sup>2,10</sup> Critical reflection assignments can benefit growth of the learner directly, while analysis of these reflections by educators can provide awareness of where students are struggling and what they need to progress further.<sup>16</sup> Unfortunately, structured reflection assignments often inadvertently encourage students to describe what the teacher wants to hear, rather than process their own thoughts.<sup>17</sup> Especially for sensitive topics, students must be provided with a safe space in which to explore their perspectives and behaviors, even when those perspectives are controversial or uncomfortable.

Students grapple with difficult topics throughout training and must have a way to thoroughly question and process their thoughts safely and effectively. Critical reflection can be used as a tool to stimulate this process, but students cannot be disincentivized from being vulnerable and honest. The purpose of this study was to explore the use of a critical reflection initiative designed to maximize learner value and explore current learner attitudes toward relevance of skin color on patient care.

## METHODS

### Setting

The Medical College of Wisconsin (MCW) is a private medical school in the midwestern United States. All second-year learners enroll in the Musculoskeletal Skin Unit, which teaches dermatologic and musculoskeletal content. The retrospective study described here was conducted using data collected from an assignment within this course. Informed consent for this study was waived by the Medical College of Wisconsin Institutional Review Board, PRO00041742.

### Critical Reflection Initiative

As part of the week of required curriculum introducing dermatology, second-year students in academic years 2020-2021 (n = 252), 2021-2022 (n = 272), and 2022-2023 (n = 270) were asked to consider how dermatological disease may present differently depending on skin pigmentation. At the end of this week, students were required to submit a critical reflection responding to the prompt “How is skin tone relevant to the care you provide as a future physician?”

Students were provided with resources regarding critical reflec-

**Table 1.** Enrollment in M2 Musculoskeletal Skin Unit, Rate of Submission by Academic Year

	2020–2021 n (%)	2021–2022 n (%)	2022–2023 n (%)	All Years n (%)
Complete submission to Qualtrics	244 (96.8)	241 (88.6)	253 (93.7)	738 (93.0)
Brightspace submission	251 (99.6)	265 (97.4)	269 (99.6)	785 (98.9)
Enrolled in course	252 (100)	272 (100)	270 (100)	794 (100)

Abbreviation: M2, second-year medical student.

**Table 2.** Frequency of Reflection Submission Format in Each Academic Year

	2020–2021 n (%)	2021–2022 n (%)	2022–2023 n (%)	All Years n (%)
Written Narrative	226 (92.6)	225 (93.4)	230 (90.9)	681 (92.3)
Image	13 (5.3)	5 (2.1)	16 (6.3)	34 (4.6)
Poem	3 (1.2)	11 (4.5)	6 (2.4)	20 (2.7)
Video	2 (0.8)	0 (0.0)	0 (0.0)	2 (0.3)
Audio	0 (0.0)	0 (0.0)	1 (0.4)	1 (0.1)
Total Submissions	244 (100)	241 (100)	253 (100)	738 (100)

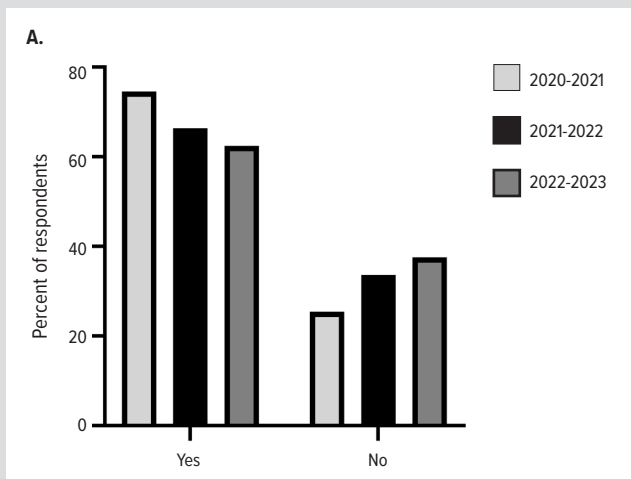
tion via their learning management system, Brightspace (D2L, Kitchener, Canada), including a matrixed feedback tool demonstrating different critical reflection components and levels of reflection.

To maximize comfort expressing feelings honestly, students submitted their reflections anonymously through the online survey platform, Qualtrics (Provo, Utah). Students then submitted a blank document to the learning management system to confirm their reflection was complete and receive credit for completion. To encourage thoughtfulness and creativity, the reflection format was left open, allowing learners to submit reflections using the medium of their choice. Reflection submissions were read by several staff and faculty (authors KQ, JN, TP, MS; acknowledgements TG, JM, AG) who collated aggregate feedback and provided it to students before the end of the course.

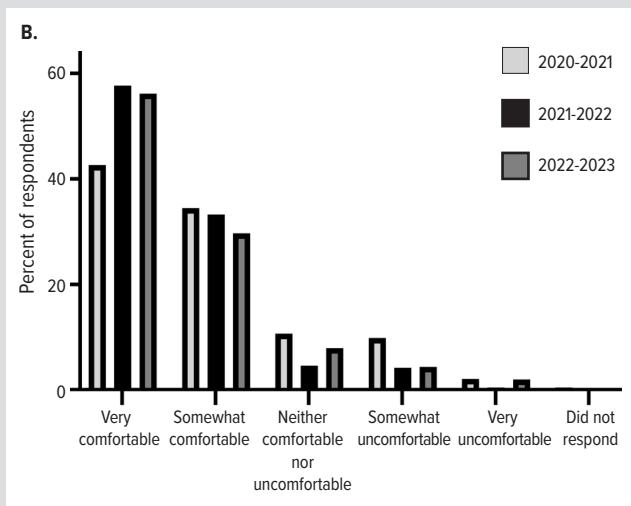
### Analysis of Submissions

Constructivist thematic analysis was performed retrospectively on content of all submitted reflections from academic year (AY) 2020-2021.<sup>18-20</sup> First, a team of staff and faculty (authors KQ, JN, TP, MS; acknowledgements TG, JM, AG) performed inductive analysis of all written reflections to develop an initial coding scheme. Together, this group reviewed all reflections and agreed on 11 initial codes describing all the submissions. Subsequently, 3 authors (ED, MT, TP) performed deductive analysis beginning with the initial 11 codes and identified 2 additional codes. The final 13 codes fell into 2 major themes, described below. Subthemes were applied to each submission, and consensus was reached based on group discussion. Subthemes were confirmed by an independent fourth coder (GR). Most reflections encompassed multiple subthemes, though each subtheme was counted

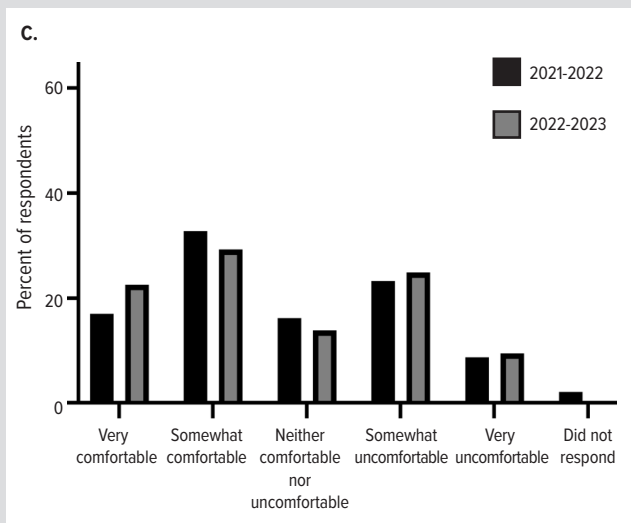
**Figure 1. Student Survey Responses**



Frequency of student permission to share reflection with a wider audience shown as percent of respondents within each academic year.



Level of comfort being honest in this anonymous reflection format within each academic year.



Level of comfort being honest if they had to identify themselves in academic years 2021-2022 and 2022-2023.

only once per submission, even if repeated multiple times. Results from a follow-up survey were compiled and analyzed using GraphPad Prism (San Diego, California).

## RESULTS

Of 794 total second-year learners enrolled in the Musculoskeletal Skin course in AY 2020-2021, 2021-2022 and 2022-2023, 785 students uploaded a blank document to Brightspace (98.9%), and 738 complete submissions were uploaded to Qualtrics (93.0%) (Table 1). During the submission process, students were asked for permission to share their reflection anonymously with a wider audience. Across the 3 academic years, 500 respondents gave permission to share their response (67.7%) while 238 did not (32.3%); however, the rate of those giving permission to share declined progressively from AY 2020-2021 to AY 2022-23 (Figure 1A).

While the majority of students submitted written responses (92.3%), some respondents submitted images (4.6%), poetry (2.7%), video (0.3%), or audio (0.1%) (Table 2). Examples of visual and poetry submissions are included in the Appendix. One of the visual submissions was later submitted by the student and accepted for publication in the *Wisconsin Medical Journal*.<sup>21</sup> Regardless of submission type, many learners showed creativity and investment in the topic. Certain formats were more common in different years. For example, poetry was more popular in AY 2021-2022 than the other 2 academic years.

A student feedback survey was included as part of the Qualtrics submission form. Here, students were asked to provide feedback regarding the reflection paradigm itself. Across the 3 years, most students (624/738, 84.6%) reported feeling very or somewhat comfortable expressing themselves honestly within the anonymous structure, and relatively few (56/738, 7.6%) reported feeling uncomfortable or very uncomfortable (Figure 1B). In written comments, many expressed relief in being given a platform to delve into personal thoughts. In AY 2021-2022 and AY 2022-2023, students also were asked to gauge how comfortable they would have felt expressing themselves honestly in this assignment if they had to identify themselves. Interestingly, only half of the students (251/494, 50.8%) would have felt very or somewhat comfortable being honest, while a third (164/494, 33.2%) would have felt uncomfortable or very uncomfortable (Figure 1C).

*“Thank you for letting us do this anonymously. Even though I trust that we are in a safe space, I feel that especially in these moments anything can be misconstrued or taken out of context and being able to think and write about this freely allowed me to be honest.”*

—Student in AY 2020-2021

To better understand learner perspectives, thematic analysis was performed on submissions from AY 2020-2021 (n=244 submissions). The authors identified 13 final codes that fell into 2

**Table 3.** Frequency and Representative Quotes of Each Subtheme Within Submissions From Consenting Students

Subtheme	n (% out of 244)	Representative Quote
Responsibility of the individual	165 (67.6)	"Implicit biases are real and are present in everyone. Localizing these biases in myself and countering them with actions that results in the better treatment is the first step."
Responsibility of the medical system overall	151 (61.9)	"So, this question addresses a big problem for physicians today, which is how are we going to get rid of the current system? so that we can create a system in which 'skin tone' is not a risk factor."
People of color experience increased stress within the medical system	115 (47.1)	"There's a long history of oppression, injustice, mistreatment, and bias that's bound to skin tone. There's a huge emotional burden and mistrust carried by Black and Brown patients. I've seen it in patients I've talked to these past few months. And, knowing the history of how the profession has abused and used Black bodies for research, the racial disparities in health outcomes, the lack of representation and broken pipelines – knowing this adds weight to those observations."
Importance of treating people of color with compassion	101 (41.4)	"I do not want to be a physician who is 'colorblind' because I think that takes away from seeing the patient as a whole person which includes your skin tone and your culture which, as we know, play fundamental parts in the manifestation of health conditions."
Lack of representation in training leads to downstream disparities	99 (40.6)	"We're not training to see the effects of skin tone, so we practice blind to the differences. We look for clinical patterns like erythema migrans that are apparent on light-skinned bodies but might be missed or absent on darker-toned bodies. This isn't seeing patients."
Responsibility of the medical training process	99 (40.6)	"A lot of work has to be done within the medical school curriculum to prepare me and my classmates for the diverse world that we have taken an oath to serve. During my first year, I was very disappointed to find a lack of representation of Black skin when demonstrating clinical correlations."
Responsibility of society and the community	97 (39.8)	"...but our society has deemed people with different skin colors as less than since its inception, and these scars perpetuate almost every aspect of our lives, whether it is apparent or not."
Current lack of comprehensive educational resources (websites, textbooks)	51 (20.9)	"What we learn in our medical textbooks with pictures of White patients does not accurately reflect our patient populations ... It seems like such an obvious problem that can be easily fixed by including images of pathologies on all skin types in our medical textbooks."
Description of specific discrepancy in health care for people of color	43 (17.6)	"In a climate where maternal mortality is 3 to 4 times more likely for Black women and where racial bias in pain assessment is rampant, skin tone is not a barrier, but a potential death sentence."
Has personally experienced or witnessed an instance of racism in a medical setting	25 (10.2)	"As an African American woman, I have experienced physicians and health care providers display nervousness when I have presented as a patient with a dermatological concern. I could feel their nervousness in the examination room. These experiences continuously made me wonder if I was alone in these uncomfortable interactions. Many individuals of deeper skin tones echo [these] sentiments."
Minimization or denial of racism in health care system	17 (7.0)	"I believe that privilege is real and noteworthy, but very few people are racist."
Minimization or denial of racism within self	12 (4.9)	"I don't plan to treat my patients different because of their skin tone. Why would I? Some will say there is implicit or inherent bias in every person, especially White people. Assuming that's accurate, who says that will affect how I treat my patients?"
Combative comment or comment supporting racist ideology	8 (3.3)	"My ability to control my behavior based on what I believe to be right and true and good is what makes me a person. So get out of my face with this ***."

major themes: (1) description of the complexity of racial disparities in health care and responsibility for change, and (2) trivialization or denial of racism in health care (Figure 2, Table 3). Students addressed multiple topics within their reflections, with a mean of 4.08 (SD = 1.77) subthemes identified per submission. Within theme 1, most subthemes focused on various elements of racism in health care and brainstormed how individual students or larger systems could help. In theme 2, subthemes included attributing problems to individuals rather than a larger issue or denying the existence of these problems altogether (Figure 2).

The most frequent subtheme was responsibility of the individual (165/244, 67.6%, Table 3). Many discussed issues with systemic racism at the societal and community level, calling for changes at a public level to address racial equity (97/244, 39.8%, Table 3).

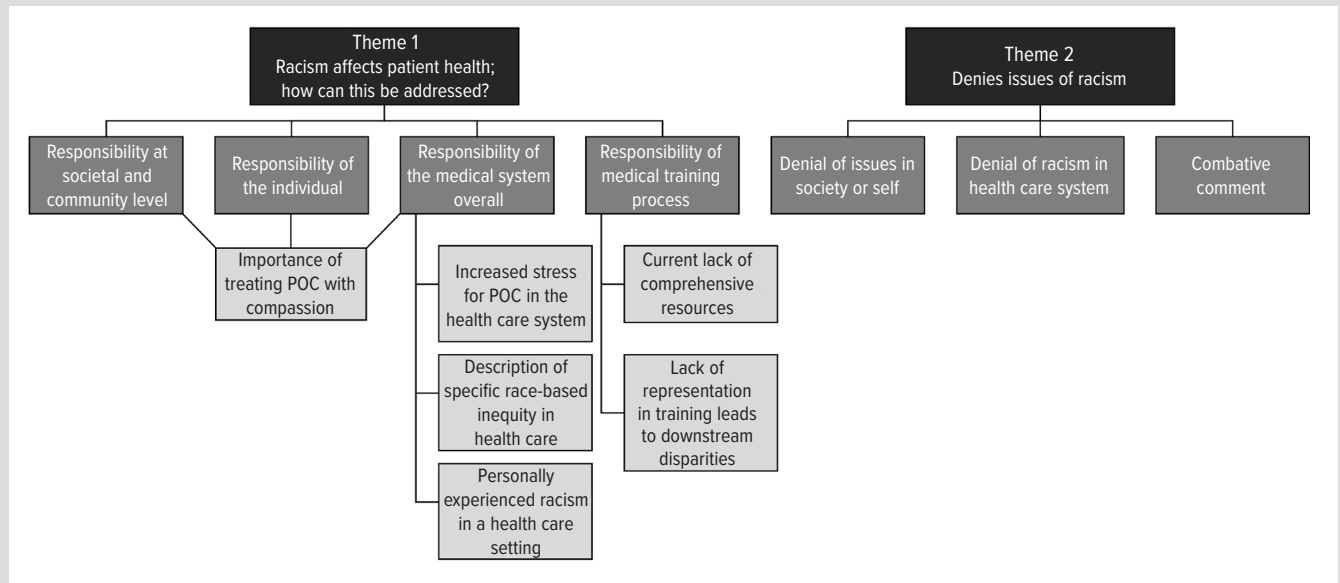
Issues of racism in medicine that must be fixed at a medical sys-

tems level was another notable subtheme (151/244, 61.9%, Table 3). Related to this subtheme, many described particular examples of racism in the health care system (43/244, 17.6%, Table 3). Additionally, 25 respondents (10.2%) provided examples where they personally witnessed or experienced racism in a health care setting (Table 3). Nearly half of respondents (115/244, 47.1%) described how people of color experience increased levels of stress and discomfort within the health care system, both as patients and trainees (Table 3). Correspondingly, many discussed the importance of treating people of color with empathy and compassion, including listening to the patient's individual story, learning individual barriers the patient faces to access care, and acknowledging the shared humanity among us all (101/244, 41.4%, Table 3).

Of importance were descriptions of how medical training programs are accountable for training culturally competent physi-



**Figure 2.** Model of Relationship Between Themes and Subthemes Within Reflection Submissions



Abbreviation: POC, people of color.

Within their reflections, respondents incorporated reputable evidence to support their understanding that institutional racism is/is not present in the health care system and in the world at large. Theme 1 further categorizes respondent perceptions on current issues at all levels of health care – individual level (patients, providers), societal level (social environment, exposure to violence/ trauma/ food deserts), and government level (health policy, health care coverage) within the medical system. Theme 2 reviews respondent submissions related to denying racism in self, society, and the health care system; a separate categorization in Theme 2 also acknowledges combative responses in respondents' efforts to deny racism.

cians and supporting diversity in the health care space (99/244, 40.6%, Table 3). As students were learning to discern various dermatological conditions, many utilized third-party resources and subsequently described difficulty finding comprehensive resources showing examples of disease on pigmented skin, such as textbooks or web searches (51/244, 20.9%, Table 3).<sup>21</sup> Students often went on to describe how lack of representation of people of color in medicine, either in training resources or among clinicians leads to downstream health care disparities for people of color (99/244, 40.6%, Table 3).

There were relatively fewer submissions minimizing or denying the existence of racism in medicine (Table 3, Figure 2). These included comments that treating everyone equally in medicine is the expectation and that while individuals may fail, there is not a problem with racism in the health care system (17/244, 7.0%, Table 3). Some submissions expressed a general discomfort acknowledging racism in general, denying issues of racism within themselves or society, preferring the term “discrimination” to describe racist actions, or denying the existence of implicit bias in themselves (12/244, 4.9%, Table 3). Finally, some submissions included comments that were combative or seemed to be propagating racist ideas (8/244, 3.3%, Table 3).

## DISCUSSION

Students at our institution were acutely aware of health care inequities among people of color and supported changes at multiple levels to avoid perpetuating these inequities. They com-

mented on current issues at all levels of health care, including the individual level (patients, clinicians), learning environment (training institution, learning resources), societal level (social environment, trauma, food deserts), and health systems level (health policy, health care coverage).<sup>3</sup>

Importantly, our study echoes previous findings that requiring students to identify themselves within emotionally rife reflections discourages honesty and authenticity.<sup>17</sup> Even with anonymous submission where credit was given entirely on the honor system and was worth minimal credit for the course overall (1% of the final grade), 93% of students participated meaningfully in this initiative. This level of engagement is numerically similar and mirrored the trend in submission rates for required reflection assignments where students were identified by name in other courses and where roughly 95% to 100% of students completed the homework on time depending on the course, cohort, and academic year (unpublished data gathered 2021-2023). Many specifically described appreciation for the anonymous nature, suggesting that students may not have participated as meaningfully if they were identified. Offering anonymity was a crucial aspect to obtaining honest reflections and should be considered when implementing an assignment that deals with difficult topics.

The most common subtheme amongst student submissions was personal responsibility, in which learners described their role as individual physicians in combating racial inequity. Many described the need to address implicit bias within themselves as

a first step. Students suggested the need for a group discussion in addition to the reflection assignment as utilized in other course initiatives relying on reflective formats.<sup>22</sup>

Students voiced frustration at the lack of representation of skin conditions across the skin tone spectrum in their learning resources (course materials, textbooks, and Google image searches). This phenomenon has been described previously at other institutions as well.<sup>4,23</sup> Any description of conditions affecting appearance of the skin, including terms like erythema and cyanosis or various rashes, should include example images across skin tones. Institutions can use publicly available resources like Mind The Gap<sup>24</sup> or subscription services like VisualDx (visualdx.com/diversity/) to provide representative images of clinical signs in deeply pigmented skin. Course resources at the authors' institution have since been audited and updated for representation. The authors have continued this instructional approach to meaningfully assess incoming student experiences and regularly refresh course materials.

In our study, learners described ways medical schools and the health care system at large are responsible for addressing inequities, including comprehensive training for current students as well as actively recruiting and supporting people of color into the medical field. Many went on to describe how a lack of these types of representation leads to further disparities. Students often included reputable evidence outside of course materials like journal citations to illustrate that institutional racism pervades health care systems and American culture at large.

Personal experiences of racism within a clinical setting also were noted in the submissions. Previous studies have shown that minoritized students perceived a higher lack of respect for diversity in role-modeling,<sup>13</sup> and students underrepresented in medicine have described more hostility and having less mentorship during training.<sup>25</sup> It is crucial for educators to realize students of color face barriers to practicing medicine that their white peers do not and provide ample support, safe spaces to process, and quality mentorship to encourage their success.

It is also important to note that a minority of students commented that there is not a problem with racism in the health care system. While relatively few students expressed this belief, it may be useful to explore these comments to determine where (and if) there is an area for improved education. While it was uncomfortable to read submissions with comments that do not align with the ideals of the authors' institution, it was evidence that students were being honest about their feelings and not merely writing what they thought instructors wanted them to say, which was the main purpose of the assignment. The presence of these comments, no matter how few, illustrates a persistent refusal to acknowledge bias. It indicates that teachers and learners alike must be aware of the contrasting views in our health care system. As we work towards improving implicit bias in health care, it is crucial to remain cognizant of this issue and actively address it in future education interventions.

This retrospective analysis was conducted at a single institution. These reflections were self-reported, completely anonymous, and did not collect demographic information. While this provided space for students to reflect honestly, authors were unable to correlate frequency of subthemes with learner demographics. While a few students self-identified as members of certain demographic groups in their submissions, the authors were unable to draw meaningful correlations between responses and demographics given the anonymous nature of the assignment.

## CONCLUSIONS

Our analysis indicates that this reflection initiative provided a relatively safe outlet for students to grapple with a difficult topic internally. The anonymous, honor system-based reflection paradigm helped establish trust between the educator and student, encouraging meaningful participation, while educator review of reflections provided valuable insight into how students feel, their goals for making changes, and what tools they need from their training to accomplish those goals. The authors recommend performing such analyses at one's own institution to evaluate thoughts among their own students, as well as repeating them annually to monitor progress in meeting students' needs.

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**Appendix:** Available at [www.wmjonline.org](http://www.wmjonline.org).

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# Perceptions of the Minority Tax Experienced by Faculty and Students Underrepresented in Medicine at the University of Wisconsin

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## ABSTRACT

**Introduction:** The minority tax in academic medicine can be defined as the additional responsibilities placed on underrepresented in medicine (URiM) faculty, staff, and students in the name of diversity. Often this looks like participating in additional diversity committees, recruitment efforts, and mentorship activities. These extra responsibilities often are not recognized, not included in promotions, and take time from other clinical, research, and traditional scholarly responsibilities.

**Objectives:** There is a significant gap in the literature examining the experiences of URiM-identifying faculty and students in relation to the minority tax. Our goal was to do a quality improvement project to explore this gap through interviewing URiM-identifying faculty and conducting focus groups with URiM-identifying students, with the goal of making recommendations to help reduce the minority tax burdens to this community.

**Methods:** A scoping literature review on the minority tax burden in academic medicine was used to inform the development of questions to use in focus groups of URiM University of Wisconsin School of Medicine and Public Health (UWSMPH) students and interviews of URiM UWSMPH faculty members. After development of a facilitation guide, we conducted three 1-hour focus groups with 14 students who identified as URiM and did eight 30-minute interviews with faculty who identified as URiM. A codebook was generated using inductive analysis after reviewing transcripts. Coding was performed independently with 2 separate coders in order to ensure inter-coder reliability.

**Results:** Ninety-one percent of students and 62.5% of faculty endorsed experiencing the minority tax at UWSMPH. Faculty also reported increasing feelings of support due to UWSMPH programs that support URiM faculty. Students reported the minority tax being central to their role as URiM students. Both students and faculty reported that the additional burdens of the minority tax took time away from traditional scholarly activities that were essential for promotion (faculty) or residency (students).

**Conclusions:** The minority tax burden experienced by URiM faculty and students may negatively affect their careers, as they note spending more time on activities that may not be valued for promotion. It is essential to address these burdens in order to achieve equity within the medical institution.

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## INTRODUCTION

The minority tax in academic medicine—or the additional responsibilities placed on individuals from racial and/or ethnic groups that are underrepresented in medicine (URiM)—is an often-overlooked source of inequity.<sup>1</sup> To advance antiracist missions, institutions seek URiM students, faculty, and staff participation across multiple domains. However, disproportionate overtime participation in service-oriented committees (eg, diversity taskforces, recruitment efforts) takes away from scholarship that is often valued for promotion and tenure<sup>2</sup>—which may place those with a minority tax burden at a career disadvantage. The 2019 Association of American Medical Colleges (AAMC) Diversity Report<sup>3</sup> notes that of full-time academic faculty, 0.2% identify as Alaska Native/American Indian, 3.6% as Black/African American, and 5.5% as Hispanic/Latino/Spanish origin. These low percentages are striking given the demonstrated need to diversify the health care workforce to achieve health equity and improve health outcomes across underserved communities.<sup>4</sup> The minority tax affects diversification efforts by increasing URiM faculty

fatigue and frustration and is an important factor in URiM faculty leaving academic medicine.<sup>2</sup> In addition to supporting the recruitment of URiM individuals, reducing minority tax burdens could bolster retention of URiM individuals and help diversify academic medicine.



Diversity, equity, and inclusion (DEI) programs have been established in medical schools to help address diversity among faculty, staff, and students.<sup>5</sup> There are several initiatives at the University of Wisconsin School of Medicine and Public Health (UWSMPH) to increase recruitment and retention of URiM faculty and students, including second look programs for admissions, the Building Equitable Access to Mentorship (BEAM) program to support self-identified URiM students with trained URiM faculty mentors, the Centennial Scholars/Clinicians program to support the recruitment and career development of URiM faculty members, and Office of Multicultural Affairs (OMA) programs for URiM students and faculty. The development and success of these programs that build community and provide support to the school's URiM population often depend heavily on time and committed service investments of faculty and students who are URiM. As such, these programs increase participation expectations of URiM individuals and may increase the minority tax burden for those involved.

Understanding how the minority tax burden might be perceived and experienced by individuals is important when considering the development of DEI programs to alleviate unintended negative outcomes to participating URiM individuals. The aims of this quality improvement initiative were to explore the experiences of URiM faculty and students at our institution, to identify their perceptions of minority tax burdens, and to elucidate ways to reduce the minority tax and improve the environment for individuals who are URiM.

## **METHODS**

### **Quality Improvement Project Design**

In July-August 2022, semistructured interviews and focus groups were used to explore experiences and perceptions of UWSMPH faculty and medical students from racial and ethnic groups that are URiM to understand how minority tax burdens impact the learning and working environment for URiM faculty and learners. Based on the UW–Madison Quality Improvement (QI)/Program Evaluation Self-Certification tool, this project was identified as a QI project that did not meet the federal definition of research pursuant to 45 CFR 46 and did not require Institutional Review Board review (certification on February 28, 2022).

The QI project team created an open-ended question guide for both the semistructured faculty interviews and student focus groups. It consisted of 6 questions with branching logic and prompts to elicit and fully explore responses. Five questions were asked of each participant, with the sixth question asked depending on whether a participant endorsed experiencing a minority tax. The guide also included an introductory script that reiterated the goals of the study, voluntary nature of participation, and consent for recording.

### **Participant Recruitment**

Recruitment for faculty interviews was done through emails to 23 faculty who were current or former mentors in the BEAM Program from 2019 through 2022, as the faculty in the program self-identify as URiM. Of the 15 faculty respondents, all 8 who were able to participate in interviews during the 4-week interview timeframe were chosen to participate. Faculty did not receive compensation for participation. The semistructured 30-minute one-on-one virtual interviews were conducted by the same QI team member (EFC) via Zoom.

Students were recruited through email to all medical students inviting participation from those who identified as URiM. Nineteen responding students were randomly assigned to 3 focus groups. Five students were unable to attend their focus group, resulting in three 1-hour long virtual (Zoom) focus groups that ranged in size from 3 to 7 participants. Students received a \$15 item from the university bookstore for their participation. After receiving coaching on good facilitation practices, EFC facilitated focus groups using the facilitators guide, which included the same semistructured questions as the faculty interviews described above.

Due to the number of participants and desire to maximize their comfort and sense of psychological safety to encourage candid responses, specific demographic data were not collected. In addition, the facilitator (EFC)—along with 4 of 5 study team members—self-identify as being a member of a racial and/or ethnic group that is URiM.

### **Data Analysis**

Transcripts were generated from interview and focus group recordings and checked for accuracy by the QI team member who conducted them (EFC). Transcripts were reviewed multiple times using an open inductive process to identify emerging codes. The QI team (EFC, EAF, JS, EMP) met multiple times to review transcript content to clarify codes, identify emerging themes (see Table), and create an initial codebook. Proposed codes guided development of an analytic thematic framework of primary and secondary codes in the final codebook. This codebook was used to analyze both faculty interviews and student focus groups. Two authors (EFC, S-RN), including one not involved in creating the codebook (S-RN), independently coded transcripts and identified comments. After independently coding the transcripts, coders met to resolve 21 discrepancies out of the 132 codes through consensus agreement.

## **RESULTS**

### **Faculty**

The majority of URiM faculty reported experiencing some degree of the minority tax (62.5%), noting institutional pressure to represent URiM groups and participate in DEI work (37.5%). (See Figure.) One participant said:

**Table.** Quotes Illustrating Emergent Themes Identified During Qualitative Analysis

Theme	Illustrative Quote
Increased feeling of the minority tax	"We're always regarded as possible volunteers for activities regarding improvements in representative, more representative mentoring, or ways or activities to foster diversity and inclusion. Of course, I get very excited about those and I would love to... I love to participate on those and sometimes they can be distractors over my main research goals that maybe other non-URM [URiM] faculty do not have to face."
Increased feeling of isolation	"Being underrepresented in medicine, a lot of us are also ... maybe first gen[eration] or first in medicine and it seems like a lot of our other ... counterparts have a lot more of a foothold in the medical field already and ... a lot of us have to try and ... figure things out ... as we go, and that can be pretty alienating."
Increased feeling of support	"I've had opportunity related to being an underrepresented minority in medicine. I've had grant funding that was targeted at increasing research opportunities for URMs [URiMs], and I personally have come to know many people through the BEAM mentoring program and through the Centennial Scholars program who have been tremendous mentors, colleagues, and friends, so I do feel community."
Increased feeling of challenge	"...challenging because both the breadth and depth of work that I'm responsible for. Challenging because ... figuring out how I fit in at SMPH in terms of my skill set and my areas of expertise."
Feeling of uneven playing field/hidden curriculum	"Being able to ask a sibling or a physician parent for help on one of the materials we're learning like some parent... or some classmates had parents who are surgeons and cardiologists and family med[icine] doctors, so having that connection also created a huge difference, in my opinion, for me, at least."
Perceived lack of representation	"I think another thing that I've really struggled with being here is the fact that like none of our mentors or people that we can possibly look up to look like us, so it's kind of hard to find your footing with that. And then also ... whenever we do see a person of color, it is in that DEI kind of ... position, so that it's kind of like... not that they're like forcing us to do DEI work – it's not at all how I feel – but it's like whenever we do see someone that possibly resembles us, it's in a position of advocacy instead of just like a regular physician to look up to in a field that's not necessarily doing just the DEI work."
Increased feeling of emotional toll	"I feel like the difference would be the things that you have to go through as a URM [URiM] student, like figuring out how to navigate rotations and having to worry about ... microaggressions – how to address microaggressions without feeling like it could affect your evaluations – or how your reputation is in medical school."
Decreased value of DEI work	"There seems to be – and not across the board – ... a lack of understanding or appreciation of the types of scholarship and practice expertise that people who have expertise in health equity or racial equity bring, or community engagement, and a perception that there may not necessarily be a need for training or expertise – that anyone can just all of a sudden become someone who does that. That doesn't apply to any other type of work, like nobody just all of a sudden becomes a surgeon."
No perceived difference from non-URiM faculty	"I would say my experiences don't really differ from other faculty mainly ... because of the perception that I'm not underrepresented essentially. I think I have internal differences ... especially not growing up... near professionals at all. There was initially some hesitancy on my end and some ... how should I put it... unease being in that... sphere, but I think the other perceptions towards me are, you know, as opposed to any other faculty member... non-existent."
Mentorship gaps	"Overall finding mentorship has been interesting I guess, to say the least, because it's like you don't really know how to start, where to go, who to look to, what to do, and stuff like that."
Mentorship assets	"One of the things that I enjoyed the most here is the mentoring, both the opportunity of being mentored by other diverse faculty and also the opportunity to get trained to be a better mentor for students who may represent as part of one URM [URiM] group. So, for example, I'm part of the BEAM program at SMPH and I think I would get together with my chair every week, just to share how amazing the training was and the great resource that it is."
Increased additional opportunities (career advancement)	"I think I'm in a unique position. I did receive the Centennial scholarship so that's given me access to things that I don't think I otherwise would have. So that's provided money for some of the conferences that I'm going to."
Unaware of DEI efforts	"Honestly, I don't know what DEI initiatives SMPH has going on ... if someone names them and I do, then cool, but ... I guess I don't know off the top my head any DEI initiatives."
Inadequate leadership/administrative response	"I am part of certain committees, or not committees but ... groups or organizations on campus, and just by how I've been working with them and interacting with ... the administrators and stuff, I do feel sometimes that ... the things that we do are kind of done in vain, because we don't see a lot of movement in terms of ... our projects and things or the asks that we have for them."
Increased desire to support URiM community	"I think I look for opportunities where I can help my colleagues that are underrepresented more so because of what we're seeing in medicine at this time, which we're not ... represented, so I kind of want to do things where I know I can help other faculty along in the same boat that I'm in."
Decreased time due to minority tax	"I think it's just simply taken more time of mine away from other things, which ... from my perspective, is not inherently a negative thing. [Be]cause I think even when you're serving the minority tax, in theory, it's at least doing something good. So even if I'm ... participating in an event where you're talking to undergraduates trying to recruit more students ... that is a great thing, and I guess [the] downside is simply that I just lose time from doing other things, and so I think a lot of times it's just that I have to spend more time focusing on the identity of being URM [URiM] in a space ... or trying to create more of a URiM diversity population in this space, but I think it just always negatively affects my time. And you could argue that that negatively impacts ... career advancement and ... grades and ... all these other things."
Perceived obligation, sense of responsibility to drive change	"Sometimes when I see certain committees that are ... there is no student of color there, I almost feel obligated to go and ... be a part of that committee just because I feel like our experiences wouldn't [sic] be represented. And so in that regard, it is kind of like ... the obligation that was mentioned before ... it's more work on you, but also, you know this is something that needs to be represented."

*continued on page 116*

**Table.** Quotes Illustrating Emergent Themes Identified During Qualitative Analysis (continued from page 115)

Theme	Illustrative Quote
Outside pressure from community or medical institution	“So, when they couldn’t find people to fill the spots in, the old coordinators took it upon themselves to kind of like scout for people and sent out an email to ... LMSA email server... just because we have this one skill of speaking Spanish and we should want to use it, but we shouldn’t be expected to – especially if that means sacrificing school time with volunteering and this leadership role that we should want, and it doesn’t seem like other students would have ...experienced the same kind of pressure to apply. And if we didn’t apply, then okay, now these patients don’t have a Spanish-speaking volunteer helping them and that creates...another domino effect, and then you start feeling guilty about that, and if they can’t have a Spanish speaker with them, are they really receiving quality health care that they deserve.”
No experience of minority tax	“I haven’t experienced that to be honest. And I think that there is... a responsibility from us. I mean also to ... just help people and share our experiences.”
Need stronger administrative leadership and support	“But a lot of times I feel like our administration doesn’t do a good job of laying out the resources that are available. Like they say ‘oh ... we have all these things,’ but ... what are they? ... please lay them out to me.”
Increased value of DEI work	“We use ... all this [sic] economic words around it, but I mean, reduce the burdens for medical school for us in the most stressful way ... I totally agree with Speaker 6 ... additional scholarships, would be really, really helpful for student leaders for ... stepping up to the plate and, you know, putting in this extra time that’s taking away from other pursuits.”
Increasing diversity	“Hire more URM [URiM] faculty, both not just to serve on committees, but to bring their scholarly and practice expertise into all of these requests for team science or ... collaboration, which would both lower the burden, but ... also increase the quality of scholarship and practice because we wouldn’t have people who are potentially saying that they’re doing health equity or community engagement work that actually don’t have any training or skill in it but are very good grant writers.”
Increased resources to combat uneven playing field/hidden curriculum	“I don’t even know about ... mentor[s] for sure ... but also someone who will introduce you to different people, as well like, ‘hey, here’s so and so, and I know [interviewee name] is great at x, so why don’t you talk with her?’ So that also introduction aspect.”
Increased support from outside of UWSMPH	“I think, for example, providing more resources to help social integration for the family as a whole –for example, the faculty are coming abroad providing more orientations ... or where to bring your kids, what schools, could be useful. Probably help the partner get a job, even if it is not like actually ...an offer but providing some information of where can you find a job in the US, ... what are the websites that you could look at to get a job, what kind of work permits do you need. Or ... orientation for the partner might be also very useful.”
Increased efforts on community outside of UWSMPH	“I mean UWSMPH is kind of a microcosm within a bigger... And we’re only here for so long, within the bounds of this area. I think outside of UWSMPH is where addressing needs to be done. I talk to people and they say UW’s fine or the medical school’s fine, it’s outside of that is not fine. So somehow that’s like a bigger thing that’s... somehow that needs to be addressed.”

Abbreviations: BEAM, Building Equitable Access to Mentorship; URiM, underrepresented in medicine; UWSMPH, University of Wisconsin School of Medicine and Public Health; LSMA, Latino Medical Student Association.

*“We are usually expected to represent those URM [URiM] groups in terms of our experiences so usually we could face tokenism. And we’re always regarded as possible volunteers for activities regarding improvements in representative, more representative mentoring, or ways or activities to foster diversity and inclusion. Of course, I get very excited about those and I would love to... I love to participate on those and sometimes they can be distractors over my main research goals that maybe other non-URM [URiM] faculty do not have to face.” (Faculty 3)*

Despite the minority tax, 37.5% of URiM faculty stated that they felt supported, and 50% believed they had additional non-service-oriented opportunities because they identified as URiM. Faculty 2 said:

*“I’ve had grant funding that was targeted at increasing research opportunities for URM [URiM] and I personally have come to know many people through the BEAM mentoring program and through the Centennial Scholars program who have been tremendous mentors, colleagues, and friends, so I do feel community.”*

Suggested areas for improvement included increasing diversity within the UWSMPH community (25%), providing increased

resources to combat the uneven playing field/hidden curriculum (12.5%), and providing increased social support for faculty and their family members (12.5%).

**Students**

The majority of URiM medical students indicated feeling some degree of a minority tax burden (91%) (See Figure). Participant descriptions included “emotionally taxing,” “tokenizing,” and “obligated” (Focus Group 1, Speakers 2, 3, and 4). One stated, “I’m often sent these ‘hey look URM [URiM] opportunit[ies]’...it’s kind of like OK, but what about my other stats?” (Focus Group 1, Student 5). Over one-third (35.7%) reported that in comparison to their non-URiM peers, they took on additional responsibilities, including serving on committees and participating in recruitment, retention, and DEI efforts. One medical student recounted the cognitive and emotional toll of juggling these increased responsibilities:

*“I think we’re not yet at a place where people value DEI like they might value that kind of other work that medical students do, so I think that’s frustrating because then sometimes I’m like, why am I doing this? I know why. It’s just I hope that in the end it helps increase the diversity at UW or hope it opens up a door for something else, but it’s definitely not valued the same*

way. And it just feels like sometimes I'm doing it because I am a Black woman and I can't figure out why else." (Focus Group 3, Student 6)

This unequal burden decreased time from other pursuits (14.3%) and was often catalyzed by a perceived obligation to drive change (28.6%).

"You know, when my other classmates are just, I don't know, eating lunch or going to the gym or doing normal people things, but I felt like I needed to... Okay, this is my hour during the day, it's my break, but I need to do it to recruit or talk about the school and I think that's definitely something that differs." (Focus Group 3, Student 3)

Students reported feelings of isolation (29%), mentorship gaps (21.4%), and an uneven playing field (21.4%), while others (14.2%) described the mentorship assets through the BEAM program. One stated, "I loved...having access to particular mentors who also identified as an underrepresented individual in medicine (Focus Group 1, Student 2). Another said:

"The school is putting in the effort to have these conversations and to celebrate diversity...it's good to have at least this avenue to help improve both the culture of this class as well as the make-up of the next couple of classes or next incoming classes of med students." (Focus Group 1, Student 4)

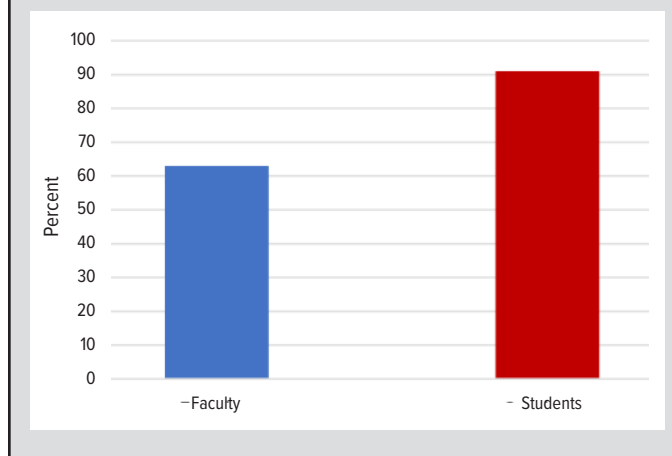
Despite some recognition of ongoing efforts and engagement in OMA activities, 42.9% of students stated they lacked awareness or had very limited knowledge of UWSMPH DEI efforts. Proposed improvements included stronger administrative leadership and support (14.3%), including regular updates on DEI work and modeling of a zero tolerance for discrimination policy. Others included increasing diversity within the student body (21.4%) and increasing the value of DEI work (14.2%).

## DISCUSSION

Faculty were passionate about DEI work but noted the work can feel unjust when it negatively affects scholarly productivity required for promotion, creating a vicious cycle that can limit advancement of URiM faculty in academic medicine. Existing literature highlights similar burdens in academic medicine.<sup>2</sup> To increase diversity and improve retention of URiM faculty, decreasing the minority tax and increasing the value of and time for DEI work is essential.

Recent threats to public health<sup>6</sup> stimulated widespread DEI and health equity initiatives.<sup>7</sup> Academic medicine leaders recognized the importance of multipronged approaches, including administrative-led initiatives and volunteer-run activities. Volunteer-run DEI committees may paradoxically undermine academic DEI goals given cost is directly proportional to perceived value in our society. Not only is this harmful for individuals who commit extra time to DEI work, but it may decrease institutional buy-in for DEI initiatives.

**Figure.** Participants Who Experienced Minority Tax at the University of Wisconsin School of Medicine and Public Health



Some faculty were very "strategic in what [they were] getting involved in [because they didn't] want to be labeled only in a diversity, equity situation" (Faculty 2). This is not unique to UWSMPH; junior URiM faculty have been advised to avoid DEI roles until they are in senior positions with established careers.<sup>1</sup> While this allows them to engage in traditional scholarly pursuits, it removes critical voices from the DEI space. To affirm DEI support, institutions must value DEI work and invest in resources to support individuals doing this work. One faculty stated,

"I think it's everybody's natural response to say, 'Hey I'm doing too much, and I need to take a break' or you're not getting all your tasks done and you know things suffer, and you want to put out quality products, but it suffers because you're feeling burdened to do things that you normally don't want to be doing." (Faculty 7)

This raises critical questions about who is chosen and expected to participate in DEI work. Have they expressed interest in DEI work or is it simply because they are URiM? Are DEI opportunities presented to everyone or are a select few repeatedly "encouraged" to participate? While it is vitally important to include diverse voices in service-oriented committees and activities, if uncompensated, they must be truly optional. As one speaker noted, "If there is a DEI committee, my chair will say 'how about you?' And I will say 'no, how about someone else?'" (Faculty 5).

While 62.5% of URiM faculty experienced or witnessed the minority tax, 50% noted increased opportunities because of their identity, and 37.5% noted increased support. Contrastingly, 91% of URiM students experienced the minority tax, and only 7% noted increased opportunities and 0% endorsed increased support. Faculty may feel more supported due to their older age and position within the medical institutional hierarchy. They also may feel more supported than students due to the Centennial Scholars/Clinicians Program, which encourages career development and provides departmental funding for faculty scholarship.



While participating faculty still experience minority tax burdens, such programs lessen the burden by supporting career advancement, building community, and increasing the number of URiM faculty, reducing the tax on any one individual. More departmental/institutional DEI programs valued by promotion committees that include compensation and protected time for involved URiM faculty could further reduce faculty minority tax burdens and support URiM faculty career advancement. To address this, institutions like UWSMPH are integrating DEI work into promotion guidelines, allowing faculty engaged in such work a solidified place in academic medicine<sup>1</sup> and making DEI an institutional priority that lessens minority tax burdens.

Contrasting faculty, 91% of students experienced a minority tax burden. Unlike employed faculty, students described a sentiment that DEI work is core to their student status. For faculty, DEI work seemed to be an additional, rather than central, responsibility. One student said:

*“...because there’s that much pressure to... let the incoming students know or prospective students know that... we’re here and that, ...there’s people that look like them, even though it is in Wisconsin. And it’s, you know, recruitment event after recruitment event; it’s... you know, it’s like it feels like it’s part of our role and, like, the reason why we’re here.” (Focus Group 3, Student 4)*

Students described an initial interest in DEI work that transformed into a stronger sense of responsibility to recruit URiM students and combat issues of equity in medical school. Previous studies cite this sentiment in faculty as the gratitude tax, “the feeling of obligation that URiM faculty have to the academic institution and to future generations of URiMs for being given the opportunity to be a physician. It is a feeling of indebtedness to the institution and others that can at times diminish one’s sense of accomplishment and stimulate a desire to pay back the perceived debt.”<sup>8</sup>

Similar to faculty, students described how the minority tax and participating in additional DEI efforts negatively affected time:

*“I am not on the top of my class or anything like that. But... I wonder like what would have looked... differently for me from... a rotations and academic standpoint if I wasn’t spending, you know, like X amount of hours every week or every month kind of to... DEI type initiatives.” (Focus Group 3, Student 3)*

Students suggested additional time spent on DEI initiatives affected their thoughts on residency selection and applications, as it took away from time spent on traditional scholarly activities:

*“I feel...if I wanted to do surgery... or...one of those specialties that ...require, maybe not require, but there’s a lot of pressure on ...doing conferences and research, that would be very challenging to try and fit all of those things in while doing the, like, extracurricular organization stuff.” (Student 8)*

Student DEI work could limit residency options if the minority

tax negatively affects other scholarship that is more important to residency programs.

Both faculty and students discussed a hidden curriculum or uneven playing field in academic medicine for URiM individuals. Eric Margolis describes the hidden curriculum as “the norms, values, and belief systems embedded in the curriculum, the school, and classroom life, imparted to students through daily routines, curricular content, and social relationships.”<sup>9</sup>

Those who experience the minority tax may be more likely to experience the uneven playing field and hidden curriculum of medicine. When participants were asked how their experiences were different from their non-URiM colleagues, 25% of faculty and 14% of students noted they lacked an understanding of the culture of medicine. When faculty were asked how to reduce the burdens of the minority tax, 25% requested resources to combat the hidden curriculum in medicine. Thus, the minority tax may be intimately intertwined with the hidden curriculum and uneven playing field spoken about by project participants.

### Limitations

Limitations of this QI-focused work include its small number of participants from a single institution where many were already engaged in DEI work. This limits generalizable conclusions. Additionally, specific demographic data (eg, race, ethnicity, gender) were not collected to ensure anonymity, even though such factors may impact minority tax experiences. Lastly, given interviews were performed by a medical student (EFC), participants may have given guarded responses due to hierarchical roles and/or desire to protect images and reputations.

### Future Directions

Additional studies with larger sample sizes are needed to understand the academic medicine minority tax in its totality. Studies could explore whether the minority tax differs by demographics and academic rank and address existing gaps in the literature about minority tax burdens of medical students. Future studies also could elucidate how to address equity without increasing burdens for URiM students and faculty.

### CONCLUSIONS

It is crucial to understand how individuals in academic medicine are experiencing the minority tax to reduce burdens on the URiM community. At UWSMPH, both faculty and students are experiencing this burden. Faculty had more mixed experiences, citing both positive and negative aspects. Student focus groups suggest a more negative experience, discussing both the emotional toll of explaining their experience to peers and an increased burden of participating in DEI initiatives. Exploring how individuals are experiencing the minority tax at their own institution may be a first and important step in ensuring a diverse academic medicine workforce, as well as equity within the medical institution.

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# A ‘PEaRL’ of Support and Cooperative Learning: A Pilot Study Shifting the Sands of the Dreaded Morbidity and Mortality Conference

Sarah C. Yale, MD; Kelsey Porada, MA; Patrick J. McCarthy, MD, MME

## ABSTRACT

**Background:** When unanticipated and/or poor patient outcomes occur, clinicians frequently experience guilt, anger, psychological distress, and fear, which can be intensified by traditional morbidity and mortality conferences.

**Methods:** The Pediatric Event Review and Learning (PEaRL) curriculum was developed to discuss unanticipated and/or poor patient outcomes and foster support while highlighting foundational safety concepts. Pre- and post-implementation evaluations of quarterly case-based sessions were completed.

**Results:** All respondents endorsed that unanticipated and/or poor patient outcomes affected their mood, well-being, and functioning. Post-implementation of the PEaRL curriculum, significantly more respondents endorsed existence of a safe environment and structured format to discuss these outcomes, as well as feeling more supported.

**Discussion:** The PEaRL curriculum provides a valuable opportunity for trainees and experienced clinicians alike to explore and discuss unanticipated and/or poor patient outcomes while addressing key patient safety principles

icians and trainees may result in avoidance of conversations about UPPOs.<sup>2</sup> Knowing the negative impact these outcomes can have on well-being, psychological support for individuals involved is crucial.<sup>3</sup> One potential area of improvement is through integration of support into clinician educational conferences. Recent work has called for morbidity and mortality conferences to incorporate compassion, empathy, humanity, and respect.<sup>4</sup> Morbidity and mortality conferences cannot meet these goals unless they provide a high degree of psychological safety, which is the belief shared by all that they are in a safe space to take risks, express themselves, and share their true feelings without fear of ridicule, retribution, and embarrassment.<sup>5,6</sup>

## BACKGROUND

When unanticipated and/or poor patient outcomes (UPPO) occur, health care providers frequently experience guilt, anger, frustration, psychological distress, and fear.<sup>1</sup> For individual clinicians, distress can be intensified by morbidity and mortality reviews that are solely focused on the critique of care and may diminish learning opportunities these reviews could offer. Despite efforts to create an environment of “Just Culture” with shared accountability, a culture of blame remains prevalent, and its impact on clini-

Prior literature has focused on redesigned morbidity and mortality conferences at all levels of medical training, with the goal to promote enhancement of quality and patient safety.<sup>7</sup> The Accreditation Council for Graduate Medical Education (ACGME) has established competencies for patient safety, interprofessional collaboration, and quality improvement that must be addressed within training programs and identified patient safety as a required area for faculty professional development.<sup>8</sup> Additionally, the American Board of Pediatrics (ABP) also has incorporated principles of patient safety, quality improvement, and system-based improvement into the content specifications for certification and maintenance of certification in general pediatrics and subspecialties.<sup>9</sup> In order to properly address the foundational patient safety principles highlighted by the ACGME and ABP, it is imperative that trainees have opportunities to learn more from UPPOs in a psychologically safe environment. UPPOs can allow for the discussion of these

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important concepts, while also attending to individual and group well-being through case discussion in a supportive venue. We developed this pilot study to guide both pediatric hospital medicine fellow trainees and established clinicians involved in UPPOs to explore the events in a psychologically safe environment and acquire vital patient safety knowledge.

## METHODS

The pediatric hospital medicine section at our institution consists of 32 physicians, 9 advanced practice providers (APP) and 4 fellows. It has over 5000 annual admissions across 4 resident services and 1 APP service. We created the Pediatric Event Review and Learning (PEaRL) curriculum as a pilot to integrate into the section's ongoing professional development efforts and fellowship curriculum with 2 main goals:

- 1) Review UPPOs in a case-based format to address specific ABP content specifications for pediatric hospital medicine related to patient safety.
- 2) Provide a supportive and psychologically safe venue for exploration of emotions that trainees and clinicians experience in response to UPPOs.

We developed core learning objectives (Box) based on the ABP pediatric hospital medicine content specifications, and each session addressed 2 to 3 of these defined learning objectives. Educational content related to cases was selected with the goal of addressing each objective at least once during the pilot study, with flexibility on the order of topics to allow for case-specific learning. Pediatric hospital medicine clinicians self-selected cases to present. The presenter then met with the PEaRL director for assistance in content preparation in a case-based fashion with inclusion of interactive content to facilitate engagement (eg, polling questions, breakout rooms for open-ended questions, or small group activities).

Starting in July 2020, 45-minute case presentations occurred quarterly during standing group meeting times. These sessions were scheduled specifically within preexisting conference times to facilitate attendance for busy clinicians. Due to the COVID-19 pandemic, conferences initially were held virtually. Sessions were not recorded to preserve confidentiality and attend to psychological safety.

Both at introduction of the curriculum and then at individual sessions, specific guidance was provided about psychological safety. Clear expectations were provided both verbally and in written format about respectful communication, transparency, and using the conference as an opportunity to learn from one another. Although it was repeatedly emphasized that PEaRL was not meant to be punitive or judgmental, the session facilitator alone was not responsible to ensure this supportive environment was maintained. The PEaRL course director was present at each session to ensure there was no entry of "shame and blame" discussion and to redirect any conversation that was a threat to maintaining psy-

### Box. Pediatric Event Review and Learning (PEaRL) Objectives

At the end of this curriculum, participants will be able to:

1. Define terms such as patient safety, adverse event, near miss, root cause analysis and healthcare failure mode and effects analysis.
2. Identify the potential for error within the health care system.
3. Recognize and define key types of medical errors.
4. Describe the different types of cognitive errors and how these are intertwined with system errors.
5. Demonstrate the ability to use a diagnostic time-out.
6. Demonstrate effective teamwork skills involved in error analysis.
7. Draw and illustrate a written diagram of an Ichiikawa fishbone.
8. Identify areas in their own practice and local system that can be changed to improve the processes and outcomes of care.
9. Develop an action plan for the prevention of error in the future.
10. Demonstrate collaborative teamwork skills using a shared learning model with peers.

chological safety. When any drift away from a psychologically safe environment was noted, the course director would interject during the discussion with a direct statement about removal of punitive or judgmental language.

Clinicians experienced the PEaRL curriculum as a 12-month pilot, and evaluation of the impact of this new experience was measured with both pre-implementation and follow-up surveys distributed electronically. A baseline survey of pediatric hospital medicine physicians, APPs, and fellows about opportunities for discussion and support after UPPOs was completed with follow-up surveys at 6 and 12 months. Responses were on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree). Mann-Whitney-Wilcoxon test was used to compare the baseline and 6-month and 12-month post-implementation survey responses.

## RESULTS

Participants at all levels (fellows, APPs, faculty) responded to surveys in similar proportions throughout the study period, with fewer total responses at 6 months and 12 months post-intervention (Table 1A). At baseline, all respondents indicated that a new standardized process to discuss and review UPPOs was needed, that discussion of these outcomes helped with coping and well-being, and that reviewing UPPOs was an important aspect of their job—all of which were sustained at both the 6-month and 12-month marks. Throughout the study period, all respondents endorsed that UPPOs affected their mood, well-being, and functioning. Post-implementation, there was improvement in feeling supported after UPPOs and existence of a safe environment and structured format to discuss such outcomes. These improvements were sustained at 6 and 12 months (Table 1B). Most respondents (79%) reported quarterly sessions were optimal, while 21% desired more frequent sessions.

## DISCUSSION

Our experience suggests that the PEaRL curriculum provides a valuable opportunity for pediatric hospital medicine fellowship



**Table 1.** Respondent Demographics and Attitudes Before and After Implementation of the Pediatric Event Review and Learning Curriculum

	Pre-implementation		6-Month Post-intervention			12-month Post-intervention		
<b>A. Demographics</b>								
<b>Role</b>	<b>n (%)</b>		<b>n (%)</b>			<b>n (%)</b>		
Hospitalist faculty	23	(74.2)	14	(73.7)		15	(79.0)	
Hospitalist fellow	2	(6.5)	2	(10.5)		2	(10.5)	
Hospitalist advanced practice provider	5	(16.1)	2	(10.5)		2	(10.5)	
Other (research coordinator)	1	(3.2)	1	(5.3)		0		
<b>B. Responses</b>								
<b>Survey prompt</b>	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>P value</b>	<b>Mean</b>	<b>SD</b>	<b>P value</b>
Reviewing patient cases with unanticipated and/or poor outcomes should be an important aspect of my job in pediatric hospital medicine	3.94	0.25	3.89	0.32	0.61	3.94	0.24	0.901
Patient cases with an unanticipated and/or poor patient outcome affect my mood, functioning and/or well-being	3.84	0.374	3.74	0.45	0.387	3.84	0.38	0.975
Discussing patient cases with unanticipated and/or poor outcomes helps with my coping and wellness	3.64	0.488	3.72	0.58	0.415	3.72	0.46	0.579
I feel supported after an unanticipated and/or poor patient outcome	2.89	0.641	3.28	0.46	<b>0.036</b>	3.47	0.51	<b>0.004</b>
Discussing unanticipated and/or poor patient outcomes helps our section to learn about important patient safety principles	3.87	0.341	3.95	0.23	0.387	3.79	0.42	0.450
Discussing other section members' unanticipated and/or poor patient cases is valuable for my learning	3.87	0.341	3.89	0.32	0.804	3.84	0.38	0.777
The section of hospital medicine currently provides a safe environment to discuss patient cases with unanticipated and/or poor outcomes	2.96	0.824	3.74	0.45	<b>&lt;0.001</b>	3.67	0.49	<b>0.003</b>
The Section of Hospital Medicine currently has a structured format to discuss patient cases with unanticipated and/or poor patient outcomes	2.00	0.834	3.63	0.60	<b>&lt;0.001</b>	3.61	0.50	<b>&lt;0.001</b>

Baseline demographics (A) and mean participant survey responses (B) on a 4-point Likert scale (1=strongly disagree, 4=strongly agree) were compared to those at 6 and 12 months post-implementation. n denotes number of respondents for each item (total N=45). P values <0.05 were considered statistically significant. Statistically significant values are denoted in bold.

trainees and experienced clinicians alike to explore and discuss UPPOs while addressing key patient safety principles. This integration of both “education” and “wellness” led to an increase in perception of interpersonal support after UPPOs. Clinicians were able to participate in error analysis and learn to apply patient safety tools, all while using a shared learning model with peers. During implementation, it was noted that clear communication and repeated reinforcement of ground rules and goals related to psychological safety was needed. We communicated frequently to participants that this conference structure was put in place to create a safe learning environment and NOT to create an ad hoc interrogation about errors. Success of this approach is reflected in the survey responses related to psychological safety. Having the PEaRL course director (in addition to the presenter) in attendance and active in the conversation was crucial to reframe the conversation in real time to ensure discussions were viewed through the lens of learning opportunities rather than one of shame and blame.

To have focused, valuable, and thought-provoking sessions, preparing the presenter in advance emerged as highly important. By having the presenters prepared to share their own responses and emotions experienced both during and after UPPOs, an opportunity was provided for others to share emotions in similar situations.

Limitations of this work include small sample size of pediatric hospital medicine clinicians, self-reported reaction data, lack of validated survey tools, and lack of practice-based patient safety education outcomes. Further study is needed to determine patient-focused safety outcomes as well as applicability across disciplines.

For clinician groups looking to address patient safety and clinician resilience, the format and focused objectives of PEaRL may be helpful. This curriculum may benefit future patients as this fostering of psychological safety may open the doors for further discussion that can lead to downstream changes that positively affect patient care. While this curriculum was built for pediatric hospital medicine fellows and clinicians, future directions could include dissemination to additional trainee levels, such as resident trainees and medical students. This could help learners recognize early in their training that addressing UPPOs with their peers in a supportive environment and learning from others is a crucial aspect of practicing medicine. Additional future directions could include dissemination of this curriculum to other specialties and creation of a multidisciplinary PEaRL-style conference that could foster collaboration and further cooperative learning, as well as incorporation of validated tools to measure broader aspects of psychological safety.

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# A Virtual Communication Workshop to Increase Confidence Using Telehealth Modalities

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## ABSTRACT

**Introduction:** COVID-19 ended in-person communication training workshops at our institution, so we sought to provide a way for family medicine residents to hone their telephone and audio-visual skills online.

**Methods:** We developed a 2-hour online workshop where residents practiced delivering serious news to family members via telephone or videoconferencing call and measured participant confidence via pre-, post-, and 6-month surveys.

**Results:** Participant confidence in delivering serious news via telephone and videoconferencing increased. Sustained confidence at 6-month follow-up was not confirmed.

**Discussion/Conclusions:** Offering an online opportunity to practice delivering serious news by telephone or videoconferencing call appears to be a successful way to bolster confidence. Participants found using realistic scenarios and discussion of best practices most helpful.

## INTRODUCTION

Physician-patient communication has been tied to measurable outcomes, such as patient satisfaction, adherence to treatment plans, and clinical outcomes.<sup>1-3</sup> Additionally, interpersonal and communication skills comprise 1 of the 6 core domains of physician competency as determined by the Accreditation Council for Graduate Medical Education (ACGME).<sup>4</sup>

An important part of family medicine residency training is advancing communication skills as guided by the ACGME. While

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many of these skills are honed over time through observation and practice, communication skills workshops have become common in residency training to address communication skills deficits and to prepare residents for future clinical encounters.<sup>5,6</sup>

Since 2016, Mayo Clinic Health System in Northwest Wisconsin has collaborated with the University of Wisconsin-Eau Claire to hold quarterly daylong Palliative Care Communication Workshops for various health care team members, including family medicine residents, to practice difficult communication assignments in the safe setting of small groups. These work-

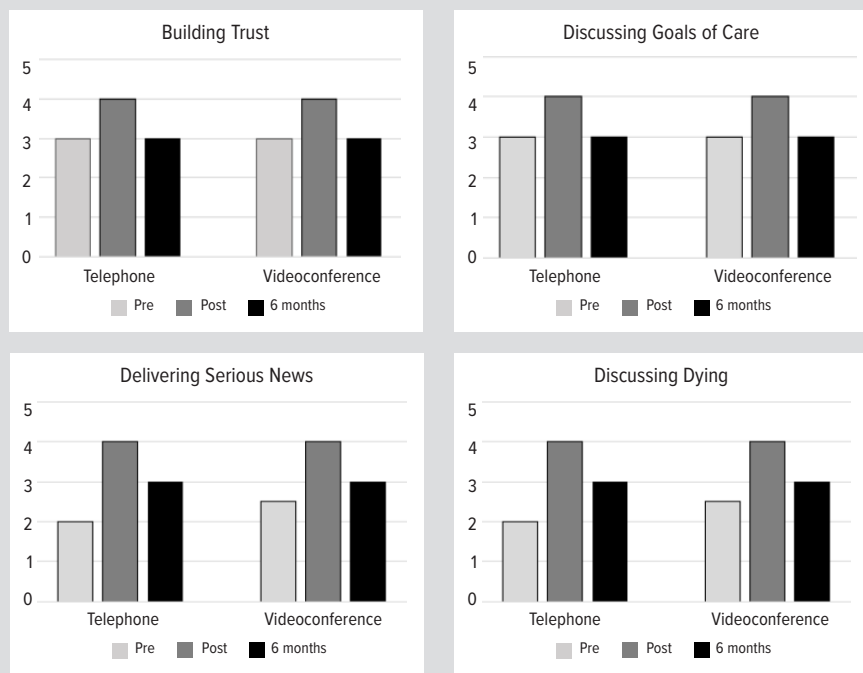
shops traditionally resulted in increased confidence among attendees in navigating challenging health care conversations.

Since safety protocols resulting from the COVID-19 pandemic suspended this in-person training, we wondered if similar confidence could be developed through a synchronous online classroom experience. To our knowledge, at the time of our study, there were no communication programs that taught phone and video skills online. Since then, there have been a few other pilot studies<sup>7-10</sup> and some adaptation of tools to deliver bad news via remote modalities.<sup>11,12</sup> In sharing our experience, we hope to promote development of other communication education.

## METHODS

We developed a 2-hour workshop using the Zoom video communication platform where residents practiced delivering serious news to family members via telephone or videoconference. Each workshop hosted up to 4 participants to mimic the small group nature of an in-person session, and participants completed role-plays and discussions about 4 different challenging

**Figure.** Median Scores of Participants' Self-reported Confidence Performing 4 Tasks by Telephone or Videoconference Pre, Post and 6 Months Following Communication Workshops



follow-up survey was administered with Qualtrics XM (Experience Management Company, Provo, Utah) using a slightly different 5-point confidence scale (1 = not at all, 2 = somewhat lacking, 3 = neither confident nor not confident, 4 = somewhat confident, and 5 = extremely). To compare across all 3 surveys, we mapped “neither confident nor not confident” (score = 3 in the third survey) to “a little confident” (score = 2 in the first 2 surveys), and “somewhat confident” (score = 4 in the third survey) to “somewhat confident” (score = 3 in the first 2 surveys). Median confidence scores reflect the consensus confidence of the participants. Given the small sample in this pilot study, the analysis is limited to describing the general trends.

In all 3 surveys, participants were asked to respond to open-ended questions about what aspects of managing care by phone/video they found most challenging. In the third survey, participants also were asked what components of the Palliative Care Communication Workshop were the most helpful in advancing their communication skills for providing care by phone/video visits.

**Table.** Friedman’s Analysis of Variance of Participants’ Self-reported Confidence on 4 Tasks by Telephone and Videoconferencing Across 3 Times (Before, After, and 6 Months Following Communication Workshop)

	$\chi^2$ Statistic	P value
<b>Building Trust</b>		
Telephone	9.33	.01 <sup>a</sup>
Videoconference	9.08	.01 <sup>a</sup>
<b>Delivering Serious News</b>		
Telephone	7.58	.02 <sup>a</sup>
Videoconference	9.75	.01 <sup>a</sup>
<b>Discussing Goals of Care</b>		
Telephone	5.25	.07
Videoconference	7.58	.02 <sup>a</sup>
<b>Discussing Dying</b>		
Telephone	9.75	.01 <sup>a</sup>
Videoconference	9.75	.01 <sup>a</sup>

<sup>a</sup>P < .05.

## RESULTS

All 12 resident participants completed pre- and post-surveys, while 6 returned the 6-month follow-up survey. The trends in residents’ confidence performing communication tasks are shown in the Figure. Before the workshop, participants were “somewhat confident” in their skills establishing trust and discussing care goals by phone and videoconference but were less confident about delivering serious news or discussing end-of-life issues regardless of communications modality. Immediately after the workshop, confidence increased substantially, and most participants were “fairly confident” about their ability to perform all 4 tasks either by phone or videoconference. Six months later, confidence levels in the 6 respondents returned close to their pre-workshop levels across all tasks.

Comparison of the repeated measures was performed using Friedman’s analysis of variance. Differences across the 3 times (before, after, and 6 months following the communication workshop) showed a statistically significant increase for 7 of the 8 measures (Table).

All 3 surveys asked the residents to list the most challenging aspects of managing health care by telephone and by videoconference. Lack of nonverbal communication cues, time management, technical difficulties, and establishing rapport and trust were most frequently mentioned.

tion tasks—establishing trust, discussing goals of care, delivering serious news, and discussing dying. The Appendix contains an overview of the curriculum.

Assessment was conducted with pre-, post-, and 6-month follow-up surveys. The pre- and post- surveys were administered with REDCap Version 10.6.14 (Vanderbilt University, Nashville, Tennessee) using a 5-point confidence scale (1 = not at all, 2 = a little, 3 = somewhat, 4 = fairly, and 5 = very) for 4 tasks across 2 different communication modalities (telephone and videoconferencing). Due to an institutional change in software, the 6-month



The 6-month survey also asked what components of the workshop were most helpful. The most frequent responses were practicing the skills via the mock scenarios and discussing best practices.

## DISCUSSION

Results indicate increases in participant confidence in establishing trust, discussing goals of care, delivering serious news, and end of life via phone and video encounters immediately after our online communication skills workshop. Participants identified that actual application of skills in realistic scenarios and discussion of best practices were the most helpful aspects of the workshop. Six months later, postworkshop confidence levels in the 6 respondents were not maintained. This finding may be due in part to temporal degradation of confidence in clinical skills, the different wording of the Likert scale in the 6-month survey, or the lower frequency of needing to engage in these conversation topics via virtual encounter as a family medicine resident. Degradation of clinical skills in medical learners has been seen as early as 12 weeks after given training for that skill.<sup>13</sup>

The COVID-19 pandemic accelerated the transition to telephone and video health, which can pose communication challenges. Creating strategies to improve clinicians' confidence and competence in conveying warmth, caring, sincerity, and validation by phone and video can lead to better therapeutic relationships with patients.<sup>14</sup>

The small sample size of this study limits the ability to draw more robust conclusions. Additionally, the variations in the survey scale, the change in surveying software, and the low response rate for the 6-month follow-up limit the direct comparison of data to measure longer-term outcomes.

Future work could include a larger number of participants and participants across different specialties to allow for more robust statistical analysis and generalizability. Using additional follow-up surveys at various intervals after the workshop would be informative to assess the rate of confidence decay. Further work exploring the rank order of the perceived challenges uncovered here could help identify what additional training is needed.

## CONCLUSIONS

Overall, offering an online opportunity to practice delivering serious news to loved ones by telephone or videoconferencing appears to be a successful way of conveying principles of effective communication and bolstering resident short-term confidence.

Delivering serious news—a difficult skill even when done in person—can be more difficult when limited to a virtual encounter by phone or video. This pilot study demonstrated the value and feasibility of teaching residents to deliver difficult news using phone/video, as well as demonstrating the need for additional training.

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**Appendix:** Available at [www.wmjonline.org](http://www.wmjonline.org).

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# A Single Wisconsin High School Students' Projected Uptake of COVID-19 Vaccines at the Onset of Its Emergency Use Authorization

Krish Vasudev, Lyle DP Mondano, Ainsley Regner

## ABSTRACT

**Introduction:** This study assessed high-school students' anticipated COVID-19 vaccine uptake following the US Food and Drug Administration Emergency Use Authorization—before its availability to adolescents—and compared it to current national vaccination rates in similar age groups.

**Methods:** A web-based survey was conducted in January 2021. Data were analyzed using SurveyMonkey and SPSS. Predictors of vaccine willingness were explored.

**Results:** One hundred twenty of 407 students responded, with 70% indicating willingness to receive the COVID-19 vaccine. Current data from the Centers for Disease Control and Prevention show a 72.2% uptake among the 12- to 17-year age group. Students with a general belief in vaccinations and those who self-identified as liberal were more willing to receive the vaccine.

**Discussion/Conclusions:** High school students exhibited positive attitudes towards COVID-19 vaccines, with acceptance influenced by general vaccine beliefs, political affiliation, and projected uptake rates aligned with national data.

## INTRODUCTION

In response to the COVID-19 pandemic, pharmaceutical companies swiftly developed vaccines to decrease the spread and severity of the viral infection, aiming for widespread vaccination as the avenue toward herd immunity. Two notable milestones were the Pfizer/BioNTech and Moderna's mRNA vaccines, which received Emergency Use Authorization by the US Food and Drug Administration in December 2020. Their high levels of efficacy and safety ignited enthusiasm among medical professionals worldwide.<sup>1,2</sup>

While the medical community's embrace of these vaccines is

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well-documented, there is a paucity of high school student-led research on high school students' perceptions of and attitudes toward the COVID-19 vaccine. This demographic, with its distinct social and behavioral attributes, is crucial for the understanding of acceptance of public health measures.

High school students have a foundational grasp of essential principles and concepts pertaining to the COVID-19 pandemic.<sup>3</sup> Our initiative aimed to explore the minds of high school students in a single Wisconsin high school to understand their perspectives on vaccines in general and, more specifically, their willingness to receive the COVID-19 vaccine following

an election cycle, given that political affiliations can influence vaccination intention.<sup>4</sup> We sought to identify the influence of their political leanings and examine if personal experiences, such as knowing someone diagnosed with COVID-19, had any bearing on their decision to get vaccinated.

From reported data since the onset of the pandemic to May 11, 2023, it has been found that children represented 17.9% of total cumulated COVID-19 cases, and according to the Centers for Disease Control and Prevention, it was expected that in 2023, the United States would most likely see greater hospitalizations from respiratory illnesses than in seasons before the pandemic, underscoring the importance of assessing vaccine intent.<sup>5,6</sup>

We hoped to gain insights that would allow us to align vaccine outreach efforts more effectively in this age group, especially in the context of COVID-19 and respiratory illnesses, thereby tailoring future vaccination strategies more effectively to their needs and views. This research contributes to the growing body of literature on vaccine acceptance, adding an important layer of

**Table 1.** Demographic Characteristics of Wisconsin High School Student Survey Respondents

Characteristics	No. of Respondents	Percent
Current year in high school (n=120)		
Freshman	3730.83	
Sophomore	1915.83	
Junior	3428.33	
Senior	30	25.00
Gender (n=120)		
Male	5445.00	
Female	60	50.00
Other	65.00	
Race and Ethnicity (n=119)		
European American	7361.34	
African-American	54.20	
Latino/Hispanic American	75.88	
Asian American	1310.92	
Middle Eastern American	43.36	
Native American	21.68	
Multiracial American	97.56	
Other	65.04	
Political identification (n=119)		
Very liberal	1512.61	
Liberal	4840.34	
Centrist	108.40	
Conservative	22	18.49
Very conservative	43.36	
Independent	1411.76	
Apolitical	65.04	
Socioeconomic class (n=120)		
Upper	3630.00	
Upper Middle	50	41.67
Middle	30	25.00
Working	21.67	
Lower	21.67	

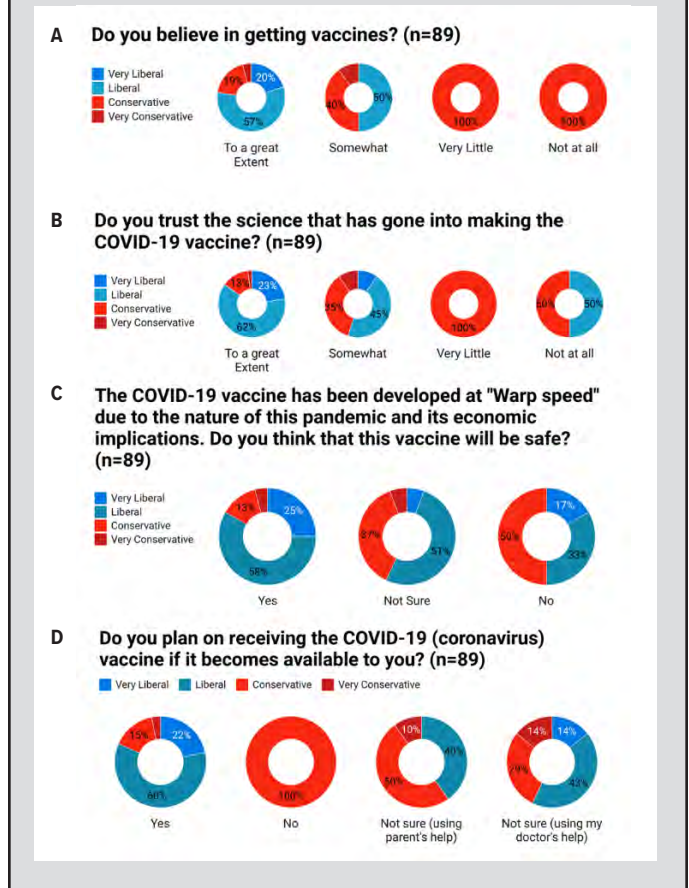
understanding by focusing on a select demographic in medical and health research.

## METHODS

A 21-question electronic survey was administered to high school students using the Survey Monkey web application (San Mateo, California; <http://www.surveymonkey.com>). The researchers independently generated survey questions and employed the Likert scale to assess opinions and attitudes. To validate the questions and minimize survey fatigue, the team enlisted 5 high school students from a nonparticipating high school, a faculty member from a local medical college, and participating high school administrators to select the most important queries. The final survey was deemed comprehensible, allowed for the maintenance of anonymity, and the questions were appropriate for high school students.

The high school's Scientific Review Committee gave the approval to send out the survey. Parental approval was not required, and teachers were available to answer questions. The

**Figure 1.** Association Between Political Views and Vaccines



survey was administered during the school day solely via an invitation to participate anonymously through a link provided within the high school's private network portal, where students received a notification to choose to participate in this survey among other available student-designed surveys as participation in the school's independent science research program. Respondents were given the option to opt out of any question in the survey.

The school where the survey was administered draws students from Milwaukee, Wisconsin, and 19 surrounding ZIP codes. From January 19 through January 23, 2021, 407 high school students received the survey link through their high school portal. The survey was voluntary and without incentive.

Results were saved on a password-protected computer with extra security measures on SurveyMonkey. The participants and the authors did not have access to information that could identify individual participants during or after data collection. Predictors of the willingness to receive the COVID-19 vaccine were determined by calculating odds ratios and 95% confidence intervals using statistical online calculators.

## RESULTS

Of 407 students invited to participate, 120 responded, representing a 29.48% response rate. The self-reported demographic

**Table 2.** Opinion and Knowledge of Influenza and COVID-19 Vaccines in Wisconsin High School Student Survey Respondents

Questions and Answers	No. of Respondents	%	Questions and Answers	No. of Respondents	%
Do you believe in getting vaccines? (n=120)			Do you personally know anyone who has died from COVID-19? (n=120)		
To a great extent	100	83.33	Yes	28	23.33
Somewhat	16	13.33	No	92	76.67
Very little	1	0.83	Do you trust the science that has gone into making the COVID-19 vaccine? (n=119)		
Not at all	3	2.50	To a great extent	71	59.66
Did you take the flu vaccine? (n=119)			Somewhat	42	35.29
Yes	91	76.47	Very little	3	2.52
No	28	23.53	Not at all	3	2.52
Do you plan to get or did you already receive the flu vaccine (shot or nasal spray) this flu season? (n=120)			The COVID-19 vaccine has been developed at “warp speed” due to the nature of this pandemic and its economic implications. Do you think that this vaccine will be safe? (n=119)		
Yes	94	78.33	Yes	64	53.78
No	26	21.67	Not sure	47	39.50
Do you plan on receiving the COVID-19 (coronavirus) vaccine if it becomes available to you and if you’re eligible for it this year? (n=120)			No	8	6.72
Yes	84	70.00	Do you think that the COVID-19 vaccine will be effective in preventing the spread of this disease by the summer 2021? (n=120)		
No	10	8.33	Very likely	26	21.67
Not sure but I plan on using my parents’ help in making the decision	17	14.17	Somewhat likely	74	61.67
Not sure but I plan on using my doctor’s help in making the decision	9	7.50	Not likely	20	16.67
If you do not believe in getting vaccines in general, why are you are hesitant? (check ALL that apply) (n=25)			Are any of your family members willing to take the COVID-19 vaccine when it becomes available to them this year? (n=120)		
Lack confidence in vaccine effectiveness	6	24.00	Yes	106	83.33
Lack confidence in vaccine safety and concerned about side effects	14	56.00	No	5	4.17
Lack confidence in the government and health care policymakers	8	32.00	Not sure	9	7.50
Perceive low risk of acquiring vaccine preventable diseases	5	20.00	Will minor side effects like fever, chills, headache, muscle ache, or the pain of injection site deter you from taking the COVID-19 vaccine? (n=119)		
Lack convenience in access to immunizations including time, place, and cost	2	8.00	Yes	9	7.56
History of serious side effects from vaccines or its contents	4	16.00	No	98	82.35
Religious reason	0	0.00	Not sure	12	10.08
Fear of vaccines	3	12.00	Do you think that widespread use of the COVID-19 vaccine will bring an end to the pandemic? (n=119)		
Other	5	20.00	Very likely	63	52.94
Are your political views similar to one of your parents? (n=119)			Somewhat likely	44	36.97
Yes	83	69.75	Not Likely	12	10.08
No	22	8.49	The currently available Pfizer COVID-19 vaccine received emergency use authorization by the FDA in December 2020 for people 16 years and older. Do you think they should have included 14 and 15-year-old children in the vaccine trial? (n=118)		
Not sure	14	11.76	Yes	30	25.42
Do you personally know anyone who has been diagnosed with COVID-19? (n=120)			No	37	31.36
Yes	111	92.50	Unsure	51	43.22
No	9	7.50			

breakdown of respondents was 61.34% European American, 5.88% Latino/Hispanic, 4.20% African American, 0.68% Native American, and 10.92% Asian-American (Table 1). The overall demographic of the high school student population at the time of the survey consisted of 62.1% European American, 6.88% Latino/Hispanic, 7.4% African American, 1.23% Native American, and 11.1% Asian-American students. In comparison, the broader Milwaukee area’s demographics include 64% White, 12% Hispanic, 15% Black, 0% Native American, and 4% Asian, with a margin of error of 10%.<sup>7</sup>

Views on the seasonal influenza immunization and COVID-19 vaccines are summarized in Table 2. More than 80% (83.33%) of respondents reported a high level of belief in vaccinations in

general, 13.33% indicated moderate belief, and 2.50% reported no belief. Furthermore, 76.47% said that they routinely receive the optional seasonal influenza vaccine. When queried about the COVID-19 vaccine, 70% planned to receive it when eligible and available.

At the time the survey was conducted, respondents were not eligible to receive the COVID-19 vaccine. Figure 1 illustrates the influence of political views on vaccine beliefs, trust, safety perceptions, and vaccination plans. Among respondents, political ideology leaned left, with 40.34% identifying as liberal and 12.61% as very liberal; 18.49% and 3.36% identified as conservative and very conservative, respectively; and 11.76% claimed independence. When correlating political views and vaccine attitudes, all



very liberal respondents and 75% of very conservative respondents indicated they believed highly in vaccination (Figure 1A). Furthermore, 80% of very liberal respondents said they trusted vaccine science, compared to 25% of very conservative respondents (Figure 1B). On the topic of vaccine safety, given its swift development, 53.78% of respondents said they considered it safe, 39.5% were unsure, and 6.72% considered it unsafe (Figure 1C). Liberal respondents were more willing than conservative respondents to receive the COVID-19 vaccine (OR 3.47; 95% CI, 1.26-9.56) (Figure 1D).

Comparing willingness to receive the influenza vaccine with the COVID-19 vaccine, 75.53% of respondents who planned to receive the flu vaccine were also willing to receive the COVID-19 vaccine. In contrast, only 50% of those not planning to receive the flu vaccine were willing to get the COVID-19 vaccine (OR 3.09; 95% CI, 1.25-7.60).

In examining the impact of personal experience with COVID-19, 92.50% of respondents knew someone diagnosed with the disease, and 28.33% knew someone who had died from it. We found no statistically significant difference in vaccine willingness between those who knew someone diagnosed with or who died from COVID-19 versus those who did not. Of those who knew someone diagnosed with COVID-19, 70.27% were willing to get vaccinated, compared to 66.67% who did not (OR 1.18; 95% CI, 0.28-5.01). Among those who knew someone who died of COVID-19, 64.29% were willing to get vaccinated, versus 71.24% of those who did not (OR 0.71; 95% CI, 0.30-1.65).

## DISCUSSION

The novelty in our study lies in exploring the perspectives of high school students toward the COVID-19 vaccine during a critical period when the vaccine was yet to be made available to this age group. Our findings revealed a general willingness among the majority of students to receive this new immunization, providing early insight into their acceptance. Interestingly, this willingness echoed the national vaccination rates witnessed at the end of the COVID-19 public health emergency, with a vaccine uptake of at least 1 dose in 72.2% of individuals aged 12 to 17 years and contributes to how views may influence future vaccination decisions.<sup>8</sup>

These insights bear substantial significance for public health strategies and vaccine outreach efforts. Understanding that political beliefs could impact vaccine acceptance among adolescents suggests the utility of targeted, nonpartisan communication in elevating vaccination rates in this demographic. However, despite the valuable insights, our study is not without limitations, such as the lower response rate and the focus on 1 geographic area (albeit with students from 19 different ZIP codes), potentially limiting the generalizability of the results. Future research could benefit from a more diverse and larger sample size to corroborate our findings.

## CONCLUSIONS

This study underscores the importance of understanding adolescents' perceptions of vaccines, especially during a public health crisis. Our insights contribute to the existing literature and guide the development of effective vaccination strategies targeting this pivotal demographic.

This study, capturing high school students' attitudes towards COVID-19 vaccination, indicates a general willingness to receive it prior to its availability in this age group. For clinicians, educators, and public health clinicians, the key insights include addressing concerns about vaccine safety and effectiveness, as 56% of hesitant respondents cited these as reasons. Engaging parents in vaccine discussions is crucial, as many students look to them for guidance. Additionally, information campaigns might focus on addressing misconceptions about vaccine development speed and side effects, as these were prominent concerns. This approach can potentially increase vaccination rates among adolescents, contributing to broader public health objectives

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# Acute Myelomonocytic Leukemia Presenting as Fournier's Gangrene

Sofie Kjellesvig, MD; Emelyn Zaworski, MD; Antoine N. Saliba, MD

## ABSTRACT

**Introduction:** Acute myelomonocytic leukemia is a type of acute myeloid leukemia with monocytic expansion. Both the disease and its treatment can be immunocompromising. Immunocompromised patients are more susceptible to infections, such as Fournier's gangrene, a rare necrotizing infection of the groin.

**Case Presentation:** A 56-year-old male presented to the emergency department with abdominal pain, leukocytosis, and perineal ecchymosis. Overnight, his perineal discoloration and tenderness worsened. He underwent irrigation and debridement for Fournier's gangrene and received broad-spectrum antimicrobial therapy. Subsequent workup revealed acute myeloid leukemia with leukemia cutis and central nervous system involvement, necessitating chemotherapy initiation prior to complete wound healing.

**Discussion/Conclusions:** This case highlights the challenges in the diagnosis and management of acute leukemia in the setting of a concomitant life-threatening soft tissue infection, as both the hematologic disease and treatment thereof can exacerbate infectious complications.

## INTRODUCTION

Acute myeloid leukemia (AML) encompasses a heterogeneous range of aggressive hematologic malignancies characterized by proliferation of immature myeloid cells (blasts) making up  $\geq 20\%$  of cells in the bone marrow or peripheral blood.<sup>1,2</sup> Acute myelomonocytic leukemia (AMML) is a rare type of AML distinguished by an increase in cells of monocytic lineage, which may occur de novo or transform from an underlying myelodysplastic syndrome.<sup>2</sup> AML can present asymptotically, with constitutional symptoms (fevers, night sweats, fatigue, weight loss), or with sequelae of pancytopenia (infections, bleeding, bruising).<sup>1</sup> Since both AML

itself and its treatment can cause immunosuppression, these patients are susceptible to opportunistic infections as well as life-threatening infections with common pathogens.

Fournier's gangrene is a necrotizing fasciitis of the groin that develops either spontaneously or secondary to external trauma.<sup>3</sup> Patients typically present with local pain, swelling, and erythema as well as systemic symptoms, including fevers and chills. Cutaneous discoloration or crepitus on exam often portends a more advanced disease state. If there is suspicion for Fournier's gangrene, radiographic studies may reveal air in the soft tissue. However, imaging should not delay treatment due

to the high morbidity and mortality of disease. The highest-risk groups of patients experience up to a 75% risk of death, and delaying treatment has been shown to significantly increase that risk.<sup>4</sup> Urgent surgical debridement is necessary for both diagnostic and therapeutic purposes.<sup>4</sup>

This report presents a case of AMML with leukemic involvement of the skin and central nervous system, complicated by Fournier's gangrene, which required extensive surgical debridement. Its purpose is to highlight the rarity of Fournier's gangrene as a presentation of AMML and the challenges of effectively treating both the malignancy and infection.

## CASE PRESENTATION

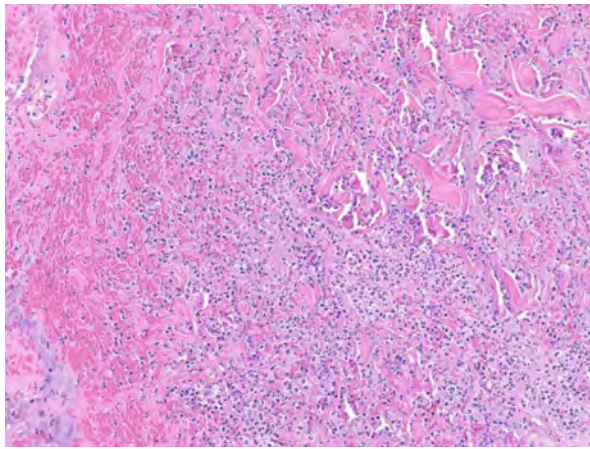
A 56-year-old male presented to the emergency department with abdominal pain, diarrhea, rigors, chills, night sweats, and appetite loss for 2 weeks. Labs revealed a white blood cell count of  $38.8 \times 10^3/\mu\text{L}$  (reference range:  $4.5 \times 10^3/\mu\text{L}$  -  $11 \times 10^3/\mu\text{L}$ ) with elevated myelocytes, metamyelocytes, monocytes, and 8%

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**Figure 1.** Surgical Pathology Slide From Biopsy During Irrigation and Debridement Procedure Stained With Hematoxylin and Eosin



Pathology demonstrated skin and subcutaneous tissue with acute inflammation and necrosis, consistent with Fournier's gangrene.

blasts, as well as anemia and mild thrombocytopenia. He was noted to have a perineal skin lesion that rapidly extended overnight from the perineum to the scrotum with worsening violaceous discoloration and severe tenderness to palpation. Broad-spectrum antibiotics were initiated. Given rapid progression and high clinical suspicion for Fournier's gangrene, urgent irrigation and debridement were performed. During patient positioning, nodular lesions with black hemorrhagic rings were noted over the bilateral ischial tuberosities and were biopsied. Intraoperative findings were concerning for early Fournier's gangrene with mild skin necrosis and significant tissue edema without frank purulence. Skin biopsy later returned as leukemia cutis. Wound culture grew polymicrobial colonies, and blood cultures subsequently grew *Clostridium septicum*.

Initial bone marrow biopsy and flow cytometry findings were consistent with AML with monocytic differentiation, specifically AMML. Marrow cellularity was 100% with trilineage hematopoietic maturation, including granulocytic hyperplasia, atypical megakaryocytes, monocytosis, and 59% blasts and promonocytes. Atypical-appearing peripheral blood monocytes were also present. Conventional cytogenetic studies showed a clonal trisomy 8. Next generation sequencing using a myeloid malignancies gene panel revealed pathogenic variants in *NPM1*, *U2AF1*, *DNMT3A*, and *TET2*. Blast percentage was stable at this time, but the patient's Fournier's gangrene had not been fully controlled, necessitating further surgical intervention. Antimicrobial and tumor lysis syndrome prophylaxis medications were initiated, but leukemia-directed myelosuppressive treatment was delayed to prioritize infection management. Several irrigation and debridement procedures were performed, and a loop sigmoid colostomy was created to facilitate wound healing. A vacuum-assisted wound clo-

**Figure 2.** Photo of Widespread Eruption of Leukemia Cutis Lesions Over the Patient's Trunk



sure device also was used to further optimize wound care. Surgical pathology confirmed the working diagnosis of Fournier's gangrene (Figure 1). The leukocytosis temporarily resolved with these interventions. Broad-spectrum antibiotics were discontinued after 29 days, and prophylactic levofloxacin was started in the setting of neutropenia. Cyto-reductive therapy with hydroxyurea eventually was initiated after recurrence of leukocytosis with circulating blasts. As the patient's wound continued to heal, he developed an eruption of violaceous papules and nodules involving most of his body (Figure 2). Punch biopsy confirmed the lesions to be leukemia cutis.

As the patient was undergoing staging, there was a concern for wound dehiscence, and he started undergoing hyperbaric oxygen therapy (HBOT) to expedite healing prior to initiation of chemotherapy. One week into HBOT, a screening lumbar puncture was performed to evaluate for leukemic involvement of the central nervous system (CNS). Lumbar puncture showed rare, atypical monocytic cells, confirming CNS involvement. Therefore, HBOT was discontinued and leukemia-directed therapy was started. The patient received intrathecal cytarabine and methotrexate for his CNS disease. The risk of exacerbating his Fournier's gangrene with intensive systemic chemotherapy with cytarabine and an anthracycline was felt to be too high. Additionally, given myelodysplasia-related gene changes, a com-



bination of a hypomethylating agent (decitabine) and venetoclax was felt to be an effective, safer option.

The patient completed 1 cycle of decitabine and venetoclax, during which time his perineal wounds healed well, though his hospital course was complicated by severe mucositis. His leukemia cutis improved quickly during this time. Following the first cycle, his AML was in complete remission, but an *NPM1* qRT-PCR assay was positive for measurable residual disease. As his CNS leukemic involvement was difficult to control with intrathecal therapy alone and as his surgical wounds had healed, high-dose cytarabine – with a dose reduction to 2.25 g/m<sup>2</sup> – was given for 2 cycles, in a fashion similar to consolidation after successful induction therapy. Following this treatment, his CNS leukemic involvement cleared, but his leukemia cutis and bone marrow disease relapsed. He decided to pursue hospice care at that time and eventually died of relapsed leukemia.

## DISCUSSION

This case demonstrates the difficulty of identifying Fournier's gangrene at an early stage. Often mistaken for ecchymosis, Fournier's gangrene may not be identified until it reaches a more fulminant state. The causative agent in this patient was *C septicum*, identified on blood cultures. *C septicum* is associated with spontaneous rather than traumatic gangrene.<sup>3</sup> *C septicum* myonecrosis is known to be highly associated with malignancy (up to 80%) and immunosuppression.<sup>5,6</sup> In this patient, it is possible that perineal leukemia cutis served as a nidus for infection in the setting of immunosuppression secondary to acute leukemia. In patients who develop spontaneous gas gangrene, it is especially important to evaluate for an underlying immunocompromising condition, such as malignancy. Other case reports have documented examples of Fournier's gangrene as a presenting symptom in patients who were ultimately diagnosed with hematologic malignancies, commonly AML, or as a complication of treatment for these disorders.<sup>7-11</sup> Of these reports, only two describe AMML presenting as Fournier's gangrene, and neither patient survived; one died within days, only receiving supportive care, and the other passed away during chemotherapy initiation.<sup>10,11</sup> The case we present is unique in that this patient completed multiple cycles of chemotherapy and was able to achieve healing of his extensive surgical wounds and remission of his bone marrow disease for a period of time.

This patient's AML morphology was most consistent with AMML. Distinguishing features of his molecular landscape were somatic mutations of *NPM1* and *U2AF1*.<sup>12</sup> *NPM1* is an AML-defining molecular abnormality regardless of blast percentage, per the World Health Organization 2022 diagnostic criteria.<sup>2</sup> *U2AF1* mutations typically are seen in AML with myelodysplasia-related changes and are associated with AML that transformed from myelodysplastic syndrome as opposed to de novo AML.<sup>2,12</sup> These findings suggest that the AML likely progressed from underlying

myelodysplastic syndrome or chronic myelomonocytic leukemia. The remainder of the genetic and chromosomal abnormalities also support an AML diagnosis, though trisomy 8 also is seen in other myeloproliferative disorders.<sup>13</sup> His leukocytosis, monocytic differentiation, and extramedullary involvement were all risk factors for leukemic CNS involvement. A rare manifestation of AML also seen in this patient was leukemia cutis: lesions resulting from neoplastic skin infiltration. Among AML subtypes, leukemias with prominent monocytic or myelomonocytic differentiation are more commonly associated with leukemia cutis.<sup>14,15</sup> The wide variability of these lesions (most commonly nodules, papules, and plaques) makes their identification as manifestations of a hematologic malignancy challenging without a prior diagnosis.<sup>12</sup> In patients with known or suspected leukemia, obtaining a biopsy of new skin lesions is recommended due to the prognostic implications of leukemia cutis.<sup>15</sup> The presence of leukemia cutis, CNS disease, and somatic mutation of *U2AF1* were all poor prognostic indicators for this patient.<sup>12,14</sup>

In this patient with Fournier's gangrene and concomitant AML, leukemia-directed treatment was delayed by 2 months to manage the rapid infection progression. His Fournier's gangrene was managed with irrigation/debridement procedures, negative pressure therapy, and antibiotics, followed by HBOT due to concern for wound dehiscence. Wound healing was monitored closely because although it was important to start chemotherapy in a timely manner, receiving myelosuppressive treatment with an open wound would have significantly increased his risk of further infectious complications.

As healing progressed, routine lumbar puncture was performed to screen for blasts in his cerebrospinal fluid. Asymptomatic CNS leukemic involvement was discovered, necessitating urgent modification of therapeutic strategy. Leukemia-directed therapy took precedence over infection control to prevent neurological decompensation. Intrathecal chemotherapy with cytarabine and methotrexate was initiated along with systemic agents. Decitabine and venetoclax were chosen in lieu of aggressive systemic chemotherapy, which was felt to be too dangerous given the need for continued wound healing. When he achieved remission but was found to have measurable residual disease, his wounds had healed well enough that systemic cytarabine therapy was started. Although this treatment eradicated his CNS disease, his AML relapsed in the bone marrow and skin following 2 cycles, and at that time he chose to transition to hospice. Extensive and frequent communication between the internal medicine, surgery, and hematology teams was critical to coordinating and adjusting this patient's treatment plan based on the most pressing concern at each point during his care.

## CONCLUSIONS

This patient exhibited two easily overlooked, consequential physical exam findings: (1) bruise-like perineal skin changes



from Fournier's gangrene and (2) leukemia cutis, an adverse prognostic factor. Without any known immunocompromising condition, it was paramount to uncover predisposing factors for his development of nontraumatic Fournier's gangrene, such as AML or another hematologic malignancy. In this patient, infection control was prioritized initially; however, upon discovering CNS involvement of his AML, leukemia-direct therapy was initiated despite the potential for wound healing complications. This strategy enabled the patient to achieve complete bone marrow remission after 1 cycle and allowed his surgical wounds to heal before adjusting his chemotherapy regimen to effectively address his residual CNS disease. After 2 cycles, however, his bone marrow disease relapsed and he elected to transition to hospice care before passing away.

Ultimately, this case highlights the importance of multidisciplinary collaboration when caring for a patient with concomitant, life-threatening conditions that are intertwined but disparately managed.

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# Hypokalemia Due to Ectopic Adrenocorticotrophic Hormone

Adil Ghaffar, MD; Tripti Singh, MD

## ABSTRACT

Hypokalemia is a common disorder in clinical practice. The underlying pathophysiology can be attributed to 3 main mechanisms: insufficient potassium intake, excessive urinary or gastrointestinal losses, and transcellular shift. Renal loss is the most common cause of hypokalemia. Renal loss of potassium can occur due to diuretics, mineralocorticoid excess or hypercortisolism (Cushing syndrome). Among patients with Cushing syndrome, ectopic adrenocorticotrophic hormone (ACTH) is the most frequent cause. We present a case of hypokalemia and hypertension due to ectopic ACTH production leading to Cushing syndrome.

## INTRODUCTION

In adults, hypokalemia, metabolic alkalosis, and hypertension are commonly associated with mineralocorticoid excess—either primary or secondary hyperaldosteronism—but there are other less common causes as well. These include inherited disorders such as Liddle syndrome, congenital deficiency of 11 beta-hydroxysteroid dehydrogenase 2, certain medications, or ectopic adrenocorticotrophic hormone (ACTH) secretion from cancers—especially small cell lung cancer.

Small cell lung cancer can present with various paraneoplastic endocrine syndromes, such as hypercalcemia due to ectopic parathyroid hormone secretion and hyponatremia due to antidiuretic hormone excess.<sup>1</sup> In addition, ectopic ACTH secretion associated with small cell lung cancer can be one such manifestation that presents with hypokalemic metabolic alkalosis and

systemic hypertension. Fifteen percent of cases with ectopic ACTH secretion arise from the tumor or its metastasis.<sup>1-3</sup> Here we describe a case of recurrent small cell lung cancer presenting with ectopic ACTH secretion.

## CASE PRESENTATION

A 64-year-old female was admitted to the hospital after presenting with complaints of feeling weak and lightheadedness.

Her history included stage IIIB small cell lung cancer, which was treated with chemoradiation in May 2020 and was currently in remission, paroxysmal atrial fibrillation, obesity, hypertension, and chronic obstructive pulmonary disease.

On examination, the patient's temperature was 36.8°F, respiratory rate was 14 breaths per minute, blood pressure was 200/106 mm Hg, heart rate was 40 beats per minute, and oxygen saturation was 96% on room air. On admission, she was started on nicardipine infusion for blood pressure control, along with oral and intravenous potassium repletion. Nephrology was consulted for worsening hypertension and hypokalemia. (Lab results are shown in Table.)

Upon evaluation by nephrology, the patient denied any recent nausea, vomiting, or watery diarrhea. She denied any diuretic, steroid, or herbal medication use. She did not have any stigmata of Cushing syndrome (hypercortisolism), such as moon facies, supraclavicular fat pad, or purplish abdominal wall striae. Lung examination showed no rales, and no lower extremity edema was elicited. Her previous labs showed serum potassium levels in the range of 4-4.5 mmol/L and bicarbonate levels 24-28 mmol/L. In the past, her blood pressure was well controlled on metoprolol alone.

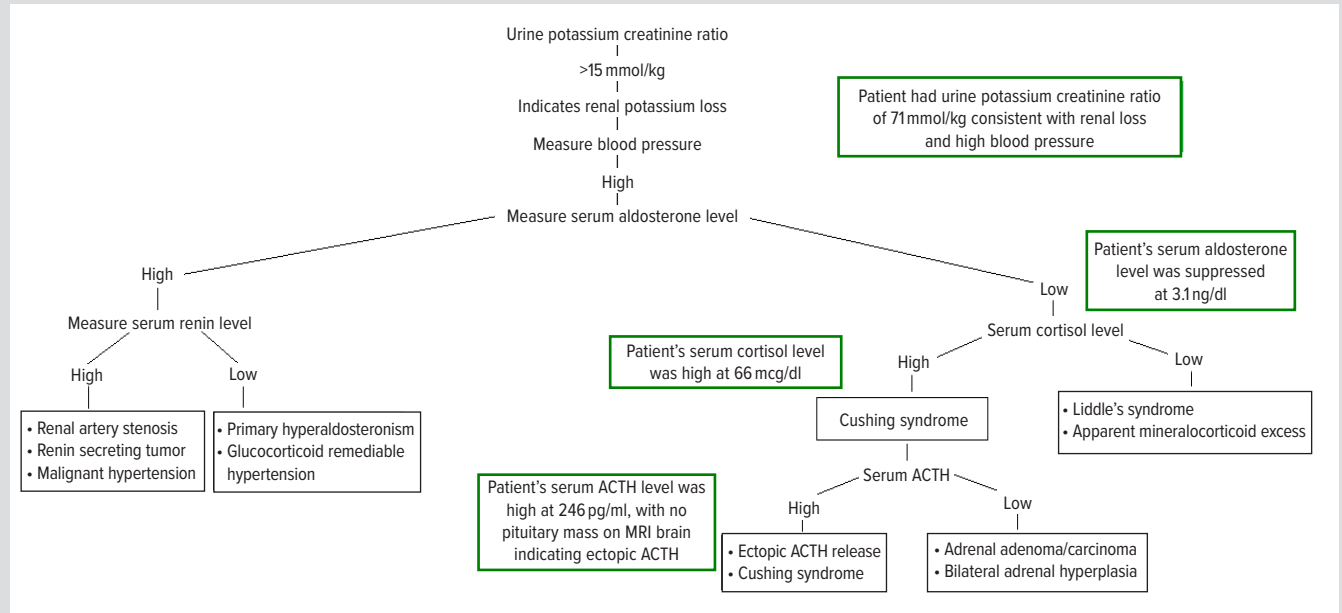
Computed tomography of the chest with intravenous contrast and a positron emission tomography (PET) scan showed enlarged

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**Figure 1.** Algorithm for Work-up of Hypokalemia Due to Renal Potassium Wasting with Hypertension



Abbreviations: ACTH, adrenocorticotropic hormone; MRI, magnetic resonance imaging.

left hilar lymph node with increased uptake suggestive of recurrent small cell lung cancer, which was the source of ectopic ACTH. Magnetic resonance imaging of the brain did not show any pituitary masses. The patient was started on spironolactone. Serum potassium level and blood pressure normalized on a spironolactone dose of 200 mg daily. She was subsequently evaluated by the oncology team to restart chemotherapy for recurrent small cell lung cancer.

## DISCUSSION

The cause of hypokalemia is usually obvious from the patient's history, but the urine potassium to creatinine ratio is an important test to differentiate between renal and extrarenal potassium wasting. If the ratio is more than 15 mmol/g, it signifies renal potassium wasting, which most commonly occurs with diuretic use. In the absence of diuretic use, differential diagnosis for new onset or worsening hypertension with hypokalemia and metabolic alkalosis includes hyperaldosteronism, Cushing syndrome, apparent mineralocorticoid excess (congenital deficiency of 11 beta-hydroxysteroid dehydrogenase 2 or drugs inhibiting it), or a genetic kidney tubular disorder such as Liddle syndrome (Figure 1).

Our patient had an elevated urine potassium to creatinine ratio, indicating renal potassium wasting. She had no prior history of hypokalemia, which makes Liddle syndrome or apparent mineralocorticoid excess unlikely. She did not report any diuretic or licorice use (licorice can interfere with cortisol inactivation in the renal tubule). Due to worsening hypertension, hypokalemia, and metabolic alkalosis, the main differential was hyperaldosteronism, but both renin and aldosterone were

**Table.** Patient's Lab Results

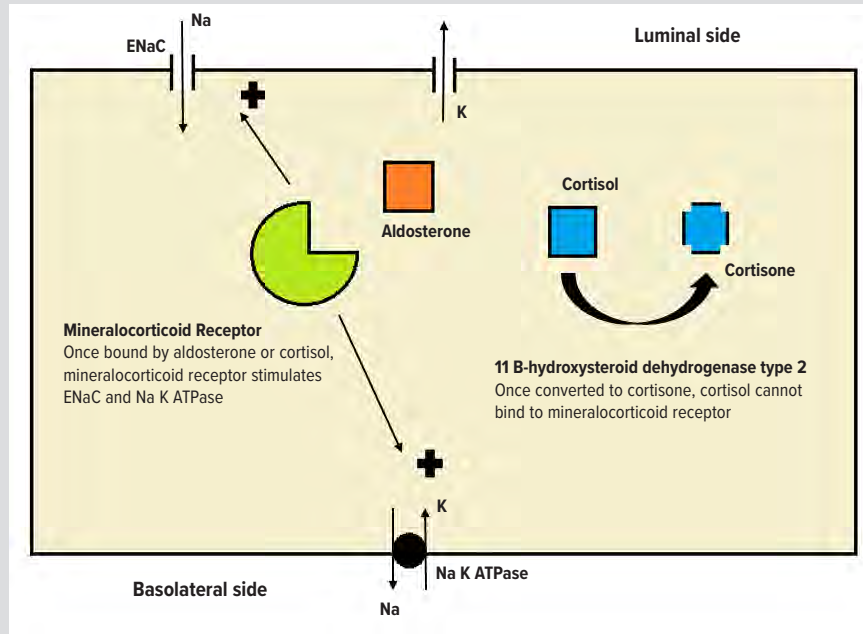
Blood Chemistry		
Potassium	2 mmol/L	Normal range: 3.5–5.0 mmol/L
Chloride	88 mmol/L	Normal range: 96–111 mmol/L
Bicarbonate	46 mmol/L	Normal range: 21–29 mmol/L
Magnesium	1.6 mg/dl	Normal range: 0.6–1.6 mg/dl
Creatinine	0.8 mg/dl	Normal range: 0.5–1.2 mg/dl
Urine Chemistry Results		
Urine potassium creatinine ratio	71 mmol/g	With hypokalemia, value >15 mmol/g signifies renal potassium wasting
Urine chloride	67 mmol/L	With hypochloremia, value >20 mmol/L indicates renal chloride wasting
Urine sodium	56 mmol/L	Varies, if <20 mmol/L indicates extra-renal volume depletion
Blood Hormonal Test Results		
Serum aldosterone	3.1 ng/dl	Upright: 4.0–31.0 ng/dL Supine: ≤16.0 ng/dL
Serum renin activity	0.4 ng/ml/hr	Supine: 0.2–1.6 ng/mL/hr Upright: 0.5–4.0 ng/mL/hr
Serum aldosterone renin ratio	0.78	Ratio >20 with aldosterone level >15 ng/dl suggests primary hyperaldosteronism
Serum cortisol	66 mcg/dl	AM: 3.7–19.4 mcg/dL PM: 2.9–17.3 mcg/dL
Serum ACTH	246 pg/ml	7.2–63.3 pg/ml

Abbreviation: ACTH, adrenocorticotropic hormone.

suppressed. However, she had Cushing syndrome, which was responsible for her presentation.

Endogenous Cushing syndrome is rare and can be divided into corticotrophin-dependent (80%–85%) or corticotrophin independent (10%–15%) causes. It is estimated that 75% to

Figure 2. Principal Cell



Abbreviations: ENaC, epithelial sodium channel; K, potassium; Na, sodium; ROMK, renal outer medullary potassium channel.

80% of cases are due to ACTH production from a pituitary adenoma, and 15% to 20% of cases are due to ectopic sources.<sup>6,7</sup>

In the principal cell of the collecting duct, aldosterone stimulates the epithelial sodium channel at the luminal membrane, driving lumen potential electronegative that stimulates potassium and hydrogen ion secretion in the lumen through the renal outer medullary potassium channel and hydrogen ATPase channel, respectively.

Cortisol also possesses mineralocorticoid activity and circulates in blood at a concentration 1000-fold greater than aldosterone. However, it does not act on the mineralocorticoid receptor in the principal cell due to its inactivation to cortisone by 11 beta-hydroxysteroid dehydrogenase type 2 (Figure 2).<sup>4</sup> At very high levels of cortisol, however, 11 beta-hydroxysteroid dehydrogenase type 2 is not only overwhelmed but also inhibited by ACTH. This inhibition by ACTH is far more important, as it is rare to have hypokalemia and metabolic alkalosis in other causes of Cushing syndrome.<sup>5</sup>

Management of ectopic ACTH syndrome depends on treating the underlying malignancy. Until treatment of malignancy, spironolactone (mineralocorticoid receptor antagonist), amiloride (epithelial sodium channel blocker), and ketoconazole (inhibits steroid synthesis) can help improve hypertension and electrolyte imbalance.

Our patient did not have any peripheral stigmata of Cushing syndrome; however, her presentation was due to elevated cortisol from ectopic ACTH. It is unusual for the ectopic ACTH to present with classical clinical signs of Cushing's syndrome as

there is exposure to high levels of glucocorticoids within a short period.

## CONCLUSIONS

We recommend evaluation of serum cortisol level as part of the workup of new onset or worsening hypertension with hypokalemia and metabolic alkalosis, along with serum renin and aldosterone. Such an evaluation is critical, especially in a patient with known small cell lung cancer who presents with this triad.

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# Six Year Old With Chronic Headache: An Unexpected Meningitis Mimic

Jennifer Hadjiev, MD; James McCarthy, MD; Leann Madion, MD; Lileth Mondok, MD

## ABSTRACT

The constellation of fevers accompanied by headache and vomiting is a red flag for clinicians that appropriately triggers evaluation for meningitis and other life-threatening diagnoses. When symptoms persist even after these conditions are ruled out, patient care becomes more challenging. We present the case of a 6-year-old male with a history of autism spectrum disorder who presented with 6 months of headaches and associated vomiting and intermittent fevers with negative infectious workup despite cerebrospinal fluid pleocytosis. Serial neuroimaging and laboratory evaluation ultimately led to a diagnosis of myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) presenting as aseptic meningitis. The clinical and radiographic findings of MOGAD are widely variable and overlap with several other inflammatory conditions, which makes diagnosis challenging. This case highlights the importance of recognizing this rare MOGAD presentation as an infectious meningitis mimic.

## INTRODUCTION

The constellation of fevers accompanied by headache and vomiting is a red flag for clinicians that appropriately triggers evaluation for meningitis and other life-threatening diagnoses. When symptoms persist even after these conditions are ruled out, patient care becomes more challenging. We present the case of a 6-year-old male with a history of autism spectrum disorder who presented with 6 months of headaches and associated vomiting and intermittent fevers with negative infectious workup despite cerebrospinal fluid pleocytosis.

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## CASE PRESENTATION

A 6-year-old male with a history of autism spectrum disorder presented with 6 months of headaches associated with nausea, vomiting, photophobia, phonophobia, and intermittent fevers. Ten days prior, he had been admitted to another institution for 48 hours. At that time, his vitals were normal except for intermittent fevers, and exam was unremarkable except for periods of "irritability." Infectious Disease service was consulted, and he had an extensive workup that was essentially unremarkable except for leukocytosis with a white blood cell count of 34.9 10<sup>3</sup>/uL, elevated

erythrocyte sedimentation rate (30 mm), and cerebrospinal fluid (CSF) pleocytosis (28 total nucleated cells) with an elevated opening pressure of >35 cmH<sub>2</sub>O. Brain magnetic resonance imaging (MRI) was remarkable for increased sulcal enhancement and foci of elevated T2/FLAIR signal within the right and left thalamus, suspicious for meningitis or other leptomeningeal process, although neoplastic process could not be excluded. He was diagnosed with viral meningitis and discharged home after blood and CSF cultures were negative and he demonstrated mild clinical improvement with scheduled outpatient follow-up and repeat brain imaging. Following discharge, his symptoms again worsened with ongoing fevers, headaches, and increasing sleepiness, weakness, and loss of appetite. The family reported no recent travel, trauma, or sick contacts. His immunizations were up-to-date, and he was on no current or recent medications.

On presentation at our institution, the patient was uncomfortable appearing and lying stiffly in bed but answering questions appropriately. He was afebrile with a heart rate of 76 beats per minute, respiratory rate of 16 breaths per minute, and blood pres-

sure of 115/73 mm Hg. He had full range of motion when asked to move his neck, but he held his neck stiffly at rest and cried out in pain with neck flexion and palpation of the abdomen and along the spine. Neurological exam was notable for normal cranial nerves, no ataxia, and a plantar reflex that was up-going on the right and down-going on the left. He could follow commands appropriately for his age.

Repeat serial brain imaging revealed an enlarging left thalamic lesion, meningeal enhancement, and multifocal white matter and subcortical lesions with varying degrees of enhancement (Figure). Lumbar puncture revealed an elevated opening pressure of 45 cm H<sub>2</sub>O, elevated protein at 52 mg/dl, and pleocytosis with 77 total nucleated cells. CSF analysis and serum immunologic studies were negative for viral, bacterial, and fungal infection. No unique oligoclonal bands were present in the CSF. Miscellaneous serum and spinal fluid immunologic studies were pending at the time of admission to the acute care floor. On hospital day 9, serum serology resulted positive for myelin oligodendrocyte glycoprotein (MOG) antibody with a titer of 1:100. He was diagnosed with MOG antibody-associated disease (MOGAD).

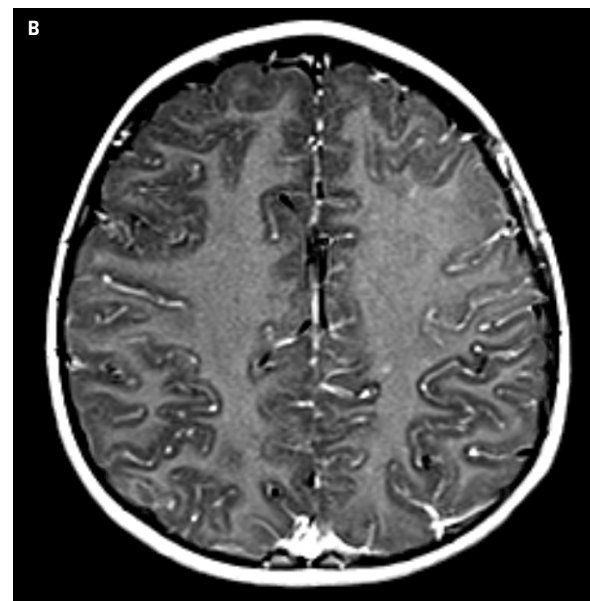
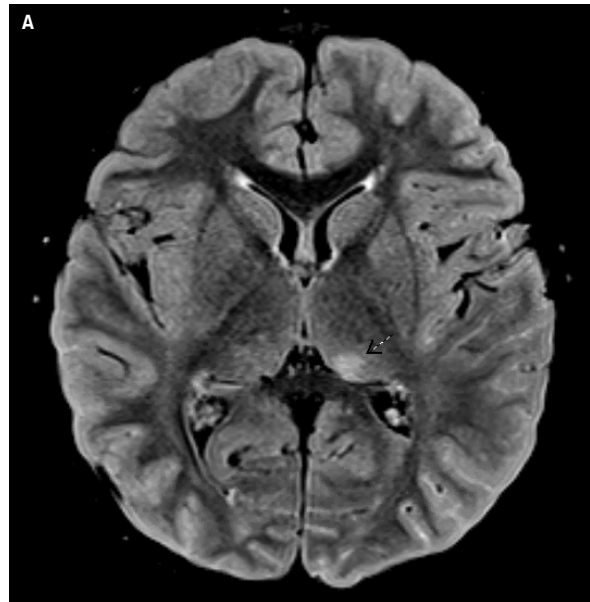
While the patient did not initially have papilledema, it developed on subsequent eye exams, and his headache was thought to be secondary to elevated intracranial pressure and autoimmune meningitis. He was treated with high dose intravenous (IV) methylprednisolone (30 mg/kg) for 5 days followed by a prolonged steroid taper and started acetazolamide for his increased intracranial pressure. He responded well to treatment with steady improvement in his symptoms. His last brain MRI and orbit 3 months posttreatment showed near complete resolution of previously seen lesions and leptomeningeal enhancement. Repeat serum MOG antibody testing 3 months posttreatment continued to be positive, but repeat testing at 10 months posttreatment was negative.

## DISCUSSION

This patient's constellation of chronic headache and systemic symptoms, including fevers, decreased appetite, and increased sleepiness, fits the pattern of aseptic or chronic meningitis. Viruses—particularly enterovirus—are the most common infectious cause of chronic meningitis; however, it can also be seen in Lyme disease, tuberculosis, and cryptococcosis. Autoimmune diseases, such as rheumatoid arthritis, lupus, and sarcoidosis, are also possible. The leptomeningeal enhancement seen on MRI can be found in cases of acute disseminated encephalomyelitis (ADEM) and other demyelinating syndromes. Neoplastic meningitis—either related to solid cancer metastasis, lymphoma, or leukemia—and drug-induced aseptic meningitis are also possible but are less likely given this patient's imaging results and history.

MOGAD is an acquired neuro-inflammatory demyelinating syndrome that causes inflammation in the brain, spinal cord, and optic nerve. MOGAD includes features of neuromyelitis optica (NMO), multiple sclerosis, optic neuritis, and ADEM.<sup>1,2</sup> The

**Figure.** Magnetic Resonance Brain Axial Images Showing (A) FLAIR Hyperintensity in the Left Thalamus and (B) Diffuse Leptomeningeal Enhancement on T1-Weighted Post-Gadolinium Scan



clinical and radiographic findings can vary among patients and overlap with several of the demyelinating conditions, which can make diagnosis challenging.<sup>2</sup> Typical signs and symptoms can include altered mental status, unilateral or bilateral visual disturbance, extremity weakness or paralysis, loss of sensation, bowel or bladder dysfunction, and seizures. MOGAD can also rarely present as aseptic meningitis, which was first reported in 2019 and has since been cited in a handful of pediatric case reports, as

well as prolonged fever of unknown origin.<sup>1,3</sup> MRI findings can be similar to patients with multiple sclerosis or non-MOGAD, NMO-spectrum disease, and ADEM. Typical CSF findings include pleocytosis (50% of patients), elevated protein (50% of patients), and absent oligoclonal bands (90% of patients).<sup>4,6</sup> MOG is a protein located on the surface of myelin sheaths in the central nervous system. Positive serum antibodies to MOG are a serum biomarker that is specific for MOGAD especially at high titers.<sup>1</sup> It is also recognized that NMDA receptor antibodies may also be positive in some patients with MOG antibodies; therefore anti-NMDA receptor encephalitis should be considered if clinically correlated.<sup>7</sup> ADEM is the most common initial pediatric presentation of MOGAD, occurring in up to almost 70% percent of all MOG-positive cases.<sup>8</sup> Children account for up to 50% percent of reported MOGAD cases with no sex predilection. In adults, the median age of onset is 20 to 30 years of age. Approximately 40% to 50% of individuals may have a relapsing course.<sup>9-11</sup>

### Treatment/Management

The standard of care for acute attacks of MOGAD is a 5-day course of high-dose IV steroids, and in most cases the condition is responsive to therapy. A slow oral steroid taper is also recommended in some instances to reduce the risk of relapse.<sup>10,12</sup> Further treatment depends on clinical response and repeat MRI findings. Second line agents include IV immunoglobulin and plasma exchange, as well as immunosuppressants or immunomodulators for severe or refractory cases.<sup>13,14</sup>

### CONCLUSIONS

MOGAD is a neuroinflammatory disorder that typically leads to CNS demyelination. In addition to common presentations like ADEM, optic neuritis, and transverse myelitis, MOGAD can also present as a meningitis mimic. These rare cases present initially with headaches, fever, and meningismus, CSF pleocytosis and leptomeningeal enhancement on imaging, then progress to have typical demyelinating lesions if left untreated. Recognition of atypical MOGAD presentations is important in order to provide timely treatment.

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# A Unique Case of Coexisting Anaplasmosis and Blastomycosis

Samira Samant, MD; James McCarthy, MD

## ABSTRACT

**Introduction:** In presenting this case of tick-borne illness in a patient with known disseminated blastomycosis, we aim to discuss the clinical reasoning and decision-making process when treating a septic presentation in a complex patient with multiple exposures and risk factors, from identifying and addressing the most devastating differentials to selecting appropriate empiric anti-infective regimens.

**Case Presentation:** We present the case of a 60-year-old male with a medical history of diastolic heart failure, cirrhosis, sarcoidosis, hypertension, splenectomy, and recently diagnosed disseminated blastomycosis, who developed sepsis following a recent tick exposure.

**Discussion:** While a review of the literature revealed a paucity of cases of coexisting fungal and tick-borne illness, each is independently well-studied. Several reported commonalities exist between *Blastomyces* and *Anaplasma*, including endemic regions and at-risk populations.

## INTRODUCTION

Anaplasmosis and blastomycosis are both endemic to the Upper Midwest region of the United States and share a range of overlapping risk factors and clinical features. Anaplasmosis is typically transmitted by *Ixodes* ticks and is associated with wooded areas of the northeastern and north-central states that harbor white-tailed deer. Blastomycosis is a fungal infection often associated with proximity to waterways or forested areas in the Ohio and Mississippi River valleys, as well as the Great Lakes region.<sup>1-3</sup> While both infections are well-described clinical entities that often present with nonspecific findings and febrile illness, there exists a dearth of data regarding the presentation of a co-infection. We

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present a case of a patient with known disseminated blastomycosis who, following a fishing expedition to northern Wisconsin, developed new-onset fevers and underwent further infectious workup.

## CASE PRESENTATION

A 60-year-old male with a history of diastolic heart failure, cirrhosis, sarcoidosis, hypertension, splenectomy, and recently diagnosed disseminated blastomycosis presented with sepsis. In the 2 weeks prior to admission, he had traveled to northern Wisconsin and removed 2 ticks from his right upper extremity. He denied any rashes or other skin changes over the bites

and had been taking itraconazole as prescribed for his blastomycosis.

On presentation, the patient was febrile to 104°F, systolic blood pressure was 80 mmHg, heart rate was 91 beats per minute, and he required supplemental oxygen to maintain appropriate saturations. Computed tomography (CT) of the chest revealed interval improvement in the destructive pulmonary nodules and bilateral opacities related to his blastomycosis and was otherwise unremarkable. Sepsis resolved with fluid resuscitation, and he was initiated on empiric cefepime and vancomycin. Infectious Disease was consulted and recommended adding doxycycline and azithromycin to cover tick-borne illnesses and atypical pneumonia. Following the initiation of doxycycline, he defervesced within 24 hours and did not develop any further fevers during his hospitalization. Vancomycin, cefepime, and azithromycin were discontinued given his response to doxycycline. He also continued on itraconazole to cover for his underlying disseminated blastomycosis.

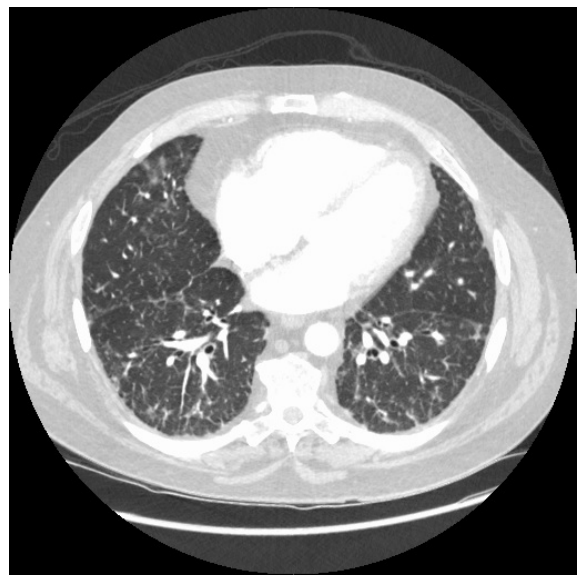
With the patient's rapid response to doxycycline, known tick



**Figure 1.** Computed Tomography of the Chest From Admission With Disseminated Blastomycosis



**Figure 2.** Computed Tomography of the Chest on Second Admission Showing Interval Improvement



bites, 2-week illness incubation period, and gradually rising fever curve, suspicion was high for tick-borne illness. Laboratory evaluation was negative for hemolysis, and no parasitemia was observed on blood smear. Prior to discharge, the removed ticks were brought into the hospital and sent to the lab for further evaluation. Due to his clinical improvement, he was discharged home on itraconazole and doxycycline while his full tick-borne illness panel was still pending. Serum *Anaplasma* polymerase chain reaction testing ultimately resulted as positive, and the patient responded well to a 14-day course of doxycycline.

## DISCUSSION

Patients with known infections who present with fevers offer a diagnostic challenge. This case was further complicated by the patient's recent tick bites, as many tick-borne illnesses share endemic areas, symptoms, and risk factors with fungal infections, such as blastomycosis. *Blastomyces* is endemic to the Midwestern, south-central, and southeastern United States, while *Anaplasma phagocytophilum* is found in northeastern and north-central states.<sup>4-7</sup> Both infections most commonly affect middle-aged and elderly males, such as our patient, and both may present with non-specific findings that make diagnosis a challenge.<sup>5,8</sup>

Patients with anaplasmosis often report a tick bite or exposure 1 to 2 weeks prior to symptom onset and typically present with fevers, myalgias, and headaches.<sup>9</sup> In contrast to ehrlichiosis and Lyme disease, which share a common vector with anaplasmosis, cutaneous manifestations at the site of the tick bite are uncommon.<sup>6</sup> Patients may develop transient leukopenia or thrombocytopenia, although these laboratory changes are variable and not

always present. Blastomycosis, caused by the inhalation of fungal conidia, typically presents with mild flu-like symptoms, although pneumonia and even acute respiratory distress syndrome may develop in severe pulmonary blastomycosis. Disseminated blastomycosis appears most commonly with cutaneous and bony lesions, although other manifestations, such as central nervous system involvement, may develop.<sup>10,11</sup>

Our patient's disease timeline, symptom course, and recent tick bites were highly suspicious for tickborne illnesses—a suspicion compounded by his rapid response to treatment with doxycycline. While disseminated blastomycosis is known to cause fevers and similar presenting symptoms, he endorsed adherence to his antifungal medication, consistent with his reassuring CT findings. In addition, his improving skin lesions and lung imaging made worsening blastomycosis a less likely diagnosis. Although babesiosis was initially a concern given his asplenia, he did not have a clinical or laboratory picture suggestive of hemolysis, and no parasitemia was noted on an urgently processed blood smear. This left us with a high clinical suspicion for Lyme, ehrlichiosis, and anaplasmosis. As the laboratory tests for these conditions may take weeks to return a result, we treated the patient with doxycycline for empiric coverage of tick-borne illnesses. Doxycycline is the first-line treatment for all tick-borne illnesses endemic to the United States. It has a relatively benign side effect profile—making it a low-risk but effective treatment option—and was confirmed with pharmacy to not interact with itraconazole.<sup>6</sup>

Our patient demonstrated a robust response to doxycycline initiation, defervescing within 24 hours with no further febrile

episodes. In most cases, symptoms tend to improve rapidly following doxycycline administration.<sup>6</sup> In cases such as this, in which the response to therapy is a temporary confirmation of the diagnosis until laboratory results are available, the duration of antibiotic therapy can be determined after the diagnosis is made and response assessed.<sup>6</sup>

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# Follmann Balanitis: An Unusual Case of Syphilis

Milan Patel; Paige Gioia, PA; Pinky Jha, MD

## ABSTRACT

A 33-year-old man presented with suprapubic abdominal pain and small vesicular lesions on the foreskin of the penis. Based on the presentation, he was empirically treated for genital herpes, although the herpes simplex virus swab was negative. He returned to the emergency department 4 months after his initial presentation with worsening symptoms that were consistent with balanoposthitis and cystitis. He was tachycardic and febrile on presentation. He denied any sexual contact for the last 3 months, with previous negative screening tests for sexually transmitted infections. Syphilis was eventually diagnosed during this admission. The incidence rates of syphilis have increased in recent years, and the infection is often undiagnosed given atypical manifestations. Here we present an atypical manifestation of syphilis that was initially misdiagnosed as herpes simplex virus.

## INTRODUCTION

*Treponema pallidum* is a sexually transmitted infection that has been on the rise in the United States and internationally.<sup>1</sup> In the United States, men who have sex with men have the highest infection rates.<sup>2</sup> Minority women also tend to experience high infection rates, and internationally, there has been a concerted effort to improve testing and screening in low- and middle-income countries.<sup>3</sup> With the increased incidence worldwide, greater vigilance is needed for atypical presentations of syphilis.

## CASE PRESENTATION

A 33-year-old heterosexual man with past medical history of gastroesophageal reflux disease and herpes simplex virus (HSV) infection presented to the emergency department (ED) in

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August 2022 with suprapubic abdominal pain and small painful lesions on his foreskin for the last day. He reported that the pain was worse with movement and palpation but relieved with rest. He stated that he was last tested for a sexually transmitted infection (STI) in August 2018 owing to concerns about penile discharge, but test results were negative at that time. On physical examination, he was found to have small, painful linear lesions on the foreskin of his penis. The lesions were swabbed for HSV, and he was discharged

home with prescriptions for lidocaine 2% jelly, meloxicam 7.5 mg, and valacyclovir 1000 mg.

The patient saw his primary care clinician for follow-up 1 month later because the lesions were not improving. He stated that his pain was under control, but he was having persistent erythematous lesions with purulent discharge on his penis that would emerge and then scab over. He denied any hematuria, dysuria, fevers, or scrotal pain. His prescription for valacyclovir was continued at 1 g 3 times daily for 10 days followed by a suppressive course of 500 mg daily.

Three months later, after he was seen by his primary care clinician, the patient presented to the ED with signs of sepsis. He reported worsening abdominal pain, nausea, vomiting, fever, progressive penile lesions, and dysuria. He was febrile and tachycardic on presentation. Initial physical examination revealed edema, erythema, and purulent erosive lesions on the glans penis. Lymph nodes were not palpable, and no other cutaneous lesions were present. He was diagnosed with cystitis and balanoposthitis.

Admission laboratory results revealed mild leukocytosis of  $11.3 \times 10^3/\mu\text{L}$  (reference 3.9-11.2  $\times 10^3/\mu\text{L}$ ) with 89% neutrophils (reference 43%-74%) and 6% lymphocytes (reference 17%-46%). His urinalysis showed elevated leukocyte esterase and

white blood cell count and the presence of bacteria. On computed tomography (CT) of the abdomen and pelvis with contrast, he was found to have prominent bilateral inguinal lymph nodes. While in the ED, he underwent tests for STIs and urinary tract infection. These included urine cultures that were positive for *Streptococcus pyogenes* and *Streptococcus agalactiae*, negative urine nucleic acid amplification test for *Chlamydia trachomatis*/*Neisseria gonorrhoeae*, and negative serologic tests for HIV-1 and HIV-2 antibodies.

The patient was admitted and empirically treated with fluids, ceftriaxone 2 g in 0.9% NaCl intravenously, and 1 dose of fluconazole 150 mg orally. He was discharged with prescriptions for augmentin 875 mg twice daily for 7 days and topical clotrimazole cream 1% for 10 days and with discharge instructions to refrain from sexual activity and to follow up with his primary care clinician. After discharge, he was found to have a positive rapid plasma reagin titer of 1:256, as well as positive treponemal IgG and IgM. Furthermore, the lesion cultures taken in the ED showed no bacterial or fungal growth, and blood cultures were negative for growth after 5 days. Upon follow up with his primary care clinician, the patient was successfully treated with weekly penicillin G injections (2.4 million units) for 3 weeks.

## DISCUSSION

Syphilis is an STI caused by the spirochete *Treponema pallidum* (*T pallidum*). Although syphilis typically is characterized as following a progression through primary, secondary, latent, and tertiary stages, its clinical presentation varies greatly. Primary infection generally presents as a painless genital chancre and inguinal lymphadenopathy that occurs after an incubation period of about 21 days. Secondary syphilis generally presents with a maculopapular rash on the palms and soles of the feet, along with condyloma lata that appear as smooth, flat wart-like papular erosions that are white in color in the anogenital region, intertriginous folds, or oral mucosa. Secondary syphilis also can present with a host of other nonspecific systemic symptoms affecting any organ, such as alopecia, polymorphic rash, lymphadenopathy, and malaise. These secondary symptoms occur weeks to months after infection. Latent syphilis refers to a period in which the infection has no clinical symptoms, although the patient remains seropositive. Tertiary syphilis is the chronic clinical stage in which patients present with systemic complications. Some of these manifestations include gummas, which are chronic granulomatous lesions with necrotic ulcerations in the center; Argyll Robertson pupils, in which the pupils accommodate but do not respond to light; neurocognitive symptoms; and tabes dorsalis, which is the progressive demyelination of the dorsal column, leading to deficits in proprioception, tendon reflexes, touch, vibration, and pain sensation. Though classically described as late-stage manifestations, neurological and ocular symptoms can present at any stage of infection.

*Treponema pallidum* is also classically associated with vertical transmission resulting in congenital syphilis in the absence of treatment. Congenital syphilis typically manifests as miscarriage, stillbirth, hydrops fetalis, hepatomegaly, rhinorrhea, rash, or skeletal abnormalities. Later in life, children with congenital syphilis may have frontal bossing, saddle noses, peg teeth, and sensorineural losses.<sup>4</sup>

Syphilis incidence was at a historic low in the early 2000s, but in recent years, there has been a resurgence in its prevalence, with almost 6 million new cases and over 300 000 fetal and neonatal deaths annually worldwide. The majority of new cases are in men who have sex with men and often involve HIV coinfection.<sup>3</sup>

Follmann balanitis is an atypical presentation of primary syphilis that was originally reported in 1948 by Eugene Follmann.<sup>5</sup> It is a rare subtype of primary syphilis, accounting for less than 0.5% of cases,<sup>6</sup> and it is defined as erosive balanitis with lymphadenopathy and positive serology for syphilis.<sup>7</sup> Balanitis is the inflammation of the glans penis, whereas balanoposthitis is the inflammation of the glans penis and the foreskin in uncircumcised males. Skin findings of balanitis also have various presentations, such as edematous erosions or smooth white/pink coalescent papules and plaques.<sup>8</sup> Lymphadenopathy may or may not be present based on the phase of the infection.

Current methods for detection include darkfield microscopy, which allows for direct visualization, and venereal disease laboratory testing or rapid plasma reagent testing, which detects anti-cardiolipin antibodies that can result in false positives.<sup>9</sup> Final confirmatory testing includes the fluorescent treponemal antibody absorption assay (FTA-ABS), which detects serum antibodies specific for *T pallidum*. The most prominent histopathologic finding in the presence of syphilis infection is a perivascular infection resulting in ischemic necrosis of tissues. When these effects are close to nerves, they also can result in the loss of sensation--a hallmark of syphilis infection. This damage occurs despite the lack of exotoxin from *T pallidum*, which seems to indicate that the damage is from the host's own immune system.<sup>10</sup> Serum testing is especially important in the treatment of syphilis, because only about 40% of cases present with typical characteristics.<sup>11</sup> While studies from 1948 suggest that the incidence of balanitis as a manifestation of syphilis is around 0.3% to 0.5%, recent studies suggest that this presentation is much higher though specific values are still unknown.<sup>5,7</sup>

Our case had the classic rare presentation as Follmann balanitis, but it was originally likely misdiagnosed as HSV. The classic triad of Follmann's balanitis is lymphadenopathy, balanitis, and positive serum syphilis test. Our case presented with balanitis, and while the patient was not found to have inguinal lymphadenopathy on examination, CT of the abdomen found reactive nodes. Additionally, similar initial presentation has been confused with HSV in previous cases, thus, syphilis should be included in the dif-



ferential diagnosis when HSV is suspected but not confirmed.<sup>7,12</sup> Fungal and other bacterial causes of balanitis also were considered. Given the negative lesion cultures, the patient being nondiabetic, immunocompetent, and the lack of recent broad-spectrum antibiotic use, primary fungal or other bacterial causes were less likely.

Treatment with 2.4 million units of penicillin G benzathine intramuscularly has been the mainstay of therapy, with physical examination findings resolving after 2 to 4 weeks.<sup>6,7</sup> A single dose is typically sufficient, and increasing dosages does not seem to result in faster clearance; penicillin G benzathine maintains adequate serum concentration for about 3 weeks, and there is generally no resistance.<sup>13,14</sup> Additionally, there does not appear to be improvement with multiple doses for individuals with HIV or those who are immunocompromised.<sup>15,16</sup> Doxycycline/tetracycline, ceftriaxone, and azithromycin are all second-line alternatives with good clinical effectiveness in the treatment of syphilis in those who cannot tolerate penicillin or have concomitant STIs.<sup>17</sup>

The diagnosis of Follmann balanitis is often challenging, even for experienced clinicians, given the resemblance to genital herpes or candida infection. Therefore, it is important to rule out other causative organisms such as *Candida*, HSV, streptococci, and anaerobic infections in patients presenting with genital lesions. If untreated, syphilis can progress to the secondary or tertiary stage, resulting in significant morbidity. This case report highlights an atypical manifestation of primary syphilis that was originally misdiagnosed as HSV. We suggest that clinicians keep syphilis in the differential diagnosis when a patient presents with balanitis or balanoposthitis to enable early intervention in the syphilis course to prevent long-term sequelae of secondary, latent, or tertiary infection and possible congenital spread.

## CONCLUSIONS

Follmann balanitis can be an atypical presentation of primary syphilis. This abnormal presentation can be confused with HSV infection resulting in delays in appropriate care. With increasing incidence of syphilis infection in recent years, clinicians should suspect *T pallidum* infection in cases presenting with balanoposthitis. Early management of syphilis can prevent subsequent health care utilization and long-term sequelae.

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# Use of Intravenous Lipid Emulsion Therapy and Insulin in a Case of Tarka Intoxication

Emrah Gün, MD; Mahmut Çiçek, MD; Mustafa Kafalı, MD; Hüsnü Demir, MD; İlnur Arslan, MD; Tanıl Kendirli, MD

## ABSTRACT

**Introduction:** Tarka (trandolapril/verapamil hydrochloride extended-release) is a fixed-dose combination antihypertensive drug formed from verapamil hydrochloride and trandolapril. Toxicologic manifestations of Tarka overdose are altered mental status, bradycardia, hypotension, atrioventricular block (first-degree), hyperglycemia, metabolic acidosis, and shock.

**Case Presentation:** We report a case of Tarka toxicity in a 2-year-old girl who presented with altered mental status, cardiogenic shock, hypotension, bradycardia, severe metabolic acidosis, hyperglycemia, and first-degree atrioventricular block. We started fluid resuscitation, epinephrine, norepinephrine, and insulin. Because of the patient's hyperlactatemia and hypotension despite standard therapies, we initiated intravenous lipid emulsion (ILE) therapy, after which her condition improved promptly.

**Discussion:** Tarka overdose may be life-threatening as it can cause cardiogenic shock. In our patient, the regression of lactate elevation in a short time with ILE therapy and the improvement of her general condition highlight the importance of ILE.

**Conclusions:** ILE is an alternative treatment method for acute lipophilic drug intoxications, such as Tarka.

respectively).<sup>2</sup> Compared with monotherapy, fixed-dose combination products have many benefits and are more efficacious when combined versus than the sum of individual drugs.<sup>3</sup> Combined drug preparations also reduce noncompliance by 24% to 26% versus taking both drugs separately.<sup>3</sup>

The toxicologic manifestations of Tarka overdose are lethargy, dizziness, fatigue, headache, constipation, chest pain, cough, altered mental status, bradycardia, hypotension, atrioventricular (AV) block (first-degree), hyperglycemia, metabolic acidosis, and shock.<sup>4</sup> Verapamil is responsible for most of the adverse effects.<sup>4</sup> There are a few case reports about Tarka overdose in adults and children in the literature, as well as a few recent reports of intravenous

lipid emulsion (ILE) use in verapamil poisoning in children.<sup>4</sup>

We present the case of a 2-year-old girl who developed altered mental status, hypotension, bradycardia, first-degree AV block, hyperglycemia, metabolic acidosis, and shock and was subsequently treated successfully with ILE and insulin therapy. To our knowledge, there is no previous report in the literature regarding ILE therapy after a Tarka overdose.

## INTRODUCTION

Fixed-dose combination drugs are becoming more common in the treatment of essential hypertension.<sup>1</sup> There are more than 20 combination products available.<sup>2</sup> Tarka is a fixed-dose combination antihypertensive drug formed from verapamil hydrochloride and trandolapril (ranging from 180-240 mg and 1-4 mg,

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## CASE PRESENTATION

A 2-year-old girl presented to the pediatric emergency department (ED) due to altered mental status after taking 2 tablets of Tarka (240 mg verapamil, 4 mg trandolapril). She was given 1 g/kg activated charcoal and 20 cc/kg normal saline followed by gastric lavage. There was no known disease in her past medical history.

On examination, the patient's Glasgow Coma Scale score was 9-10, capillary refill time was >3 seconds. Electrocardiography

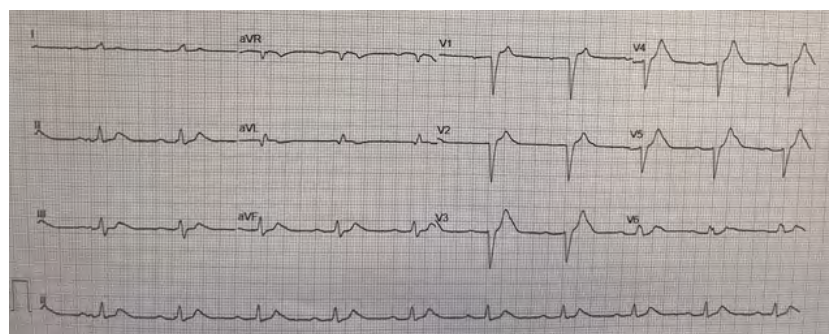
showed first-degree AV block (Figure). Venous blood gas was pH 7.08, PaCO<sub>2</sub> 44.8 mmHg, HCO<sub>3</sub> 11.8 mmol/L, lactate 9.0 mmol/L, and blood glucose 647 mg/dL. Her white blood cell count was 22.7×10<sup>3</sup>/μL, total neutrophil count was 17.8×10<sup>3</sup>/μL, hemoglobin was 8.7 g/dL, hematocrit was 29.2%, platelet count was 494×10<sup>3</sup>/μL, aspartate aminotransferase was 30 IU/L, alanine aminotransferase was 15 IU/L, urea was 35 mg/dL, creatinine was 0.82 mg/dL, sodium was 131 mmol/L, potassium was 4 mmol/L, chlorine 102 mmol/L, calcium was 8.4 mg/dL, and the C-reactive protein was 3.2 mg/dL. She had hypotension, bradycardia, and hyperglycemia.

On admission to the pediatric intensive care unit (PICU), the patient's vital signs were as follows: heart rate 60 beats per minute, blood pressure 40/20 mm Hg, respiratory rate 40 breaths per minute, body temperature 36.8°C, and oxygen saturation 97% in the non-rebreather mask.

A central venous catheter was inserted into the right internal jugular vein, and 150 cc/kg fluid therapy, epinephrine, norepinephrine, and insulin (0.1 U/kg/h) were started. Inotrope doses were increased to provide normal blood pressure values. Complete blood cell count, liver and renal function tests, serum electrolytes, and coagulation parameters were normal. The follow-up venous gas still showed metabolic acidosis and hyperlactatemia, despite vasopressor and intravenous fluid therapy; therefore, we decided to start ILE therapy. ILE was given as a 1.5 mL/kg (during 5 minutes) and 0.25 mL/kg/min infusion (during 60 minutes). After the ILE therapy, there was significant improvement in the patient's metabolic acidosis (7.08 to 7.40), a significant decrease in lactate (9.9 to 3), and a significant increase in blood pressure values and Glasgow Coma Scale scores (10-13).

The patient was hyperglycemic and had mild metabolic acidosis on admission. Insulin treatment was continued due to hyperglycemia. Acidosis regressed at the 24th hour of admission and insulin treatment was discontinued but had to be restarted 1 hour later as she became hyperglycemic.

**Figure.** First-Degree Atrioventricular Block on Electrocardiography (25 mm/s, 10 mm/mV) of the Patient Before Intravenous Lipid Emulsion Therapy



**Table 1.** Laboratory Results and Treatment Timeline

Time (hour)	pH	PaCO <sub>2</sub> mmHg	HCO <sub>3</sub> mmol/L	Lactate mmol/L	Glucose mg/dL	Insulin U/kg(h)	BP S/D	NE	E	ILE Therapy
Admission	7.14	32.5	11.9	9.9	253		40/20		0.1	**
1	7.40	16	13.7	3.2	243	0.1	67/31	0.1	0.3	
2	7.17	50	15.8	3.5	385	0.1	73/32	0.1	0.3	
7	7.25	45.2	18.1	1.9	399	0.1	80/34	0.1	0.3	
12	7.34	24.9	16	2.9	284	0.1	82/35	0.1	0.3	
18	7.37	30.9	19.3	2.0	176	0.1	77/39	0.1	0.3	
24	7.36	29	18.3	1.9	147	<sup>a</sup>	75/59	0.05	0.2	
36	7.46	33	25	2.9	145	stopped	80/44	off	0.2	
60	7.45	36	25	0.8	95		90/50		off	

Abbreviations: BP, blood pressure; S, systolic; D, diastolic; NE, norepinephrine (mcg/kg/min); E, epinephrine; ILE, intravenous lipid emulsion; U, unit.

<sup>a</sup>One hour after the patient's insulin was discontinued, it was started again after she became hyperglycemic. <sup>b</sup>1.5 mL/kg (within 5 min) and 0.25 mL/kg/min infusion (60 min).

**Table 2.** Timeline of Laboratory Results

Time (hour)	Leukocyte Count	Hemoglobin	Platelet Count	Sodium	Potassium	Urea	Creatinine	ALT	AST	CRP
Admission	22.7	8.7	494 000	131	4	35	0.82	15	30	3.2
6	29.3	13.5	546 000	127	<sup>a</sup>	48	0.69	36	58	6.5
24	41.4	8.2	422 000	138	4.11	48	0.38	26	50	10.4
48	26.7	8	384 000	138	3.37	13	0.25	30	41	4.6
60	16.3	7.9	282 000							

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; CRP, C-reactive protein. <sup>a</sup>Hemolysis.

Echocardiography showed the patient's ejection fraction was 60% while receiving inotrope treatment. Within the 1st hour of admission, a calcium gluconate (1 cc/kg) infusion was started, after which she vomited. Glucagon was not started due to her high blood glucose. Her hypotension and bradycardia regressed at the 4th hour of admission, as did her AV first-degree AV block. Inotrope doses were gradually reduced after the 24th hour of hospitalization. Insulin treatment was stopped at 36 hours, and inotrope treatment was stopped at 60 hours. On the 4th day

of admission, she was discharged. See Tables for vital and laboratory signs and treatment.

## DISCUSSION

Tarka is an oral, fixed-dose combination therapy consisting of the long-acting lipophilic angiotensin-converting enzyme (ACE) inhibitor trandolapril and sustained-release calcium channel antagonist verapamil.<sup>5-7</sup> Tarka is indicated for the treatment of essential hypertension in patients who need more than monotherapy to control normal blood pressure.<sup>6</sup> Trandolapril decreases vasopressor activity and aldosterone release and inhibits the conversion of angiotensin I to angiotensin II.<sup>6</sup> By contrast, verapamil leads to dilatation of peripheral vessels and coronary vasculature and so diminishes systemic vascular resistance and blood pressure by blocking the influx of calcium ions via L-type calcium channels.<sup>6,7</sup>

The clinical manifestations of trandolapril intoxication are hypotension, bradycardia, lethargy, fatigue, altered mental status, and severe angioedema.<sup>2,4</sup> Treatment of trandolapril intoxication includes fluid resuscitation and vasopressors.<sup>8</sup> Naloxone may be used in ACE I– induced hypotension.<sup>8</sup>

The clinical features of verapamil intoxication are hypotension, cardiac rhythm disturbances ranging from sinus bradycardia to complete heart block and asystole, hyperglycemia, metabolic acidosis, shock, hypokalemia, renal failure, seizure, stroke, non-cardiogenic pulmonary edema, and acute respiratory distress syndrome.<sup>2,4,9</sup> In verapamil intoxication, heart failure due to decreased myocardial contractility or complete heart block is a possible mechanism leading to death.<sup>2</sup> Treatment of verapamil intoxication includes glucagon, calcium, hyperinsulinemia/euglycemia therapy (HIET), and vasopressors.<sup>8,9</sup>

There are no data available on the use of Tarka in children.<sup>6</sup> There is, however, an existing case report involving Tarka overdose in a child.<sup>2</sup> Dogan et al reported a 3.5-year-old girl who presented with hypotension and bradycardia. A temporary pacemaker was implanted due to a complete AV block in the patient.<sup>2</sup> Cohen et al reported the case of a 60-year-old man who presented with hypotension and bradycardia due to a Tarka overdose.<sup>8</sup> Our patient presented with altered mental status, cardiogenic shock, hypotension, bradycardia, severe metabolic acidosis, hyperglycemia, and first-degree AV block. She was started on fluid resuscitation, epinephrine, norepinephrine, and insulin. After the lipid treatment, her general condition, hyperlactatemia, and hypotension improved.

What makes our case interesting is the clinical improvement achieved with ILE, demonstrating that toxicity from lipophilic drugs such as trandolapril and verapamil can be treated successfully with ILE.<sup>10</sup> It has been reported in the literature that ILE treatment also has been used to treat toxicity of local anesthetics,  $\beta$ -blockers, cocaine, lamotrigine, butyrophenones, diphenhydramine, olanzapine, amitriptyline, and atypical antipsychotics.<sup>10</sup> The effectiveness of ILE may be explained by two theories. The first is that it causes a “lipid sink” for toxic, lipophilic drugs, dra-

matically keeping toxic and lipophilic drugs out of the periphery.<sup>10</sup> Thus, the distribution of lipophilic drugs is reduced by ILE treatment.<sup>10</sup> The second theory is that ILE prevents myocardial inhibition because it provides a high concentration of myocardial substrate.<sup>10</sup>

## CONCLUSIONS

Tarka overdose may be life-threatening as it can cause cardiogenic shock. ILE is an alternative treatment method for acute lipophilic drug toxicity, such as Tarka. In our patient, the rapid regression of lactate elevation with ILE therapy and the improvement of her general condition highlight the importance of this treatment.

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Joseph E. Kerschner, MD



Olushola L. Akinshemoyin Vaughn, MD

## Piloting Skin Cancer Screenings to Prioritize Communities of Color

Joseph E. Kerschner, MD; Olushola L. Akinshemoyin Vaughn, MD

For the past 3 years, the Medical College of Wisconsin's Department of Dermatology has made successful inroads to address a troubling public health disparity noted by the American Academy of Dermatology (AAD) in the first 30 years of its SPOTme Skin Cancer Screening Program (1985-2014): **that 90.3% of the patients screened were White.** During those 3 decades, this free program served more than 1.9 million individuals nationwide and uncovered greater than 20,000 melanomas.<sup>1</sup>

**Clearly, patients of color have not benefited from this important, far-reaching skin cancer screening initiative.**

The AAD's website on skin cancer notes a number of sobering statistics:<sup>2</sup>

- Skin cancer is the most common cancer in the US.
- Current estimates are that 1 in 5 Americans will develop skin cancer in their lifetime.
- Skin cancer in patients with darker skin tones is often diagnosed in its later stages – when it is more difficult to treat.
- Research has shown that patients with darker skin tones are less likely than

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patients with lighter skin tones to survive melanoma.

- Twenty-one percent of melanoma cases in African American patients are diagnosed when the cancer has spread to nearby

importance of raising awareness of skin conditions, especially via skin cancer screenings for people of color – as well as the value of community partnerships to further this goal.

To that end, on Saturday, February 17, 2024,

*While there is still much work that needs to be done to re-engage patients of color and to rebuild trust in our academic institutions, in dermatology and in all specialties, we can signal our good intent through allyship and a willingness to meet patients where they are so that they can feel comfortable.*

lymph nodes, while 16% are diagnosed when the cancer has spread to distant lymph nodes and other organs.

- The vast majority of skin cancer deaths are from melanoma.

According to the University of Texas's MD Anderson Cancer Center, skin cancer in people of color tends to show up in places that are less exposed to the sun, such as the inside of the mouth, palms, groin area, and under the nails. Between 30% and 40% of cases appear on the soles of feet.<sup>3</sup>

Another challenge in treating skin cancer in people of color is that they are less represented in clinical trials that are identifying new treatment.

Olushola Akinshemoyin Vaughn, MD, assistant professor of dermatology at the Medical College of Wisconsin (MCW), understands the

faculty screeners, residents, and other health care providers from the MCW Department of Dermatology and the Froedtert & the Medical College of Wisconsin health network, as well as MCW medical students, successfully participated in the third annual Skin, Hair, and Nails Educational Event in collaboration with Gee's Clippers, located at 2200 N Dr Martin Luther King Jr Drive in Milwaukee (known as the "Barber to the Bucks"), to prioritize educating patients of color about dermatology and to demonstrate MCW's ongoing commitment to the Milwaukee community.

The screening form removed questions such as "How many blistering sunburns did you have prior to age 20?" Rather, it focused on conditions such as atopic dermatitis, dyspigmentation, alopecia, and melanoma – which are more likely to resonate in communities of

color. The MCW care team handed out flyers in both English and Spanish and included a representative on site from MCW's Saturday Clinic for the Uninsured<sup>4</sup> so that patients without insurance could schedule follow-up visits.

More than 30 people – both adults and kids – were screened at the February event, which uncovered skin diseases across the spectrum of severity. In the past 3 years of the event, approximately 150 individuals have been screened, and several skin cancers, assorted infections, irreversible hair loss, and more have been detected.

The Gee's Clippers events give people in the Milwaukee community a chance to see that doctors are not the enemy. "We are showing up for the community because we care so much about our community members, in the hope that they will start to have more trust in the medical system and engage with the medical system more," Dr. Vaughn said.

Gaulien Smith, owner of Gee's Clippers, says that these annual events are a perfect fit for his barbershop, which has long focused on being a community hub and serves a majority Black clientele. His barbers work with hair and skin all day long, and the events are a chance for even them to learn more about what signs to look out for and how to encourage people to seek medical help.<sup>5</sup>

While there is still much work that needs to be done to re-engage patients of color and

to rebuild trust in our academic institutions,<sup>6</sup> in dermatology and in all specialties we can signal our good intent through allyship and a willingness to meet patients where they are so that they can feel comfortable.

Gee's barbershop itself is located in a beautifully renovated bank building, complete with the original steel vault door and a full basketball court. A remodeled room in the back houses Gee's MKE Wellness Clinic – a health clinic collaboration with Network Health and Froedtert & the Medical College of Wisconsin (<https://www.geesclippers.com/gees-medical-clinic>). This weekly clinic offers free clinical services, such as blood pressure screening, blood glucose monitoring, and general health education. Additionally, the clinic provides health coaching in drug education, weight management, nutrition, exercise, tobacco cessation, sleep and stress, and connects clients to wellness resources.

We are very grateful to Dr Vaughn and her team for their inspiring piloting work to educate patients of color about dermatology and to demonstrate MCW's ongoing commitment to the Milwaukee community – and for their creative partnership with Gee's Clippers to sponsor this valuable annual skin cancer screening event. Ultimately, the goal is for MCW to model this new paradigm for screening events that will be emulated nationwide

and adopted through the American Academy of Dermatology.

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