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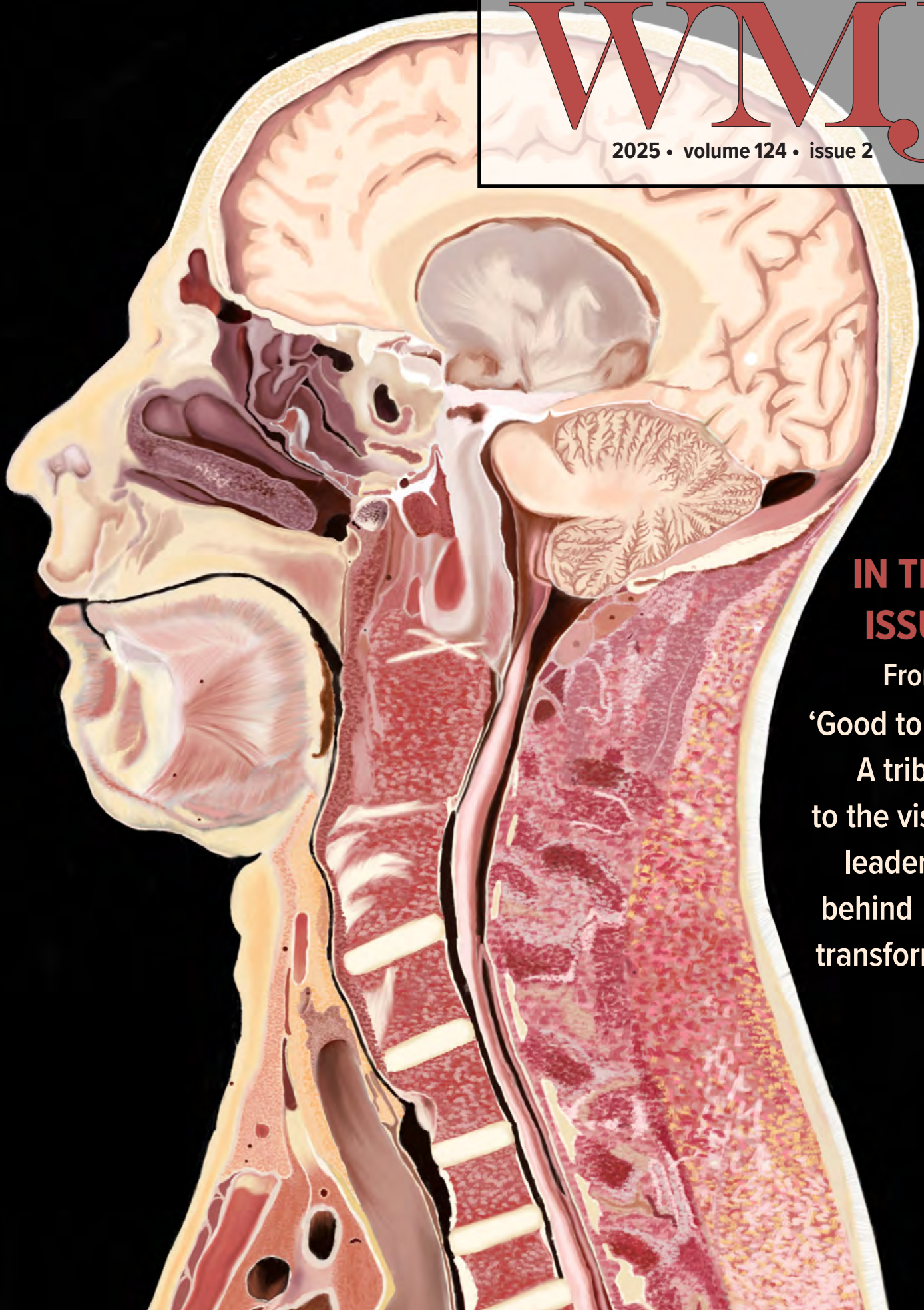
WMJ

2025 • volume 124 • issue 2



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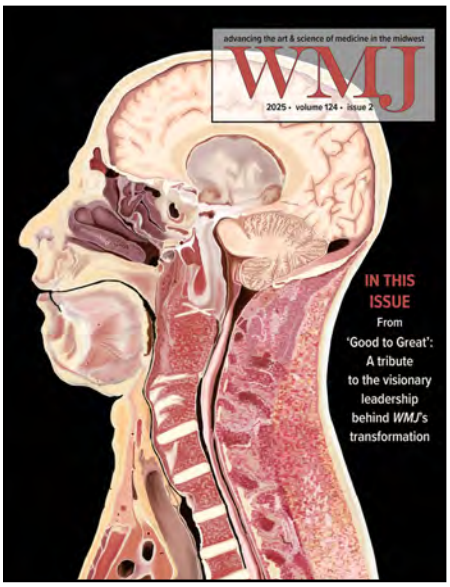

Volume 124 • Issue 2 • 2024

WMJ

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COVER ART

Intrinsic Beauty

Miller Habib

Digital Illustration on iPad

Artist Statement:

With my piece "Intrinsic Beauty," I aim to uncover the artistry woven into the human body. Created digitally on an iPad, this illustration explores anatomy as a vibrant tapestry. From the delicate folds of the brain to the mediastinum at the heart of the thorax, my work celebrates the seamless coordination that sustains life. Through vibrant colors and anatomical precision, I invite viewers to see the human form not only as a biological machine, but as a masterpiece of natural design.

See page 86 for information about the artist.

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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.

EDITORIAL

FE.ATURE

ORIGINAL RESEARCH

The *WMJ* (ISSN 1098-1861) is published by the Medical College of Wisconsin and the University of Wisconsin School of Medicine and Public Health and is devoted to the interests of the medical profession and health care in the Midwest. The managing editor is responsible for overseeing the production, business operation and contents of the *WMJ.* The editorial board, chaired by the medical editor, solicits and peer reviews all scientific articles; it does not screen public health, socioeconomic, or organizational articles. All articles and artwork published herein, including commentaries, letters to the editor, and editorials represent the views of the authors, for which neither *WMJ* nor the publisher take responsibility, unless clearly stated. Advertising content is the responsibility of the advertiser and does not imply an endorsement or sponsorship by *WMJ* or the publsiher and its affiliates unless specified. *WMJ* is indexed in Index Medicus, Hospital Literature Index, and Cambridge Scientific Abstracts.

Submit manuscripts at www.wmjonline.org.

Address all correspondence to: University of Wisconsin School of Medicine and Public Health, Attn: *WMJ* Editor, Health Sciences Learning Center, 750 Highland Ave, Madison, WI 537055; e-mail: wmj@med.wisc.edu

ISSN 1098-1861 • Established 1903

Published 6 times a year, beginning in April

Unequal Access to Sun Protection: Disparities in Sunscreen Availability in Wisconsin

To the Editor:

Skin cancer, including basal cell carcinoma, squamous cell carcinoma, and melanoma, is the most common form of cancer in the United States.[1] Fortunately, effective sun protection can reduce the risk--especially for melanoma, the deadliest type.[1] In Wisconsin, rural residents make up 26% of the population and are particularly vulnerable to sun damage, especially those in high-risk occupations like farming.[1-3] Despite this heightened risk, sunscreen use remains suboptimal in rural communities.[2,3]

Rural communities often struggle with sunscreen accessibility due to barriers in education, diagnosis, and socioeconomic status.[2] Our research aimed to quantify these disparities by evaluating sunscreen availability, affordability, and geographic accessibility in urban and rural Wisconsin counties.

We surveyed sunscreen products online from Banana Boat, Neutrogena, CeraVe, and Cetaphil at Walmart, Target, Walgreens, and CVS in 9 urban and rural counties in Wisconsin (Figure).[4] Product availability and price per fluid ounce were compared. Geographic accessibility was assessed by measuring the distance from each retailer to the nearest city center. Data analysis included the Mann-Whitney U test and Shapiro-Wilk normality test.

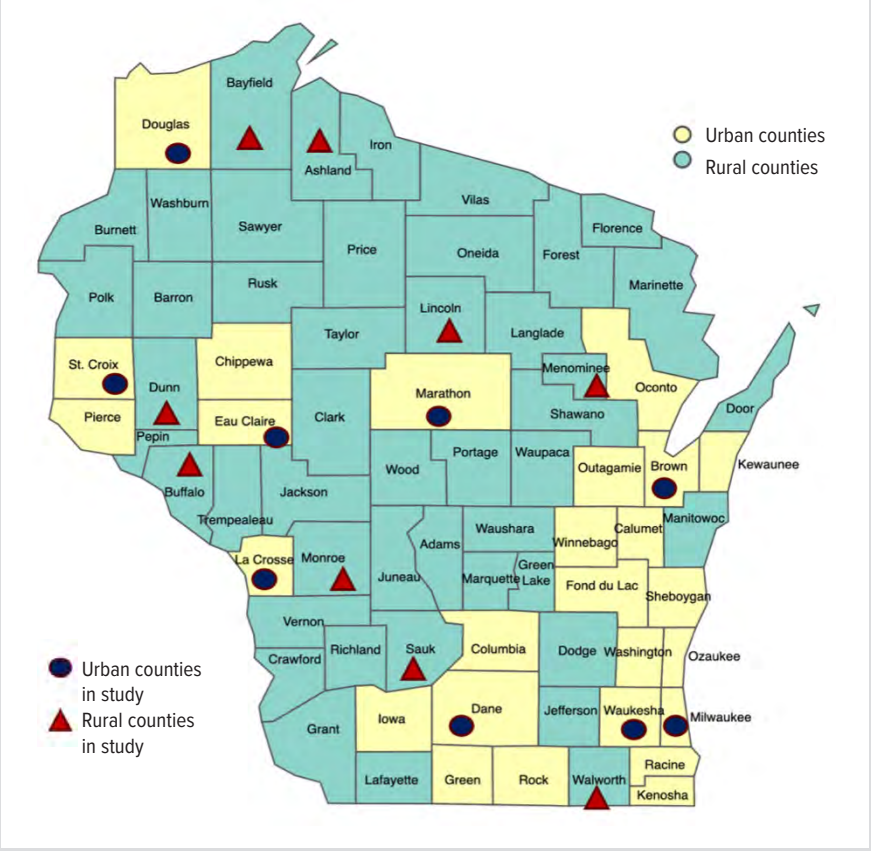
Results show significant disparities in sunscreen availability between urban and rural locations (Table). Urban retailers stocked 288 out of 413 surveyed products, while rural retailers offered fewer options (eg, Sauk County: 19 products vs Dane County: 40 products, 47.5% of urban selection). Menominee, Buffalo, and Bayfield counties had no sunscreen products due to the absence of retail stores. Walmart carried the greatest number of overall products, while CVS carried the fewest. This coincides with geographic accessibility as CVS showed the largest disparity (7 urban stores vs 1 rural store). The average cost per fluid ounce of sunscreen was similar in urban ($5.70) and rural ($5.32) areas ($P = 0.598$). However, rural residents had a lower median household income ($68,699) compared to urban ($80,622), limiting their purchasing power and furthering disparities.[5] Rural counties

Table 1. Comparison of Product Availability, Pricing, and Socioeconomic Factors Across Select Rural and Urban Wisconsin Counties[5]

Setting	County	Product Availability	Price per Ounce	Distance (miles)	Income
Rural	Ashland	21	$5.28	35.08	$57,645
Rural	Monroe	16	$4.51	13.75	$68,213
Rural	Walworth	27	$5.64	9.2	$77,359
Rural	Buffalo	0	NA	25.3	$68,722
Rural	Dunn	24	$5.76	10.03	$71,785
Rural	Lincoln	18	$5.46	18.78	$67,726
Rural	Sauk	19	$4.49	9.13	$77,648
Rural	Menominee	0	NA	40.18	$59,528
Rural	Bayfield	0	NA	42.15	$69,609
Urban	Eau Claire	39	$5.72	3.63	$71,834
Urban	Lacrosse	26	$5.16	5.08	$70,704
Urban	Milwaukee	31	$5.65	6	$62,118
Urban	Waukesha	39	$5.90	2.25	$104,100
Urban	St. Croix	30	$5.39	2.25	$102,482
Urban	Dane	40	$6.18	1.65	$88,108
Urban	Marathon	33	5.63	12.6	$761,185
Urban	Brown	28	$5.72	3.4	$77,490
Urban	Douglas	22	$5.76	12.35	$72,579

Summary of product availability, average price per fluid ounce, distance from the city center to retail store in mile, and median household income per county. Counties are categorized into 2 county settings: urban and rural.

Figure 1. Visualization of Urban and Rural Counties in Wisconsin



averaged 22.62 miles to a large retailer, compared to 5.44 miles in urban counties, increasing travel burdens.

Limited product availability, diminished income, and greater travel distances impede sun protection efforts among rural populations. Addressing these disparities include policy initiatives to enhance product accessibility, incentivize retailer participation, and raise awareness about the importance and proper application of sunscreen.

Limitations include variations of online versus in-store pricing, exclusion of small retailers, and cross-sectional nature of data collection. Future research includes expanding to other states and monitoring product availability and pricing throughout all seasons.

—Simran Kaur, MD; Eva M. Shelton, MD; Alexa Figueroa Baiges, BS; Janmesh D. Patel, BS; Yaohui Gloria Xu, MD, PhD

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Financial Disclosures: None declared.

Funding/Support: None declared.

Hidden Bias in EMR Flagging Systems: A Call for Standardization

To the Editor:

Yass et al's article[1] on electronic medical record (EMR) flagging and its association with patient demographics and psychiatric medication use in a recent issue of *WMJ* is intriguing. It found that Black male patients and those prescribed psychotropic medications were more likely to receive "vulnerable/unsafe behavior" flags. This study sheds light on a critical yet underexplored intersection of hospital safety protocols and structural bias. When EMR flagging is not standardized and routinely audited, it may reinforce stigma, particularly disproportionately affecting marginalized populations and resulting in unequal care delivery.

Another study revealed that hospitalized patients from minoritized racial and ethnic groups (eg, Black, Hispanic, and others) had significantly lower levels of EMR engagement compared to White patients at 2 academic medical centers.[2] Clinicians were less likely to perform key EMR actions—such as pending notes, reviewing problem lists, medication records, and scanning barcodes—for these patients, even after adjusting for demographic, socioeconomic, and clinical variables.[2] The presence of stigmatizing language in EMRs can influence the perceptions and prescribing behaviors of resident physicians.[3] It has been associated with more negative attitudes toward patients and less aggressive pain management, highlighting an important yet often overlooked means of bias transmission between clinicians.[3]

Artificial intelligence (AI) has the potential to implement transparent and standardized flagging protocols in EMRs to audit flag use, identify patterns of inequity, and establish real-time feedback mechanisms that alert clinical teams to potential bias.[4,5] This is both a clinical necessity and an ethical responsibility in efforts to reduce health care disparities. Emerging AI applications – particularly those using natural language processing – can be integrated to detect stigmatizing language within clinical documentation and notify clinicians and administrators to help ensure unbiased records.[5] Such interventions may raise awareness of how implicit bias influences communication and contribute meaningfully to advancing equitable care for diverse patient populations.

—Farzana Hoque, MD, MRCP

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Financial Disclosures: None declared.

Funding/Support: None declared.

Fahad Aziz, MD, FASN

Prescribing Hope: A Missing Vital Sign in Modern Medicine

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

In the clean hallways of today's health care—where machines beep, protocols lead the way, and outcomes measures take center stage, we sometimes forget about a powerful element that significantly affects healing: hope. It's important to acknowledge that hope isn't just a gentle feeling or a poetic afterthought. It is a clinically significant force – observable in our body's responses, evident in our actions, and essential in the relationship between clinicians and patients.

Hope isn't the same as being naïve. It doesn't promise miraculous outcomes. Instead, it's a way of expressing truth that opens the door to possibilities. It empowers a patient to inquire, "What's next?" instead of "Is it over?" For those facing life-altering diagnoses, hope often becomes their most lasting source of strength.

Dr Edward Livingston Trudeau was told he was going to die from tuberculosis (TB). But instead of giving up, he moved to the mountains, felt a little better, and decided to help others like him. He built the first TB sanitarium in the US – not because he had all the answers, but because he believed in the power of care, fresh air, and hope. His illness became the reason he gave others a chance to live.

Years later, during the darkest days of the COVID-19 pandemic, Joseph Varon, MD, was photographed doing something rare: hugging a patient. The man had been in isolation for days, overwhelmed with fear and loneliness. Dressed in full personal protective equipment – mask, gown, gloves, face shield – Dr Varon wrapped his arms around the man as he wept.

> ...healing is not only about medicine—it's about being seen, being comforted, being human, and being hopeful.

There was no miracle drug in that moment. No significant clinical breakthrough. Just a doctor showing up with presence and compassion. It wasn't part of a treatment protocol, but it was exactly what the patient needed. In the middle of machines, alarms, and uncertainty, that simple hug reminded everyone watching that healing is not only about medicine – it's about being seen, being comforted, being human, and being hopeful.

The Neuroscience of Hope

Recent findings in neurobiology back up what doctors have always sensed: hope is rooted in our biology. Functional magnetic resonance imaging studies show that people who are hopeful engage their prefrontal cortex—the area of the brain responsible for planning and problem-solving – more actively than those who feel hopeless. Furthermore, the excitement that hope brings triggers dopamine release in the mesolimbic system, boosting motivation and the drive to achieve goals.[1,2]

Hope not only brightens our mood; it also impacts the hypothalamic-pituitary-adrenal axis, resulting in lower stress-related cortisol levels and boosting immune markers. These physiological changes are essential for defending against inflammation and infection, common hurdles in chronic illness.[3] This shows us that hope isn't just a mental state but actively influences physical well-being.

Hope in Chronic Illness: A Psychological Anchor

Chronic illness doesn't just damage the body—it shakes a person's sense of self, purpose, and emotional stability. For patients on dialysis,

Author Affiliations: Dr Aziz is *WMJ* editor in chief; associate professor, Department of Medicine, and director, Nephrology Fellowship Program, University of Wisconsin School of Medicine and Public Health (UWSMPH), Madison, Wisconsin.

on chemotherapy, or living with autoimmune disease, the struggle goes beyond physical symptoms. They often face deep fear, grief, and uncertainty.

In these moments, hope becomes essential. I once had a kidney transplant recipient tell me, "I need my kidney numbers to improve, but I also need to believe my life is still mine." What motivates the patients to continue with their treatment, overcome challenges, and remain involved is not solely the lab results. It is hope.

As Viktor Frankl, an Austrian neurologist, psychologist, and Holocaust survivor, once said, "Those who have a 'why' to live can endure almost any 'how'." It is our role as clinicians to assist our patients in discovering that "why."[4]

Balancing Honesty and Possibility

One of the most sensitive roles a medical provider has is finding the right balance between honesty and hope. We have the responsibility to share information about prognosis, risks, and limitations with our patients. At the same time, we need to communicate in a way that upholds their dignity and opens up possibilities.

As Dr. Jerome Groopman, MD, beautifully expressed in The Anatomy of Hope, "Hope, unlike optimism, is rooted in unalloyed reality."[5] Offering hope doesn't mean giving false reassurance; it means saying, "I can see the path ahead with you – and we'll continue this journey together."

We should be trained to do more than just provide diagnoses; we should learn to be companions in this journey.

Making Hope a Clinical Priority

If hope can strengthen the immune system, lower stress, improve treatment adherence, and deepen the patient-clinician relationship, then why isn't it treated as a core part of medical care? Too often, hope is seen as a byproduct, something that "just happens" if everything else goes well. But hope isn't incidental. It's instrumental. And if we believe it can influence outcomes, we must start treating it like any other clinical priority.

That means making deliberate changes. We need to train clinicians in empathic communication and narrative medicine – not just to improve bedside manner, but to help patients feel seen and heard. We should create space in every visit to ask about a patient's fears, goals, and what gives them strength. Hope-promoting behaviors should be documented with the same seriousness as vital signs. And finally, we must treat stories – those shared by patients and clinicians alike – as a real and powerful form of healing.

Let us be the kind of clinicians who don't just manage illness but uplift the human spirit. Hope is not the opposite of realism – it is its necessary companion. It enables our patients to face the unknown with courage, and it allows us to practice medicine not only with skill but with heart. Whether we can cure or not, we can always bring comfort in every clinical encounter. And comfort often begins with a simple, powerful question: "What still gives you hope?"

A Heartfelt Thank You

In the same spirit, we want to extend our special thanks to Robert Treat, PhD, for his incredible service to *WMJ*. Dr Treat, an Associate Professor of Emergency Medicine and Director of Measurement and Evaluation in the Office of Academic Affairs at the Medical College of Wisconsin, joined the editorial team as Deputy Editor in 2019. Over the past six years, he has played a crucial role in shaping the journal's editorial direction, providing thoughtful insight on key manuscripts and contributing significantly to several of our special issues. His steady presence and editorial leadership have helped guide the journal through times of uncertainty and growth. As he now steps down to focus on other important professional commitments, we offer our deepest gratitude and wish him continued success in all his future endeavors.

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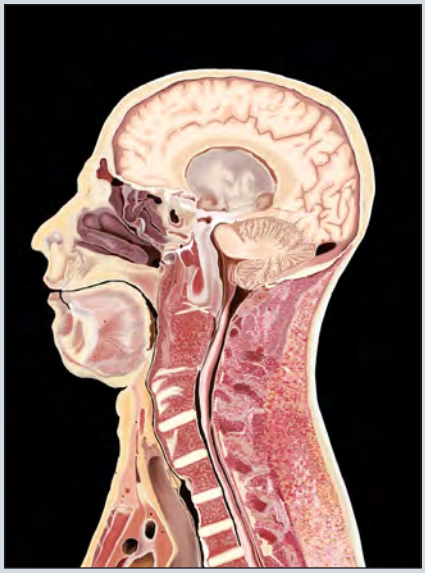

"Intrinsic Beauty"

About the Artist

Miller Habib is a dedicated neuroscience aficionado, currently serving as a research intern at the Penn State College of Medicine with a focus on antibody staining and data analysis. He has received distinction as the 2025 Eastern USA Anato-Bee champion and one of four nationally recognized winners, as well as a competitor in the 2024 National USA Brain Bee. With eight years of experience in the arts, Miller has employed a variety of mediums to reflect the intrinsic beauty of medicine.

‘From Good to Great’

A Tribute to the Visionary Leadership Behind WMJ*’s Transformation*

Fahad Aziz, MD, *WMJ* Editor-in-Chief, and Kendi Neff-Parvin, *WMJ* Managing Editor

‘A leader is one who knows the way, goes the way, and shows the way,” wrote John C. Maxwell. These words capture the essence of true leadership: vision in thought, courage in action, and generosity in example. Two leaders who embody these characteristics are Robert N. Golden, MD, and Joseph E. Kerschner, MD, who have each profoundly shaped the landscape of medical education and public health in Wisconsin as deans of their respective institutions.

Myriad Achievements

Golden, who became the ninth dean of the University of Wisconsin School of Medicine and Public Health and vice chancellor for medical affairs at UW–Madison in 2006, led the school for nearly two decades, making him one of the longest-serving medical school deans in the country. He is a nationally recognized psychiatrist and medical educator whose remarkable career includes 21 years at the University of North Carolina prior to his arrival at UW–Madison, shortly after the UW Medical School had changed its name to the UW School of Medicine and Public Health. Since then, he guided the school through a profound transformation marked by the integration of public health into the core of medical training and a renewed focus on health equity and community partnerships that included establishment of a Preventive Medicine Residency Program, significantly expanding the Master of Public Health Program, and the creation of the Wisconsin Academy for Rural Medicine and Training in Urban Medicine and Public Health Program. He also oversaw significant increases in National Institutes of Health (NIH) funding and the expansion of translational research, including the launch of the Institute for Clinical and Translational Research, among many other notable achievements.

> “This shared journal is a commitment to the medical and public health enterprises of both schools and represents a true collaboration for education, research, equity, and outreach, and commitment to the ‘sifting and winnowing’ of information and ideas....”
>
> *–Jonathan L. Temte, MD, PhD*

“We are deeply indebted to Dean Golden for his many incredible years of service to our students and for all his leadership in service to the health of our state’s residents,” said UW–Madison Chancellor Jennifer Mnookin, JD, PhD, in a 2024 article in *Quarterly* magazine (Volume 26, Issue 4). “His tireless dedication embodies the Wisconsin Idea and innovation for the public good. He has worked hard across almost two decades to strengthen health care in every county in Wisconsin, and it shows.”

Meanwhile, Kerschner, a pediatric otolaryngologist and accomplished physician-scientist, brought a similarly transformative approach to the Medical College of Wisconsin (MCW). An MCW faculty member since 1998 who also served as CEO of Children’s Specialty Group, Kerschner was appointed dean in 2011 and assumed the additional role of provost in 2017. Under his leadership, MCW experienced more than a decade of strategic growth in medical education, research, and community engagement. The school of medicine expanded to include regional medical campuses in Green Bay and Central Wisconsin to address physician shortages in underserved areas, and MCW’s graduate medical education program also expanded to include new training positions for psychiatry and behavioral health, as well as a new residency program in family and community medicine. At the same time, the school’s NIH funding has nearly doubled, and advances in cutting-edge biomedical research initiatives include the formation of a new Data Science Institute and the development of several new centers of research excellence. Known for his clear communication and ability to unite academic and clinical missions, Kerschner championed initiatives that elevated the role of science, training, and public service in Wisconsin’s health ecosystem.

John R. Raymond, Sr., MD, and Joseph E. Kerschner, MD

Robert N. Golden, MD

"Dr. Kerschner has been a trusted thought leader and partner," said John R. Raymond, Sr., MD, MCW president and CEO, in an article published in the fall 2024 issue of *MCW Magazine*. "He has brought an infectious enthusiasm, energy, and work ethic to his many roles at MCW. He has helped to elevate MCW's missions, support our people, enhance our visibility – throughout the state, country and globally – and enrich our partnerships across multiple venues and entities."

Golden and Kerschner recently concluded their tenure as deans, and while their accomplishments have many parallels, perhaps one of their most unifying achievements is the joint stewardship and long-term preservation of the *Wisconsin Medical Journal* (*WMJ*) – a legacy that reflects their enduring vision for medicine in Wisconsin.

WMJ's Transformation

Founded in 1903, the *WMJ* has served for more than a century as a platform for disseminating medical and public health scholarship in Wisconsin. Initially published by the Wisconsin Medical Society (Society), the journal reflected the voices of practicing clinicians and researchers alike. But by the late 2010s, the journal's future was uncertain, as mounting financial pressures threatened its sustainability.

According to John J. Frey, III, MD, emeritus professor and former chair of the UW School of Medicine and Public Health Department of Family Medicine, the Society approached the medical schools – whose faculty and learners authored much of the research published in *WMJ* – about sponsorship.

"Thanks to a high level of cooperation, understanding and support, Deans Golden and Kerschner and MCW President John Raymond came together to assure the future of the journal – not just as sponsors, but as co-owners and publishers," said Frey, who served as *WMJ* editor-in-chief from 2006 to 2019. "Their leadership not only preserved the journal as a cornerstone of academic and clinical scholarship but strengthened its role as a shared platform serving faculty, learners, and practicing health care professionals across Wisconsin and the region."

Golden recalled how the collaboration came to fruition. "John Raymond, the president of MCW and I have enjoyed a wonderful partnership from the very start of his leadership role at MCW and got together for periodic lunches during which we would discuss potential projects of mutual interest. I think it was over one of those lunches that we created a vision of taking the *WMJ* off the hands of the Society and having the two schools run it together. This would allow the journal to have a stronger academic focus, enjoy greater stability, and create opportunities for the faculty and students at the schools to get more engaged with the journal."

An agreement was reached, and *WMJ* moved to its new institutional home in 2019.

"The past six years have demonstrated the success of this model, as the journal continues to receive high quality submissions and has sustained its 100-plus year tradition of serving the public health and health care needs of Wisconsin," said Patrick L. Remington, MD, MPH, Professor Emeritus of Population Health Sciences at the UW School of Medicine and Public Health. As the UW School of Medicine and Public Health's liaison to the Society in 2019, Remington was instrumental in *WMJ's* transition from the Society to the schools.

A Publishing Board was then created to oversee operations, including finances and appointment of the editor-in-chief and deputy editors, which alternate between the two schools. The Board comprises three members from each school appointed by their respective deans, as well as an ex officio member representing the Society.

Sarina Schrager, MD, MS, professor of fam-

ily medicine at the UW School of Medicine and Public Health, served as editor-in-chief throughout the transition until 2022, when she became editor-in-chief of *Family Medicine,* the official journal of the Society of Teachers of Family Medicine. "The process of developing a joint publishing model in a collaborative and cooperative manner is a testament to their (the deans) strong leadership," said Schrager. "Dean Golden was a staunch proponent of the new publication model and providing staff support for the editorial process, and both deans encouraged faculty to submit papers and contributed columns to each issue." Kerschner also frequently spotlighted *WMJ* in his weekly internal communication with the MCW community.

What has emerged was more than a rescue – it was a renaissance. Since 2019, annual submissions to the journal have more than doubled, reflecting a renewed trust and enthusiasm from researchers, clinicians, and trainees across the state. In the past year alone, the *WMJ* published 137 papers, compared to just 39 in 2019 – an achievement that speaks not only to growth in volume, but to the journal's role as a platform for regional scholarship.

"The access to a strong peer-reviewed journal is essential for scholars to communicate their findings and to develop junior authors, including students and residents, while being able to share current research improves health care practices across the state," said William Hueston, MD, who served as inaugural chair of the *WMJ* Publishing Board and was associate provost for education, senior associate dean for medical education and a professor in the department of family and community medicine at MCW prior to his retirement. "Supporting the *WMJ* was an obvious win-win for both the academic institutions and the practicing physicians in the state of Wisconsin."

Kerschner agrees. "The *Wisconsin Medical Journal* is an outstanding peer-review journal, and I was extremely happy to support this as dean of the school of medicine at the Medical College of Wisconsin," he said. "It provides an outstanding platform – especially for those early in their academic careers – to publish excellent work and especially work that is relevant to medicine in Wisconsin."

Since the transition, the journal has also undergone a comprehensive modernization: its editorial processes were streamlined, digital accessibility was improved, and the introduction of an annual themed issue allows the journal to address timely and locally resonant topics, from rural health equity to mental health access.

"The success of the journal has been spectacular," Golden agreed. "It has moved from 'good to great,' with high quality articles, modernization of its presentation and processes, and strong engagement from faculty at both organizations. The theme issues have been wonderfully relevant and timely, and the articles are consistently interesting and well written.

"I feel this is one example of how Wisconsin's two medical programs have worked together to advance a shared vision of service to the state's physicians and the populations and patients they care for," Golden added.

Equally important has been the journal's role in mentoring the next generation of academic voices. *WMJ* is an accessible venue for original research, reflective essays, and thought leadership for faculty, fellows, residents, and medical students – many who publish for the first time in its pages. And it also has become a valuable training ground for editorial fellows and junior reviewers, reinforcing its mission not just to publish knowledge, but to cultivate it.

Jonathan L. Temte, MD, PhD, UW School of Medicine and Public Health associate dean for public health and community engagement, has witnessed the journal's evolution firsthand, as past chair and current member of the Publishing Board, as well as an author and reviewer.

"The *WMJ* is a palpable extension of the Wisconsin Idea. The journal serves as a dependable, high-quality, high-integrity publication that accepts submissions without fees," said Temte. "This shared journal is a commitment to the medical and public health enterprises of both schools and represents a true collaboration for education, research, equity, and outreach, and commitment to the 'sifting and winnowing' of information and ideas."

Through their collaboration, Golden and Kerschner demonstrated how academic leadership can transcend boundaries in service of the public good, and together, their leadership has left a legacy that will ensure that the benefits of academic medicine extend to every corner of the state – something that undoubtedly will continue during the next phase of their careers. Golden, emeritus dean of the School of Medicine and Public Health, emeritus vice chancellor for medical affairs at UW–Madison, and a professor in the Department of Psychiatry, will shift his focus to mentoring faculty members and trainees. Kerschner, dean emeritus of the MCW School of Medicine, will begin a new journey as CEO of one of his research start-up companies (OtoNano, LLC) and as a consultant for Chartis Consulting. Meanwhile, the *WMJ* continues to grow as a resource for clinicians, educators, and public health professionals across the state and beyond, and it does so on a foundation laid by leaders who transformed uncertainty into opportunity by reimagining what a regional medical journal could be.

"In a time of competition between health systems, this collaborative model is a testament to the leadership of Deans Golden and Kershner," said Remington, whose involvement with *WMJ* dates back to medical school and has continued throughout his career. "It is truly a win-win-win, for the School of Medicine and Public Health, the Medical College of Wisconsin, and the State of Wisconsin. The goals of the journal align perfectly with the goals of each medical school – in research, education, and community service. It is truly a model of the Wisconsin Idea."

"In a time of competition between health systems, this collaborative model is a testament to the leadership of Deans Golden and Kershner. It is truly a win-win-win, for the School of Medicine and Public Health, the Medical College of Wisconsin, and the State of Wisconsin."

–Patrick Remington, MD, MPH

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Impact of an Integrated Electronic Health Record Protocol on Inferior Vena Cava Filter Retrieval Attempt Rates: An Observational Cohort Study

Benjamin M. Parsons, DO; Sean R. O'Neil, MD; Andrew L. Horstman, PA-C; Mary C. Oldenburg, MS; Attila J. Kovacs, PhD; C. Isaiah Fitzmaurice, MS; Samuel Mosiman, MS; Tiana L. Carlson, BS

ABSTRACT

Introduction: To improve inferior vena cava (IVC) filter retrieval rates, an electronic health record prompt for scheduling retrieval before patient discharge was implemented.

Methods: This retrospective comparative cohort study was conducted in a single Midwestern tertiary care medical center. Adult patients with IVC filters placed for a medical (Medical subgroup) or trauma (Trauma subgroup) indication before and after protocol implementation and who had follow-up documented in the electronic health record were included. IVC filter retrieval attempt rates both overall and by indication for placement before and after protocol implementation were compared.

Results: Three hundred eighty-five patients met eligibility criteria: 223 before implementation (Before group) and 162 after implementation (After group). The attempted retrieval rate for the After group was 11.4% higher than the Before group ($P = .012$). Attempted retrieval rates in the Medical Before and After subgroups were 56.2% and 76.0%, respectively ($P = .001$). The Trauma subgroups' rates were similar to each other ($P = .594$). Time to retrieval attempt was significantly shorter in the Medical After subgroup than in the Medical Before subgroup ($P = .018$) but similar in the Trauma subgroups.

Conclusions: Attempted retrieval rates were significantly higher in the After group and Medical After subgroup. Trauma subgroup rates were similar, likely because a previous intervention to increase retrieval in trauma patients was in place during the pre-implementation period of our study. Findings suggest that using an automated electronic health record-based prompt to facilitate IVC filter retrieval scheduling could greatly improve retrieval rates and patient safety.

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INTRODUCTION

Venous thromboembolism, which includes deep venous thrombosis and pulmonary embolism, affects as many as 900 000 individuals each year in the United States.[1] Inferior vena cava (IVC) filters are designed to be temporarily placed as a prophylactic option for patients at high risk for potentially fatal pulmonary embolism. The most widely recognized indication for IVC filter placement is venous thromboembolism when anticoagulation is contraindicated. Other indications include recurrent venous thromboembolism despite adequate anticoagulation, as well as high-risk trauma and certain surgeries and malignancies.[2]

Complications from IVC filter placement are relatively minor and include venous injury or perforation, misplacement of the filter, and insertional site deep venous thrombosis.[3] However, the long-term complications of retained IVC filters—including IVC thrombosis, IVC filter migration, IVC perforation, filter fracture, embolization, and tilting—are being recognized increasingly as major health concerns.[4] These concerns prompted the US Food and Drug Administration (FDA) to release a safety communication in 2010 and an update in 2014 regarding the concerns over long-term retention of IVC filters and recommended removal as soon as a filter is no longer clinically indicated.[5,6]

Approximately 65 000 IVC filters are placed in the United States annually.[7] Unfortunately, this rate of filter placement generally has not been accompanied by a comparable retrieval rate. Reported rates of IVC filter retrieval vary widely. One study conducted in Florida found that only 6.6% of 131 791 filters were

retrieved successfully.[8] Another study evaluating all IVC filters entered in the National Vascular Quality Initiative Registry from January 2012 to August 2018 showed a 34.5% retrieval rate.[9]

Practice patterns for IVC filter retrieval planning vary by institution. In the current study, the Interventional Radiology (IR) Department performed all IVC filter placement and retrieval procedures. The IR Department documents all IVC filter placements (medical and trauma patients) in a database that is reviewed quarterly to identify patients who need filter retrieval. In January 2005, a structured, protocol-driven retrieval process was implemented by the trauma service with the aim of increasing IVC filter retrieval rates. This protocol provided the trauma service with an independent database to track and plan retrieval before discharge, affording them an additional layer of filter tracking. A 2019 study found that this 2-layer retrieval tracking process resulted in more than 2 times the rate of removal of filters placed for trauma indications than of those placed for medical indications.[10]

To improve retrieval rates system-wide, on January 13, 2016, the IR Department implemented an appointment reminder retrieval strategy that focused on using the electronic health record (EHR) for IVC filter retrieval planning before patient discharge. When an order for IVC filter placement is made in the EHR, the EHR automatically populates a message to the IR scheduling team. This message prompts the scheduler to triage the patient for follow-up with the assistance of a physician assistant or nurse practitioner. Thus, when patients with IVC filter placements are discharged, they already have an appointment for filter retrieval. The IVC filter database continues to be reviewed approximately every quarter to update clinical events for patients with prolonged clinical course or retained filter.

The purpose of this study was to evaluate the efficacy of this integrated EHR retrieval protocol by comparing rates of attempted IVC filter retrieval before and after implementation of this protocol.

METHODS

Following study approval and waiver of informed consent by the Gundersen Clinic LTD, Human Subjects Committee/Institutional Review Board, the EHRs of all patients with a IVC filter placed in a 5-year period before (January 13, 2011- January 2, 2016: the Before group) and after (January 3, 2016- December 31, 2020: the After group) implementation of the retrieval protocol were reviewed retrospectively. The groups were further subdivided by indication for filter placement (Medical Before/After and Trauma Before/After). Eligible patients were 18 years or older at the time of filter placement and had documented follow-up in the EHR. Patients with no EHR data after their filter placement were deemed lost to follow-up and excluded from the analysis, as were those who died within 30 days of filter placement.

During the 10-year study period, 405 IVC filters were placed. Twenty patients were lost to follow-up, leaving 385 for final analysis. Patient demographic and clinical characteristics are provided in Table 1, and sociodemographic data are provided in Table 2. Of the filter placements reviewed, 223 and 162 were reviewed before and after implementation of the EHR retrieval protocol, respectively. Of the filter placements before protocol implementation, 137 were in the Medical subgroup and 86 were in the Trauma subgroup. Of those placed after protocol implementation, 104 and 58 were in the Medical and Trauma subgroups, respectively (Figure 1). Data for predetermined variables, including patient characteristics (age, sex, body mass index, smoking history, comorbid medical conditions) and dates of filter placement and retrieval attempts were abstracted from the study patients' EHRs.

Because the purpose of the intervention was to ensure that patients were scheduled for retrieval, the rates of attempted IVC filter retrieval were defined as the percentage of retrievable IVC filters in which retrieval was attempted—whether successfully or unsuccessfully—during the study period within each group. Time to retrieval was defined as the number of days between filter implantation and retrieval attempt. Time to IVC filter retrieval attempt was further analyzed by time categories (0-119 days, 120-

Table 1. Medical and Trauma Subgroup Demographic and Clinical Characteristics Before and After EHR Retrieval Protocol Implementation

	Before		After	
Characteristic	**Medical n = 137**	**Trauma n = 86**	**Medical n = 104**	**Trauma n = 58**
Sex, n (%)				
Male	73 (53.3)	60 (69.8)	63 (60.6)	43 (74.1)
Female	64 (46.7)	26 (30.2)	41 (39.4)	15 (25.9)
Mean age by sex, years ± SD				
Men	64.9 ± 13.3	42.3 ± 17.5	62.9 ± 12.6	50.4 ± 18.8
Female	62.1 ± 17.3	52.9 ± 20.5	66.1 ± 13.9	48.2 ± 13.0
Body mass index, kg/m^2, n (%)				
< 30	62 (45.3)	57 (66.3)	39 (37.5)	37 (63.8)
≥ 30 to < 35	26 (19.0)	14 (16.3)	26 (25.0)	12 (20.7)
≥ 35 to < 40	25 (18.2)	7 (8.1)	19 (18.3)	6 (10.3)
≥ 40 to < 50	13 (9.5)	6 (7.0)	16 (15.4)	3 (5.2)
≥ 50	9 (6.6)	0 (0)	4 (3.8)	0 (0)
Unknown	2 (1.5)	2 (2.3)	0 (0)	0 (0)
Smoking status, n (%)				
Current	15 (10.9)	19 (22.1)	9 (8.7)	17 (29.3)
Former	61 (44.5)	23 (26.7)	35 (33.7)	14 (24.1)
Never	58 (42.3)	38 (44.2)	60 (57.7)	23 (39.7)
Never assessed	3 (2.2)	6 (7.0)	0 (0)	4 (6.9)
Comorbidities, n (%)				
Congestive heart failure	13 (9.5)	0 (0)	12 (11.5)	3 (5.2)
Nephrotic syndrome	1 (0.7)	0 (0)	0 (0)	0 (0)
Hypertension	68 (49.6)	13 (15.1)	63 (60.6)	19 (32.8)
Diabetes	20 (14.6)	5 (5.8)	16 (15.4)	7 (12.1)
History of stroke	13 (9.5)	29 (33.7)	19 (18.3)	40 (69.0)
History of MI	9 (6.6)	0 (0)	7 (6.7)	1 (1.7)
Coronary artery disease	18 (13.1)	1 (1.2)	10 (9.6)	4 (6.9)
Chronic lung disease	14 (10.2)	3 (3.5)	10 (9.6)	1 (1.7)

Abbreviations: EHR, electronic health record; MI, myocardial infarction.

Data are presented as number of patients (%) unless otherwise noted.

Percentages may not total 100 due to rounding.

Table 2. Sociodemographic Data for Patients Who Received IVC Filters Before (N = 223) and After (N = 162) EHR Retrieval Protocol

Characteristic	Before n (%)	After n (%)
Race		
Other	10 (4.5)	3 (1.9)
White	213 (95.5)	159 (98.1)
Ethnicity		
Hispanic	2 (0.9)	3 (1.9)
Non-Hispanic/Non-Latino	221 (99.1)	158 (97.5)
Refused	0 (0)	1 (0.6)
Insurance type		
Commercial/private	81 (36.3)	48 (29.6)
Medicaid	29 (13.0)	26 (16.0)
Medicare	71 (31.8)	80 (49.4)
Other	10 (4.5)	5 (3.1)
Self-pay	8 (3.6)	3 (1.9)
Unknown	24 (10.8)	0 (0)
Rural/urban		
Rural	70 (31.4)	55 (34.0)
Rural advantaged	43 (19.3)	25 (15.4)
Rural underserved	24 (10.8)	20 (12.3)
Urban	15 (6.7)	19 (11.7)
Urban advantaged	55 (24.7)	38 (23.5)
Urban underserved	0 (0)	1 (0.6)
Unknown	16 (7.2)	4 (2.5)

Abbreviations: IVC, inferior vena cava; EHR, electronic health record.
Percentages may not total 100 due to rounding.

364 days, and 365+ days) to help account for significant outliers that would affect data interpretation (ie, individuals who retained filters for many years). The rates of attempted IVC filter retrieval and time to attempted IVC filter retrieval were determined before and after protocol implementation.

Categorical variables were compared using the χ^2 or Fisher exact tests. Continuous variables were evaluated with Wilcoxon rank sum tests. All statistical analyses were performed in SAS version 9.4 (SAS Institute Inc) with a significance level of .05.

RESULTS

Overall, 98 filters (25.4%) were placed for absolute indications, 100 filters (26.0%) for relative indications, and 185 filters (48.1%) for prophylactic indications. Two filters (0.5%) were placed for indications outside the Society of Interventional Radiology's guideline.[11] The most common indications for IVC filter placement in the Medical Before subgroup were pulmonary embolism with large clot burden (n = 31, 22.6%), bleeding complications on anticoagulation (n = 29, 21.2%), and surgery with thrombophilia history (n=28, 20.4%). After intervention, the most common indications were bleeding complications on anticoagulation (n = 27, 26.0%), pulmonary embolism with large clot burden (n = 22, 21.2%), and presence of deep vein thrombosis (n = 17, 16.3%).

Collectively, IVC filter retrievals were attempted 11.4% more in the After group than in the Before group (131/162, 80.9% and

Figure 1. Patient Selection Flow Chart

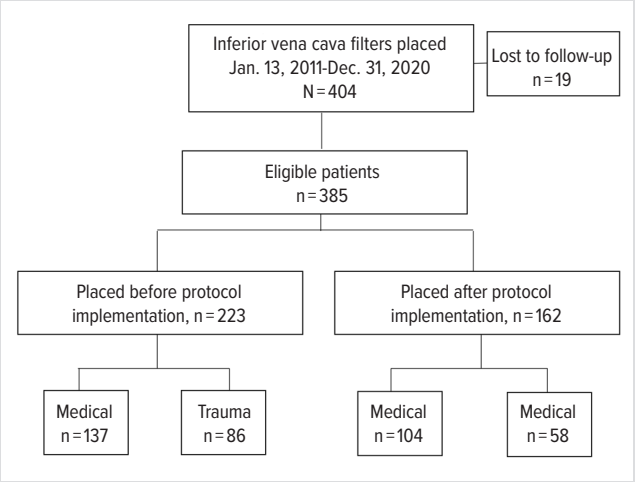
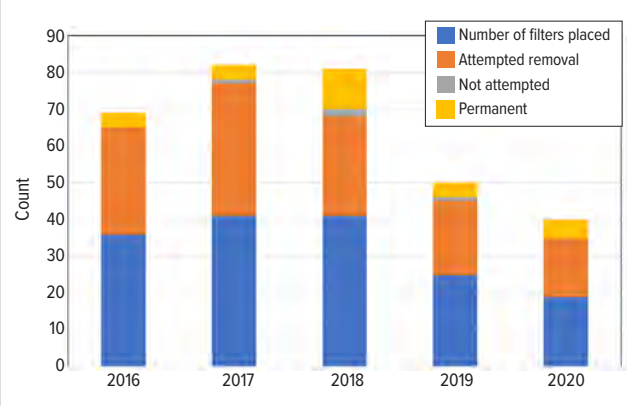


Figure 2. Inferior Vena Cava Filter Placement and Disposition Over Time



155/223, 69.5%, respectively, $P = .012$). The attempted retrieval rate in the Medical After subgroup increased by 19.8% versus the Medical Before subgroup (79/104, 76.0% and 77/137, 56.2%, respectively; $P = .001$). Of the 137 filters placed in the Medical Before subgroup, 49 were deemed permanent and 11 patients either did not keep their appointments or no appointment was made. Of 104 filters placed in the Medical After group, 22 were deemed permanent, and 3 scheduled retrieval appointments were not kept, for reasons inconsistently documented in the EHR. No significant difference in IVC filter attempted retrieval rates before and after intervention was found in the Trauma subgroup (78/86, 90.7% and 51/58, 87.9%, respectively; $P = .594$). The number and disposition of IVC filters placed over time are illustrated in Figure 2.

Although ensuring and improving the timeliness of retrieval attempts was the primary outcome, the rate of successfully removed IVC filters after protocol implementation was also of interest. Successful IVC filter removal rates were similar in the Trauma Before and After subgroups (74/86, 86.0% and 50/58,

86.2%, respectively; $P = .945$), but in the Medical Before and After subgroups, the rate of successful retrieval improved significantly (70/137, 51.1% and 78/104, 75.0%, respectively; $P = .0002$).

In the Trauma Before and After subgroups, mean times to first IVC filter retrieval attempt were similar ($P = .795$). In the Medical After subgroup, mean time to first retrieval attempt was lower, but not significantly so ($P = .054$). However, when analyzing by time intervals (0-119, 120-364, and 365+ days) to account for outliers, time to retrieval attempt decreased significantly in the Medical After subgroup ($P = .018$) but not in the Trauma After subgroup ($P = .70$) (Table 3).

Table 3. Number and Percentage of Attempted IVCF Retrievals Before and After EHR Retrieval Protocol Categorized by Time and Indication

	Medical			Trauma		
Time Range	**Before**	**After**	***P***	**Before**	**After**	***P***
0–119 days	49 (63.64%)	66 (83.54)		56 (71.79)	37 (72.55)	
120–364 days	18 (23.38%)	9 (11.39)	.018	18 (23.08)	13 (25.49)	.70
365+ days	10 (12.99%)	4 (5.06)		4 (5.13)	1 (1.96)	

Abbreviations: IVCF, inferior vena cava filter; EHR, electronic health records.
Data are presented as number of attempted retrievals (%).
Percentages may not total 100 due to rounding.

DISCUSSION

Use of an integrated EHR retrieval protocol significantly increased attempted IVC filter retrieval rates overall (11.4%) and in the Medical After subgroup (20.7%). It also decreased time to filter retrieval attempt in the Medical After subgroup when accounting for outliers with analysis by time intervals. Successful filter retrieval also increased in the Medical After subgroup. Attempted retrieval rates and time to filter retrieval attempts were similar before and after intervention in the Trauma subgroup, likely due to a 2-layer tracking system that was already in place for trauma patients prior to implementation of the EHR retrieval protocol. The 2-layer tracking system used by the Trauma Before subgroup functions similarly to the EHR retrieval protocol in that it facilitates IVC filter retrieval planning and tracking prior to discharge.

Various institutions have implemented filter retrieval registries or databases to track IVC filter placement and plan for filter removal when clinically indicated. Sheehan et al conducted a study evaluating the efficacy of maintaining a prospective IVC filter registry within their institution from 2011 to 2020 and found that doing so resulted in retrieval rates of 92.5% overall for those eligible for filter removal.[12] The Cardiovascular and Interventional Radiology Society of Europe (CIRSE) and the British Society of Interventional Radiology (BSIR) have shown increased filter retrieval rates when online registries are maintained, with retrieval rates of up to 92% for some institutions.[13,14] Other studies also have demonstrated that preemptive scheduling of IV filter removal during the preoperative consent process for filter placement results in increased retrieval rates.[15] Ongoing efforts to leverage EHRs should be pursued, considering their potential to increase IVC filter retrieval rates and to reduce time to filter retrieval.

Similar efforts have been made to utilize the capabilities of the EHR to improve patient outcomes in other clinical contexts. A study by Banerjee et al demonstrated that an embedded EHR-based protocol into hospital admission and discharge was associated with a significant increase in nicotine replacement therapy prescriptions and improvement in quit rates.[16] Additionally, a recent study in *JAMA Surgery* demonstrated how the use of an embedded EHR-based intervention can significantly reduce the rate of low-value axillary surgery in older women with early-stage, node-negative, hormone receptor-positive breast cancer.[17] Considering the EHR's potential to increase IVC filter retrieval rates and improve other patient outcomes, efforts to leverage its power should be ongoing.

Given the retrospective nature of this study, a limitation is the vulnerability of the data source and confounding variables. Accuracy of the data collected relied upon quality of documentation in the EHR, which is subject to omissions, misclassification, and misreporting. Intent of filter permanence, patient preference for filter retrieval, reasons for failed attempts at filter retrieval, or other relevant data points were not readily available by EHR review. Changing practice patterns for IVC filter use over the study period also may have affected the rate of IVC filter placement and retrieval.

CONCLUSIONS

Study findings demonstrate that implementation of an integrated EHR prompt at the time of IVC filter placement to plan retrieval prior to discharge significantly increased rates of attempted filter retrieval, as well as reduced time to retrieval attempt in patients whose filters were placed for medical indications. A systematic, multidisciplinary approach to IVC filter use has the potential to significantly improve long-term patient safety, shorten duration of filter placement, and increase filter retrieval rates. To date, there are few reports of institutions leveraging EHRs for purposes of improving IVC filter retrieval rates. Therefore, future efforts should focus on using the EHR in a systematic way to assist in scheduling IVC filter retrieval.

Financial Disclosures: None declared.

Funding/Support: None declared.

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Mind the Gap: Analysis of the Timeline of Medical Readiness and Qualitative Review of Discharge Delays

Madeleine Nowak, BS; Matthew Bye, MPH; Amanda Rogers, MD

ABSTRACT

Introduction: Efficient discharges lead to decreased length of stay and improved hospital flow. An efficient discharge requires timely recognition of medical readiness for discharge (MRD) and effective preparation. The objective of this study was to better understand pediatric hospital medicine discharges by (1) analyzing the time of MRD and discharge throughout the day, (2) assessing the time from MRD to discharge, and (3) categorizing commonly identified discharge delays.

Methods: A retrospective chart review of pediatric hospital medicine patients with the diagnoses of asthma, "brief resolved unexplained event," hyperbilirubinemia, or "rule out sepsis neonates" was completed. MRD was determined by reviewing the patient's chart for completion of diagnosis-specific discharge criteria. MRD was compared to the time of discharge order and discharge. Delayed discharges were reviewed further to identify reasons for the delay.

Results: One hundred discharge events were analyzed – 25 from each of the 4 selected diagnoses. MRD occurred throughout the day (33% morning, 43% afternoon, 14% evening, and 10% night). The median time from MRD to discharge was 1.7 hours (0.5 hours from MRD to discharge order and 0.9 hours from order to discharge), with the longest MRD to discharge time in asthma patients. Forty percent of patients had a delayed discharge, and identified reasons for delays were further categorized.

Conclusions: MRD occurred throughout the day, suggesting the MRD to discharge time may be an informative metric of discharge efficiency. Next steps include developing forward-facing electronic health record alerts noting MRD for improved tracking and real-time communication and targeted interventions to address reasons for discharge delays.

INTRODUCTION

The overall quality of care received during hospitalization depends on safe, effective, and efficient discharges. Delayed discharges contribute to a higher rate of in-hospital complications and increased length of stay (LOS), which negatively impact patients and the system as a whole.[1-3] Discharge delays also can impact hospital throughput negatively, and improving discharge timeliness by even hours is associated with improvement in hospital flow.[4] Successful discharge requires a complex interplay of medical readiness for discharge (MRD), logistical coordination, and effective communication within the health care team and with the patient/family.

Increasing understanding of the timeline and underlying causes of discharge delays is essential to improve the discharge process. Previous studies have explored setting wide targets for discharge by a certain time of day such as "discharge before noon" (DCBN). The literature remains divided as to whether DCBN decreases or increases LOS.[5-9] Some authors argue there may be consequences of DCBN, such as prolonged LOS, due to clinicians withholding afternoon or evening discharges until the next day to meet the DCBN goal.[4-6] In addition, it has been suggested that implementing such a broad hospital-wide metric may be ineffective due to differences within provider workflows and responsibilities between services (eg, surgical service with responsibilities in the operating room compared to a medicine service that may have more availability to reassess the patient throughout the day).[3] DCBN also may affect readmission rates and distract care from

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other patients.[6] In light of inconclusive findings and the aforementioned potential complications, many authors suggest a more tailored approach – one that does not focus on a particular hour, but rather individualized discharge milestones to help determine the best and earliest discharge time for each patient.[7,8,10] Setting broad discharge goals by time of day across various patients and diagnoses implies that patients' medical readiness for discharge is predictable by time of day. The objective of this study was to better understand the timeline of medical readiness by diagnosis to individualize setting timely goals for discharge and to inform future discharge optimization work.

This study aimed to provide a more nuanced analysis of time of discharge as it relates to diagnosis-specific medical readiness to better understand the discharge process in pediatric hospital medicine patients. These data can be leveraged to reveal how system improvements can increase discharge efficiency, leading to better resource allocation and patient outcomes. The study objectives were threefold: (1) analyze the time of MRD and the time of discharge throughout the day, (2) assess the time from MRD to discharge, and (3) categorize commonly identified discharge delays.

METHODS

Study Design and Participants

The described study is a retrospective electronic health record (EHR) review and included pediatric medical hospitalizations from a single academic medical center from September 2021 to September 2022. The freestanding children's hospital is a 296-bed, tertiary care, pediatric academic medical center with teaching services that include residents, fellows, and medical students supervised by attending physicians. Epic (Epic Systems, Verona, Wisconsin) is the EHR used at our institution.

Using the EHR report function, data sets of patients admitted to the acute care units on the pediatric hospital medicine service were generated and further categorized by 4 diagnoses: asthma, "brief resolved unexplained event" (BRUE), hyperbilirubinemia, and "rule out sepsis" neonates (ROS). These diagnoses were selected because they are common, high-volume pediatric diagnoses with previously established objectives and well-defined discharge criteria. This allowed feasible chart review to identify when each criterion was completed and when patients were medically ready for discharge. Diagnosis-specific discharge criteria for medical readiness were defined by previously established institution-specific clinical practice guidelines created on evidence-based literature and local expert consensus (see Table 1).[9,10] These criteria were diagnosis-specific medical goals and did not include social issues.

Charts of patients admitted to the pediatric hospital medicine service who were discharged with a primary diagnosis of asthma, BRUE, hyperbilirubinemia, or ROS were reviewed consecutively by 2 team members (pediatric hospitalist and medical student) until 25 charts that met inclusion criteria were reviewed for each diagnosis. Review of timestamps in the EHR was used to determine the time of completion of diagnosis-specific discharge criteria (Box), then defined as medical readiness for discharge (MRD) when all criteria were met.

Box. Diagnosis-Specific Discharge Criteria for Four Common Pediatric Hospital Medicine Diagnoses

Asthma
- Oxygen saturations > 90% on room air for approximately 8 hours
- Tolerating 2 consecutive albuterol treatments spaced to 4 puffs every 4 hours
- Meeting oral intake goals (defined as time IV capped)
- Peak flow > 60% predicted (only applies to patients older than 5 years)

Brief Resolved Unexplained Event (BRUE)
- Monitoring for 24 hours

Hyperbilirubinemia
- Bilirubin level < 14 mg/dL
- Lactation consult completed (if needed)

Rule Out Sepsis (ROS) Neonates
- Afebrile for 24 hours (fever = 38.0 °C)
- Cerebrospinal fluid culture negative for 36 hours
- Blood culture negative for 36 hours
- Urine culture negative for 36 hours

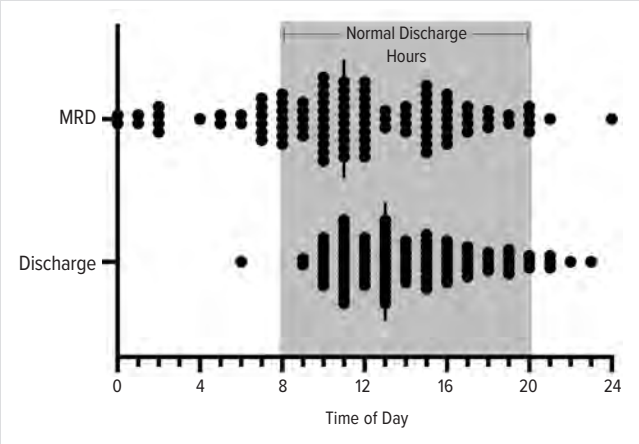
All included patients were admitted to the pediatric hospital medicine service, which consists of 32 different attending physicians. Charts were excluded if the patient had more than 1 active diagnosis requiring management during their hospitalization, if the patient acquired additional signs/symptoms during their hospital stay that altered their original discharge criteria, were transferred to a higher level of care, left against medical advice, or had Child Protective Services involvement.

Measures

The goals of this study were threefold, as follows:

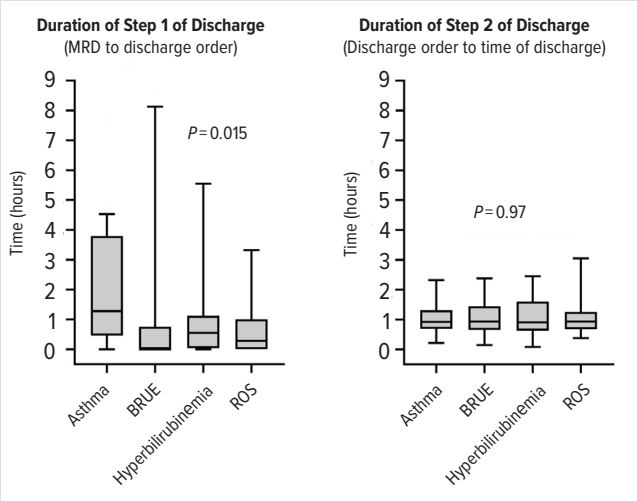
1. Analyze the time of MRD and discharge throughout the day: MRD and time of discharge were categorized by time of day in 6-hour blocks, where 0500-1059 was morning, 1100-1659 was afternoon, 1700-2259 was evening, and 2300-0459 was night.
2. Assess the time from MRD to discharge: MRD was compared to the time of discharge order and to the time of discharge as recorded in the EHR, and the primary measure was number of hours. Similar to other studies, normal discharge hours were defined as 0800 – 2000.[5,6] For discharges with MRD occurring outside of normal discharge hours, the time of MRD was adjusted to 0800 the following morning. This adjustment allowed us to correct for MRD outside of normal discharge hours and compare the time of MRD to the time of discharge. For further analysis of the time from MRD to the time of discharge, the discharge process was subdivided into 2 steps. Step 1 was defined as MRD to the discharge order placed; Step 2 was defined as the discharge order placed to discharge.
3. Categorize commonly identified discharge delays: If the patient

Figure 1. Medical Readiness for Discharge (MRD) and Discharge by Hour of Day, n = 100



Each dot represents a single patient. Line represents the median time.

Figure 2. Number of Hours Required for Completion of Discharge Process for 100 Pediatric Hospital Medicine Discharges by Diagnosis



Abbreviations: MRD, medical readiness for discharge; BRUE, brief resolved unexplained events; ROS, rule out sepsis.

remained hospitalized for more than 2 hours following MRD, the discharge was considered delayed. Previous work by White et al suggests a 2-hour window between meeting discharge goals and leaving the hospital optimal, with shorter time goals significantly increasing the rate of failure and longer time only marginally improving results.[10] If the discharge was greater than 2 hours, further chart review was completed to identify and categorize reasons for delays.

Analysis and Approval

Descriptive statistics and log-rank tests were used to analyze the time of medical readiness and discharge data. Reasons for discharge delays were assessed by content analysis. No power calculation was done for disease comparison. For the timely versus delayed discharge comparison, there is a 91.6% chance of observing a *P* value below 0.05 assuming median discharge intervals of 1.5 and 3 hours, respectively, for a sample size of n = 100. This calculation informs us that our sample size can provide adequate power and was performed using the Power Procedure in SAS version 9.4 (SAS Institute Inc).

The institutional review board (IRB) determined this study as nonhuman subject research and thus did not require IRB approval.

RESULTS

One hundred discharge events were included in this study, with discharge diagnoses of asthma, BRUE, hyperbilirubinemia, and ROS. Forty of 100 discharges were delayed with MRD to discharge exceeding 2 hours; discharges for patients diagnosed with asthma were the most frequently delayed.

Medical Readiness for Discharge Throughout the Day

Results from this project demonstrate that MRD occurs throughout the day and night, as demonstrated by Figure 1. MRD occurred in the morning for 33% of patients, in the afternoon for 43%, in the evening for 14%, and at night for 10%. It occurred more frequently in the morning for patients admitted for asthma and hyperbilirubinemia (56% asthma, 48% hyperbilirubinemia), whereas BRUE and ROS had most frequent MRD in the afternoon (64% BRUE, 44% ROS). Most discharges (94%) occurred within normal discharge hours (8:00-20:00), while 79% of MRD occurred during the same period. The median time of discharge was 1 PM, which was consistent across diagnoses.

Time from Medical Readiness to Discharge

By Diagnosis: The median time from MRD to discharge for all 100 discharges was 1.7 hours. By diagnosis, the longest duration from MRD to discharge occurred in asthma discharges, with a median time of 2.8 hours. The duration of MRD to discharge for other diagnoses was below the 2-hour goal: 1.4-hour for BRUE, 1.8 hours for hyperbilirubinemia, and 1.4 hours for ROS. Figure 2 displays the ranges for completion of step 1 (MRD to discharge order) and step 2 (discharge order to discharge) by diagnosis. In Figure 2, greater variation can be observed across diagnoses in step 1 versus step 2; the median time for step 2 was 0.9 hours across diagnoses. The log-rank test for the step 1 interval testing differential times from MRD to discharge yielded a *P* value of 0.015, while the log-rank test for the step 2 interval testing differential time intervals yielded a *P* value of 0.97. Additionally, step 1 was longer in asthma (1.3 hours) compared to other diagnoses.

By Delayed Discharges versus Timely Discharges: When comparing the duration of MRD to discharge in both timely (≤ 2 hours) and delayed (>2 hours) discharges, the 40 delayed discharges had a median duration of 3.2 hours, and the 60 timely discharges had a median duration of 1.2 hours. Figure 3 demonstrates a longer step 1 in delayed discharges versus timely discharges. Log-rank tests

Table. Identified Reasons for Discharge Delays

	Asthma	BRUE	Hyperbilirubinemia	ROS	All Diagnoses
Discharge Medications	7	1	—	—	8
Education	7	—	—	—	7
Vaccinations	1	—	1	1	3
Social	1	—	—	1	2
Transportation	—	2	1	1	4
Unclear	9	4	8	4	25

Abbreviations: BRUE, brief resolved unexplained event; ROS, rule out sepsis.

Notably, a single patient could have multiple types of delays identified, and not all patients had an identifiable delay.

revealed significant differences in both step 1 and step 2 between timely and delayed groups; however, it can be visually assessed that the range of step 1 is larger than step 2.

Figure 4 demonstrates the relationship between step 1 and step 2 compared to the total time from MRD to discharge. The Spearman correlation coefficient is statically significant in both steps. Figure 4 demonstrates that the total time from MRD to discharge is more closely related to the duration of step 1 (R = 0.75) time than the duration of step 2 (R = 0.44). This is congruent with the other findings regarding larger variation in step 1 across diagnoses and between the delayed and timely groups.

Discharge Delays

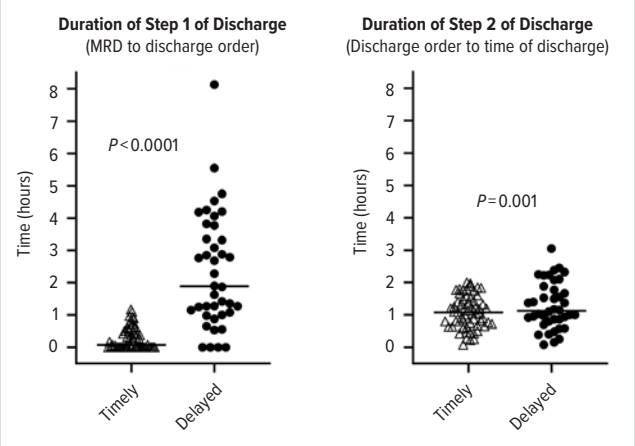
Forty of 100 discharges were identified as delayed, meaning the time from MRD to discharge exceeded 2 hours. Of the patients admitted for asthma, 16 of 25 discharges were delayed compared to 10, 7, and 7 discharges for hyperbilirubinemia, BRUE, and ROS, respectively.

Reasons contributing to discharge delay within 2 hours were categorized into coordination of discharge medications, family education (epinephrine autoinjector [epipen] teaching, medication compliance, asthma management plan), vaccinations, social barriers (interpreter, working with case management to set up outpatient follow-up), and transportation (see Table). Discharge medications and education were the most commonly identified reasons for delay in the asthma patients. For some delayed discharges, it was not possible to identify a reason for the delay via chart review, and for other delayed discharges, more than 1 reason contributing to the delay was identified.

DISCUSSION

The aims of this study were to assess medical readiness for discharge throughout the day, to understand time from MRD to discharge as a metric of discharge efficiency, and to categorize types of discharge delays by analyzing 4 pediatric hospital medicine diagnoses. This work demonstrates that MRD occurs throughout the day, and the time differs by diagnosis. Common reasons for delays were identified by diagnosis, with asthma patients having the most frequently delayed discharges due to patient education and discharge medication coordination.

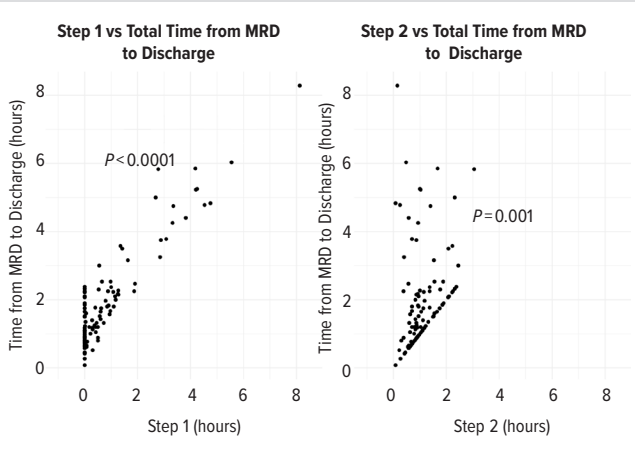
Figure 3. Duration (in hours) of Discharge Process



Abbreviation: MRD, medical readiness for discharge.

Note: Sixty discharges were found to be timely (<2 hours from MRD to time of discharge) and 40 discharges were delayed. Each dot or triangle represents a single patient. Line represents the median time.

Figure 4. Relationship Between Step 1 and the Total Time From MRD to Discharge vs the Relationship Between Step 2 and the Total Time From MRD to Discharge



Abbreviation: MRD, medical readiness for discharge.

Each dot represents a single patient.

Medical Readiness for Discharge Throughout the Day

This study demonstrated MRD occurred throughout the day, suggesting time of discharge (eg, discharge before noon) may be a less important goal compared to time of discharge relative to time of MRD. Additionally, these data reveal the need for individualized discharge goals by diagnosis, as patients admitted for asthma and hyperbilirubinemia tended to be medically ready in the morning, whereas patients with BRUE and ROS tended to have MRD in the afternoon. MRD occurring throughout the day requires frequent assessment of readiness for discharge to prepare for prompt

discharge within 2 hours of MRD. To facilitate frequent assessments and communication of patient MRD status within the team, next steps for this project include implementing diagnosis-specific alerts to clinicians notifying them when patients are reaching MRD. This tool will allow for the ability to assess MRD throughout the patient's hospitalization and allow more foresight into potential discharge planning needs, rather than rushing in the final hours to discharge the patient.

Additionally, 21% of patients achieved MRD outside of standard discharge hours of 8 AM to 8 PM. This may suggest benefit in reassessing current practices around standard discharge timing and the benefit of considering encouraging discharges at alternative times to better align with a patient's specific MRD. Additional consideration would be needed regarding the logistical implications to be able to best support off-hour discharges, such as access to discharge medications and transportation, in addition to the potential impact on other high stakes metrics, including patient satisfaction scores.

Time from Medical Readiness to Discharge

When examining all 100 discharge events together, the overall duration from MRD to discharge was 1.7 hours, which met the 2-hour goal. However, the results varied significantly when the duration of MRD to discharge by diagnosis and by timely versus delayed discharges was examined. Asthma discharges were identified as exceeding the 2-hour goal from MRD to discharge. When comparing timely discharges to delayed discharges, the MRD to discharge was significantly longer in the delayed discharges (3.2 hours) versus the timely discharges (1.2 hours). The data from this study support the conclusion from the study by White et al that the 2-hour goal from MRD to discharge is an aggressive yet realistic target, as MRD to discharge in timely discharges across diagnoses was 1.2 hours, and 60 of 100 discharges were less than 2 hours.[10]

Time from MRD to discharge was subdivided into MRD to discharge order (step 1) and discharge order to discharge (step 2) to identify areas for targeted interventions. As displayed by Figures 2 and 3, there is more variability and opportunity for improvement in step 1 than step 2. This finding suggests the cause of discharge delay could be a delay in recognition of MRD or the team needing to complete additional logistical discharge needs during the timeframe of MRD to discharge order, such as sending prescriptions or arranging home supplies.

Discharge Delays

Forty of 100 discharges were delayed greater than 2 hours. Asthma discharges were most frequently delayed, and the most identified reasons for the delays were discharge medications and patient education. However, of the 4 diagnoses, asthma requires more involved discharge planning because it is most likely to require discharge medications and in-depth education. Previous studies also have shown asthma to be the diagnosis associated with most frequent discharge delays.[10,11] Next steps include targeted interventions to address frequent reasons for delays, such as patient education with the asthma management plan and discharge medications occurring earlier in the patient's hospitalization.

Next Steps

This work provides the foundation for the future development of condition-specific discharge readiness pathways. With the understanding that MRD to discharge order (step 1) is the period with most frequent delays, future efforts will focus on this period to improve efficiency within the discharge process. Next steps include developing a tool within the EHR with alerts to clinicians indicating completion of discharge criteria for common diagnoses. This tool would assist in reducing delays in recognition of MRD and facilitate real-time communication of MRD to various team members. Future studies will focus on whether implementation of an EHR alert tool decreases duration of MRD to discharge order, frequency of discharge delays, and LOS.

In addition to delayed recognition of MRD, there is likely also a component of challenges in logistical preparation leading to discharge delay. This study identified patient/family education and discharge medication coordination to be the most frequent reasons for delay—especially within asthma discharges. Examples of future targeted interventions include providing families with a quick-response (QR) code linked to videos with frequently asked questions for common diagnoses and earlier communication with pharmacy regarding discharge medications.

Limitations

The described study has several limitations. The review was completed at a single center and includes only 100 patients admitted for 4 diagnoses. This study would benefit greatly from a multicenter approach and further analysis to include additional diagnoses. It would be beneficial for future work to complete a similar review including additional diagnoses with more complex discharge planning. Additionally, this analysis of discharge is based on timing of documentation, which may not be an accurate representation of real-time completion of medical criteria or time of discharge. Further, definitions of MRD used may differ from the clinicians who were caring for the patient at the time, as in practice medical readiness can be more subjective. Furthermore, the patient/family may have a different perception of patient readiness and comfort level for discharge than the medical team.[12,13] The study did not account for systems or social issues that contribute to discharge delays. Given that local practices typically discharge during daytime hours, the timing of MRD was adjusted to align with those hours for patients who met their discharge criteria overnight. Further analysis of time from MRD to discharge—regardless of when MRD is met—would be beneficial to assess benefits of adjusting standard discharge timing. Finally, other quality

improvement efforts were in progress during data collection, which may have affected this analysis.

CONCLUSIONS

The results of this study favor examining discharge efficiency as MRD to discharge rather than by time of day. Furthermore, there may be benefit in considering diagnosis when determining MRD, as this may allow for anticipation of diagnosis-specific discharge needs to reduce the likelihood of delays. This work is the foundation for development of diagnosis-specific medical readiness for discharge pathways to reduce discharge delays and decrease LOS in pediatric hospital medicine patients.

Financial Disclosures: None declared.

Funding/Support: None declared.

Acknowledgements: This work was presented on April 29, 2023, at the Academic Pediatric Association Quality Improvement Research Conference poster session in Washington, DC, and on May 1, 2023, at the Pediatric Academic Societies Meeting poster session in Washington, DC. The authors would like to thank Robyn Woolever and Elizabeth Berkowitz for their contribution to this project.

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Community Paramedic Pilot Program Operational Metrics and Impact on Patient Emergency Medical Services Utilization

Michael Mancera, MD; Nicholas Genthe, MD; Megan Gussick, MD; Michael Lohmeier, MD; Manish Shah, MD, MPH; Paul Hick, DO; Christopher Carbon; Gail Campbell; Andy Stephani, RN

ABSTRACT

Introduction: Community paramedicine (CP) is an expanding area of interest within the field of emergency medical services. Few studies have established operational metrics and outcome measures for CP programs. We aimed to evaluate change in 911 use and operational metrics among patients enrolled in a pilot, fire department-based, CP program.

Objective: The purpose of this study was to determine if the ongoing CP program decreased unscheduled emergency health care utilization among high utilizers. It was hypothesized that the implementation of community paramedicine visits would reduce 911 calls among this cohort.

Methods: A retrospective cohort study of adults enrolled in a CP program during 2016 to 2020 was performed. Patients were enrolled in the CP program if they frequently used a community emergency department or 911 services. This was defined as greater than 4 uses in the past 12 months. A select group of experienced paramedics received targeted training in relevant concepts. Paramedics frequently contacted patients via both in-home visits and phone calls based on perceived clinical need. Through a review of electronic medical records, we collected patient demographic and clinical information and program operational metrics. The primary outcome of interest was the change in 911 use after enrollment. These 2 groups were compared using a paired *t* test.

Results: Of 33 patients who met inclusion criteria, 29 were successfully enrolled. Pre-enrollment 911 calls averaged 31.8 calls per month. Post-enrollment 911 calls averaged 14.2 calls per month. Average calls per month decreased by 54.2% ($P = .003$) post-enrollment, a reduction of 207 calls per year across the cohort. Length of program enrollment also was found to have a greater impact on 911 call reduction.

Conclusions: A fire-department based CP program effectively reduced 911 calls for high utilizer emergency medical services and emergency department patients by 54.2%. Program participation for 6 months or longer was associated with greater reductions in 911 calls, regardless of the number of existing comorbidities.

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INTRODUCTION

There are approximately 37.6 million emergency medical services (EMS) responses annually in the United States, including 23.6 million that result in transport.[1] A significant portion of these EMS responses in the US are nonemergent, and it is estimated that nonemergent calls can account for 20% to 40% of all 911 calls.[2] This overutilization has been shown to contribute to resource strain, increased cost, provider burnout, and system inefficiency.[2] New prehospital delivery methods are being explored to reduce avoidable EMS utilization. Recently, this has led to the innovative concept of community paramedicine (CP), also commonly referred to as mobile integrated health care.

CP is an evolving practice, and programs typically are designed to address specific local issues affecting the health care system. However, programs vary widely in their scope and design. Most rely on collaborations between EMS and other health care and social service providers.[3] Interest in CP has grown substantially in recent years to improve access to and quality of care. Some of the delivery system problems targeted by CP programs include the overuse of the 911 system, the need for alternative means to manage patients who do not require transport to an emergency department (ED), repeat ED visits, and hospital readmissions. As these programs become more prevalent across the country,

evaluation of their effect on patient care and system utilization has become paramount.

Prior studies have suggested the benefits of CP programs to reduce the utilization of unnecessary emergency services; however, detailed analysis of program demographics and operational data is not well described.[4-8] Therefore, we sought to evaluate our newly implemented CP program's effect on 911 utilization in addition to the program's operational metrics. The results of this study will be used to assess the program's efficacy and to guide the development of future CP programs.

METHODS

Program Description

This is a descriptive analysis and retrospective chart review of a fire department-based paramedic EMS service CP program in a midsized Midwestern city. Program participants were identified as high utilizers of the ED and/or EMS service who reside within the response jurisdiction. A high utilizer was defined as a patient who had initiated EMS services with a 911 call 4 or more times in the prior 12 months or a patient who had 4 or more visits to the ED within the prior 12 months. Eligibility included providing a valid address for home consultation. The CP program identified and contacted eligible candidates for participation. Upon providing their consent, candidates then enrolled in the program. Providers were paramedic level trained and completed additional targeted training and instruction on motivational interviewing. Patient contact from CP providers was conducted through both in-person home visits and telemedicine visits. The first visit was a community health consultation and assessment of the patient's overall health, which included the development of a personalized plan for future visits. After initial evaluation, the frequency of future visits was determined between the patient and paramedic according to each individual patient's primary health goals and perceived need. Visits were conducted in the patient's home or an agreed upon community meeting place. Community paramedics attempted to reach patients by phone and scheduled structured time for visits. Unscheduled visits occurred occasionally if patients could not be contacted by phone. After each patient contact, community paramedics documented a summary of the visits through the electronic reporting software. Each home visit also was entered into the computer-aided dispatch system in real time for provider safety and community paramedic tracking purposes.

Data Collection

Data were obtained through retrospective chart reviews using the prehospital electronic medical record (ImageTrend, Lakeville, Minnesota) during May 2016 to February 2020. This study was deemed to be Institutional Review Board (IRB) exempt by the University of Wisconsin's online IRB evaluation tool. Specific data obtained from ImageTrend included EMS calls, community health home visits, and telehealth contacts, as well as patient demographic data and past medical history. A summary of each community health visit or 911 call also was available through a free text option completed by the community paramedics.

Community paramedic home health visits began in May 2016, identifying 33 patients and ultimately enrolling 29 into the program through February 2020. Participants remained in the program until they either reached their specific goals and were determined to no longer require services, moved out of department jurisdiction, dropped out of the program, or died. The primary outcome of 911 calls among patients enrolled were analyzed both pre- and post-enrollment. In addition to 911 call

Table 1. Enrolled Patient Demographics in the Community Paramedicine Program

	N	%
Race		
White	17	58.6
African American	11	37.9
Other	1	3.4
Sex		
Male	4	13.8
Female	25	86.2
Age		
18 – 24	0	0
25 – 34	1	3.4
35 – 44	4	13.8
45 – 54	5	17.2
55 – 64	8	27.6
65 – 74	5	17.2
75+	3	10.3
Missing age	3	10.3
Chronic disease		
Hypertension	6	20.7
Diabetes	7	24.1
Pulmonary disease	10	34.5
Chronic kidney disease	1	3.4
Rheumatologic disease	3	10.3
Mental health	13	44.8
Substance abuse	9	31.0
Single comorbidity	11	37.9
Multiple comorbidities	18	62.1

Table 2. Number of Patient Contacts and Contact Modality Utilized in the Community Paramedicine Program

	N	%
Total community paramedicine contacts	1371	100
Home visits	742	54.1
Telehealth contacts	629	45.9
Home visits 1 provider	425	57.3
Home visits 2 providers	317	42.7
	Cohort Total	**Average**
Patient-months	503	13.0/patient
Home visits	742	1.5 / patient / month
Telehealth contacts	629	1.2 / patient / month

data, operational matrix data were collected, including the total number of in-person visits, total number of telephone communications, and number of paramedics utilized for each visit. A 1-year retrospective chart review was done to establish baseline 911 call utilization for each participant. As participants engaged in the program, their 911 calls were tracked and calculated as a rate of 911 calls per month. If a participant died or became unenrolled in the program prior to 1 year post-intervention, the total number of months they were actively enrolled in the program was used for the final calculations. Independent t tests were performed to compare in group differences in baseline and subsequent measurements. A summative analysis of program operation metrics also was performed by retrospective review of ImageTrend reports for each encounter.

Table 3. 911 Calls per Month Pre-enrollment vs Post-enrollment in the Community Paramedicine Program

Length Enrolled	N	911 Calls/Month Pre-enrollment	911 Calls/Month Post-enrollment	911 Calls/Month Difference	*P* value
Entire cohort	29	31.85	14.61	17.24 (54.2% reduction)	0.003
0–6 months	9	7.66	5.97	1.69 (22.1% reduction)	0.314
7–12 months	11	13.56	5.65	7.91 (58.4% reduction)	0.072
13+ months	9	10.62	2.97	7.65 (72.3% reduction)	0.018
Single comorbidity	11	11.55	5.06	6.49 (56% reduction)	0.084
Multiple comorbidities	18	20.34	9.54	10.80 (53.4% reduction)	0.027

RESULTS

Of the 29 participants who were successfully enrolled in the CP program, 11 remained enrolled in the program at the end of the study period. Five successfully graduated from the program and no longer needed services. Six patients moved outside of the fire department's jurisdiction while actively enrolled, 4 participants dropped out of the program, and 3 participants died while enrolled in the program. Table 1 describes the patient cohort.

A total of 1371 community paramedic patient contacts were made over a 46-month period. Each participant remained enrolled in the program for a varying degree of time. Operation metric data related to community paramedicine visits performed can be seen in Table 2.

Prior to enrolling in the program, participants in the cohort averaged 31.85 calls per month. This resulted in an average of 1.10 (+/- .20) calls per month per participant. After enrollment, the cohort averaged 14.16 calls per month, or .504 (+/- .13) calls per month per participant. Overall, this represents a 54.2% ($P = 0.003$) reduction in 911 calls after program enrollment (Table 3). On average, each patient reduced their utilization of 911 services by 7 calls per year, resulting in a potential reduction of 207 calls per year collectively for the program participants.

The average participant was enrolled in the program for 405 days. Nine patients were enrolled in zero to 6 months, 11 were enrolled 7 to 12 months, and 9 were enrolled for 13 months or more. Table 3 shows sub-analysis of participants 911 call reduction related to length of program enrollment.

Of the 29 patients in the pilot program cohort, 11 had only 1 identifiable medical comorbidity, and 18 had multiple comorbid conditions. Table 3 shows the average 911 call reduction when the cohort is analyzed based on initial chronic comorbidities at the time of enrollment. Table 3 shows a summary of the sub-analysis in EMS utilization pre-enrollment compared to post-enrollment in the pilot program.

DISCUSSION

While enrolled in a fire department-based CP program, participants with high EMS utilization had a significant reduction in 911 calls. These findings suggest that CP programs may be effective in reducing 911 utilization among high utilizer patients and add to the literature supported in prior studies.[4-8] In addition, the demographic data and operational metrics of this program provide new insight into the sustainability and the resources required to replicate this type of program.

Surprisingly, the number of comorbidities did not affect the reduction in 911 calls when enrolled in the program. Prior studies have suggested that repeated ambulance use is highly correlated to medical comorbidities such as chronic obstructive pulmonary disease, chronic alcohol use, and mental illness.[9] For this reason, it was postulated that the more medical comorbidities a patient has, the more they could benefit from a community paramedic program. However, when the patient cohort was separated by number of preexisting medical conditions, a similar reduction in 911calls per month between the single comorbidity cohort and multiple comorbidity cohort (56.0% and 53.4%, respectively) was found, although this was insignificant for the single comorbidity cohort. A trend that was established suggests a similar reduction in 911 calls across both groups regardless of the number of comorbid health conditions and is likely insignificant as a result of being underpowered in this analysis. This suggests that patients with single and multiple comorbidities can both benefit from CP programs. Interestingly, a high percentage of participants had mental health as a comorbidity. This subgroup was not analyzed separately, however is an area of interest for future programs within our system. These demographic data suggest a benefit to a wide variety of patient populations.

There is limited previous analysis regarding patient characteristics and length of patient program enrollment in relation to reduction in 911 call volume. When participants were analyzed further according to their length of program enrollment, a clear trend developed linking length of enrollment to 911 call reduction. The longer patients were enrolled in the CP program, the greater their reduction in 911 calls per month. While these findings were not

statistically significant, a strong trend was established suggesting that outcomes would become significant with additional participants over time. A review of existing literature did not yield any current studies that quantified the benefits of CP programs based on length of enrollment. It appears that program participation for at least 6 months correlated with a significant decrease in 911 utilization, while participation for shorter time frames showed a less significant reduction. Given the reduction seen with longer enrollment, we suggest that an anticipated enrollment duration of greater than 6 months may need to be considered by programs prior to participant enrollment. This longer duration needed for maximum benefit was not anticipated during the early stages of our program development and would have aided in appropriate personnel and resource planning. It also suggests that the longitudinal relationships CP providers develop with their patients may be beneficial in reducing EMS utilization.

The secondary outcomes of interest were specific to the program's operational metrics. This is a novel description that is scarcely represented in the current literature. This analysis found that most patient contacts were in-person home visits supplemented with telephone communications. We also found that most home visits were completed by a single paramedic, although many required 2 providers to address concerns for provider safety. These benchmark data can be beneficial in the creation and replication of similar CP programs. Specifically, this may drive decisions regarding personnel staffing models and the number of providers required to complete to the program's anticipated workload. Time spent during each encounter may vary and was not captured in this analysis; however, having baseline knowledge of the number and types of contact anticipated may again be of benefit for resource planning.

A limitation of this study is the small number of patients enrolled (n=29). An additional limitation to this study is the lack of a true control arm. Future analysis of programs would benefit from an increased number of participants as well as a control group consisting of patients who qualified for the program but did not enroll. Further analysis of CP programs also could correlate any reduction in 911 utilization to ED visits, hospital admissions, and readmission rates. Cost analysis was not performed for this study.

CONCLUSIONS

A fire-department based CP program effectively reduced 911 calls for high utilizer EMS and ED patients by 54.2%. Participation in the program for 6 months or longer was associated with greater reductions in 911 calls. Most contacts were home visits requiring a single EMS provider. These findings can be utilized to inform the development of future CP programs.

Financial Disclosures: None declared.

Funding/Support: None declared.

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Climate Change Vulnerability and Opportunities for Adaptive Capacity in Patients with Heart Failure in an Ambulatory Setting

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ABSTRACT

Introduction: Climate change, a global crisis, affects health through changes such as more intense and longer lasting heatwaves. Some populations are more vulnerable to such events, including those with certain medical conditions, like heart failure. This study aimed to improve understanding of heat-related vulnerabilities and opportunities to enhance adaptive capacity of patients within an ambulatory heart failure clinic.

Methods: Heart failure clinic patients at the Clement J. Zablocki VA Medical Center in Milwaukee, Wisconsin, voluntarily completed a 25-question multiple-choice survey. We present descriptive statistics of the survey responses with count and percentage for categorical responses.

Results: We found that out of 60 survey respondents, 46.55% agreed or strongly agreed they would benefit from discussing heat illness risks with their physician, and 31.58% were not aware their heat illness risk is higher on days hotter than 90 °F (32.2 °C). Several vulnerability factors were common: 70.69% follow a prescribed fluid restriction, 33.33% live alone, 20.34% lack a car with air conditioning, and 20.00% worry about their ability to pay electric bills. Notable knowledge gaps included 65% do not check forecasted temperatures, 60% do not plan activities for the coolest times of day, 43.10% lacked awareness of cooling centers, 33.33% were unsure of heat illness symptoms, and 27.12% lacked awareness of Wisconsin's Focus on Energy program.

Conclusions: A sizable portion of survey respondents indicated they would benefit from discussing their heat illness risk with their clinicians, and many underestimated their personal risk of heat illness. Additionally, multiple vulnerability factors were highly prevalent and knowledge gaps were demonstrated in this population. Our findings support adaptive capacity opportunities through heat illness education, anticipatory guidance, and increased resource awareness for patients with heart failure in an ambulatory setting.

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INTRODUCTION

Climate change is a global crisis affecting human health. Extreme heat events are projected to continue to increase in severity, frequency, and duration.[1] Increases in extreme temperature events are accompanied by rising heat-associated morbidity and mortality.[2] Heat waves have been shown to have a negative impact on cardiovascular health, particularly in vulnerable populations.[2-4] Patients with heart failure are more susceptible to these events due to their decreased ability to thermoregulate, in part due to medications they may be prescribed to treat their disease, such as diuretics.[5]

Prior studies have focused on heart failure patients' knowledge of their disease or patients' awareness of their cardiovascular disease risk.[6] Other studies have assessed patient views on climate change and health.[7,8] However, there is a lack of knowledge regarding heart failure patients' awareness of their elevated risk of climate change-related heat events and their ability to adapt and prevent harm.

Patients are receptive to learning more about how their health is affected by climate change.[8] In addition, a majority of physicians believe climate change is impacting their patients' health.[7] Yet, both patients and physicians report rarely discussing climate and health during patient visits.[7,9] Some studies describe ways that patients may adapt to protect their health during elevated temperatures. Patients taking certain cardiac-related medications, such as diuretics, may need closer monitoring—especially during heat events,[2] which are defined as high humidity and temperatures

greater than 90 °F for at least 2 to 3 days.

In general, health risk awareness and adaptation may reduce morbidity and mortality. Patients with heart failure are more susceptible to illness related to extreme heat exposure. Patient-clinician dialogue and plan building can minimize the risk of heat-related illness in patients living with heart failure. Therefore, we found it important to improve our understanding of the opportunities for education and resources that can aid in awareness of and adaptation to heat illness. The objectives of this study were to identify the current level of heat-risk awareness in patients with heart failure, assess the prevalence of heat-risk vulnerabilities within this population, and understand their current resource awareness with the goal of identifying potential opportunities to build adaptive capacity.

Table. Demographic Characteristics of Survey Participants

Characteristic	n (%)
Age	
47-75	25 (41.67)
75+	35 (58.33)
Race	
White	40 (66.67)
Other	20 (33.33)
Education	
High school degree or less	15 (26.32)
Some college, no degree	25 (43.86)
Associate degree or higher	17 (29.82)
Area	
Urban	36 (62.07)
Rural	22 (37.93)

METHODS

Study Population

Study participants were recruited from the heart failure clinic at Clement J. Zablocki VA Medical Center in Milwaukee, Wisconsin, during January through March 2023. Participants had to be 18 years of age or older. Those without medical decision-making capacity were excluded from the study. Patients are typically referred to the heart failure clinic for multiple hospital admissions related to heart failure, difficulty managing volume status, and/or medication titration. Clinic providers include a nurse practitioner and 2 cardiologists. Collectively, the providers complete about 30 patient visits per week.

Survey Design and Implementation

A 25-item survey was designed based on a content expert literature review. Questions were reviewed by all study personnel and a survey design expert to ensure clarity for a basic literacy level. The study team further refined questions through cognitive interviewing of 6 individuals without a background in health care. The study process was piloted with 5 patients without any major flaws.

Six survey questions requested basic demographic data, with the option of "prefer not to answer" for most (Appendix). The remaining survey questions assessed participants' understanding of the link between heat exposure and their health, vulnerabilities to heat illness, understanding and access to adaptation strategies, and awareness of and interest in related resources.

Participants were recruited by study personnel—a clinic nurse practitioner—to voluntarily complete a survey in the clinic after their scheduled appointment. The study personnel provided a short, scripted description of the study to the participant and was available for any questions. In addition to the paper survey, participants were provided with an informational handout. Informed consent was not needed. Surveys were returned to the study personnel upon completion. (The survey and handout are included in the Appendix.)

The Clement J. Zablocki VA Institutional Review Board determined this study to be exempt on December 15, 2022.

Statistical Analyses

All analyses were done in R version 4.0.3 (R Core Team). A P value <0.05 was considered statistically significant. Summary characteristics were reported with count and percentage. Comparisons of variables were made by age (<75 vs 75+), race (White vs other), area (rural vs urban), and rating on the perceived benefit of discussing heat exhaustion with a physician (strongly agree/agree vs strongly disagree/disagree/neutral). Chi-square tests were used for these comparisons. Variables with cell sizes less than 10 were not included to maintain the VA policy regarding nonidentifiable data. Study author AT had full access to all study data and takes responsibility for its integrity and the data analysis.

RESULTS

Demographics

Of the 60 survey respondents, 58.33% were 75 years or older, and a majority reported their race as White (66.67%). Most participants indicated they live in an urban area (62.07%) and have some post-high school education (74.68%) (Table).

Prevalence of Heat Illness-related Risk Factors

Most survey respondents indicated that they follow a prescribed fluid restriction (70.69%). A third (33.33%) reported living alone, and nearly a fifth (18.97%) did not feel comfortable asking a neighbor for help. Many did not have a car with working air conditioning (20.34%) and worried about paying their electric bill during the past summer (20.00%).

Awareness of Heat Illness-Related Risk Factors

When asked if being outside on a very hot (>90 °F or 32.2 °C) or humid day puts their health at risk, 31.58% of survey respondents failed to recognize their health is at risk. The most identified heat illness symptom was dizziness (58.33%), followed by confusion (48.33%); nausea or vomiting (45.00%); heavy sweating (45.00%); cold, pale, clammy skin (40.00%); headache (38.33%);

fainting (38.33%); muscle cramps (35.00%); and decreased urination (18.33%). A third (33.33%) of respondents indicated they were unsure of heat illness symptoms.

Awareness of Strategies, Programs, and Resources for Adaptive Capacity

Participants were asked about their awareness of several community resources: 27.12% of respondents were unaware of the state's energy efficiency program, Wisconsin's Focus on Energy,[10] and 43.10% were unaware of their communities' cooling and charging centers.

When asked what steps they take to protect themselves during very hot or humid weather, the majority of respondents reported they stay indoors (81.67%) and/or turn on the air conditioner (70.00%); less than half increase water intake (45.00%) and/or plan outdoor activities for the coolest times of day (40.00%). In particular, respondents aged 75 years or older were less likely than those younger than 75 to plan outdoor activities for the coolest times of the day ($P=0.03$). Most respondents (65%) reported not checking the forecasted temperature.

Receptiveness to Heat Illness Risk Education

Respondents were asked if they felt they would benefit from discussing their risk of heat illness with their physicians: 46.55% agreed or strongly agreed, 36.21% were neutral, and 17.24% disagreed or strongly disagreed.

About 25% of patients invited to participate in the study declined. Their reasons included visual impairment with lack of usual visual aids, ie, glasses, concern about time before another visit, and lack of interest.

DISCUSSION

Vulnerability to heat events varies among different populations. Understanding how specific populations—such as those with heart failure—are vulnerable may inform strategies to preserve health during prolonged or excessive heat exposure. Wilhelmi and Hayden's framework for extreme heat vulnerability consisted of 3 components: exposure, sensitivity, and adaptive capacity.[11] They stressed the value of evaluating the knowledge and access to resources for coping with extreme heat events in order to understand the adaptive capacity of a specific population. To our knowledge, our study is the first to evaluate heat exposure knowledge, perspectives, and resource access of patients within an ambulatory heart failure clinic. We found several common vulnerabilities and knowledge gaps, which may elucidate opportunities to build adaptive capacity.

All of our study participants had 1 or more causes for impaired thermoregulation: a diagnosis of heart failure; prescription treatments, including diuretics and fluid restrictions; and/or age 65 or older. While many survey respondents were aware they were at increased risk for heat illness and were interested in discussing their risk with their physicians, nearly a third did not understand their risk and/or saw no potential benefit in discussing this topic with their physician. This knowledge gap is particularly striking considering that about 75% of the respondents had some post-high school education and could be considered a relatively educated patient population. This finding aligns with prior research showing that within a generalized population among people aged 65 or older, 35% believed heat waves pose no potential for personal harm.[12] The mismatch between perceived and actual risk related to heat exposure supports the need for effective patient education. Such education may aim to help patients with heart failure understand that their medical condition, along with its treatment, makes them more susceptible to heat illness and the precautionary measures they may take.

Our findings suggest knowledge gaps in multiple precautionary measures. While many respondents reported staying indoors and using air conditioning, a majority of participants reported not checking the temperature forecast or planning activities for the cooler times of day, including those older than 75 years. With this age group being less informed, focused education on planning outdoor activities may be more important—particularly as these individuals are also at higher risk due to less ability to physiologically compensate upon heat exposure.[5]

Helping patients identify symptoms of heat illness may be another opportunity for patient education. One-third of the study participants were unsure of these symptoms. Being aware of heat illness symptoms may allow patients to recognize the need for medical care promptly and take precautionary measures. Heart failure patients are already educated on monitoring for signs of poorly controlled heart failure, such as increasing home weights and difficulty breathing. Education regarding these and similar topics through disease management programs and patient navigator programs have been shown to improve self-care behaviors and decrease hospital readmissions in heart failure patients.[13-17] Expanding this education to include signs of heat illness may similarly reduce health care use.

In terms of demographics, a majority of survey respondents lived in an urban setting. Heat distribution in urban areas with decreased natural ground cover results in urban heat islands and increased exposure to heat.[11] A majority of respondents reported protecting themselves from excessive heat exposure by air conditioning their home. However, a fifth of respondents reported worrying about being able to pay their electric bill in the past summer. This is similar to the American Council for an Energy-Efficient Economy (ACEEE) finding that 25% of all US households experience a high energy burden, paying more than 6% of their income on energy bills.[18] Unfortunately, over 25% of our respondents were not aware of Wisconsin's Focus on Energy program, which can provide assistance with paying energy bills. Connecting more patients to energy efficiency and financial assistance programs may help preserve health.

Cooling centers are another strategy for reducing excessive heat exposure, particularly for those living in urban areas. Yet, 43% of survey respondents reported not being aware of cooling centers within their community. Hayden et al found a similarly low awareness of cooling centers in their study of household-level adaptive capacity among residents of Houston, Texas.[19] In addition to poor public awareness, access to centers is a challenge. Kim et al compared cooling centers across 25 US cities and found that only 10.3% were within walking distance from their home.[20] Our study showed that about 20% of participants lacked a car with working air conditioning. Health care professionals may improve the utilization of cooling centers by raising public awareness through patient education and providing resources for air-conditioned transportation services on high-heat days.

Despite most respondents living in an urban setting close to neighbors, a third reported living alone and nearly a fifth noted feeling uncomfortable asking a neighbor for help when not feeling well. Living alone was found to be a significant risk factor for heat-related death in the Chicago 1995 heatwave, while social contacts were protective.[21] Targeted patient outreach during high-heat days may be a solution for reducing the risk of heat-related death. Patients may also be counseled on contacting a support person for help during a heat event.

Next steps include developing and studying interventions aimed at reducing risk and preserving the health of patients with heart failure. Such interventions may include educating patients on precautionary measures and signs and symptoms of dehydration and connecting patients to available resources, including energy efficiency programs. This study also may serve as a model for future studies of other patient populations with increased vulnerability to climate change, such as those with chronic obstructive pulmonary disease or asthma.

Limitations

Our study was limited by a small sample size and a single institution. Our findings may not generalize to other VA clinics or the general public. Of note, the VA population includes a higher proportion of male patients, which may skew results. Despite these limitations, our approach may be leveraged in other clinical settings to identify and prioritize population-specific interventions.

CONCLUSIONS

Many knowledge gaps were observed in this population, including identifying signs and symptoms of heat illness, strategies to protect oneself during hot and humid days, and resources and programs available for assistance on hot days. These knowledge gaps not only support patient education and anticipatory guidance about heat illness for patients with heart failure in the ambulatory setting but also identify areas where patient knowledge is lacking and can be a focus for physicians.

Financial Disclosures: None declared.

Funding/Support: None declared.

Acknowledgments: Special thanks to Caitlin Rublee, MD, MPH, for her expertise and assistance in developing and reviewing the survey for this study.

Prior Presentations: 2023 Wisconsin Chapter ACP Annual Scientific Meeting, Wisconsin Dells, Wisconsin – Abstract poster presentation; 2024 ACP National Meeting, Boston, Massachusetts – Abstract poster presentation.

Appendix: Available at www.wmjonline.org

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Primary Care Clinicians' Satisfaction and Clinical Confidence After Participation in the Wisconsin Child Psychiatry Consultation Program

Jakob Anibas, BS; Cody Schreiner, MD; Jacob Elliot, MD; Amy Prunuske, PhD; Michelle Broaddus, PhD

ABSTRACT

Introduction: To help combat a shortage of child and adolescent psychiatrists and assist primary care providers in managing pediatric mental health care cases, the Medical College of Wisconsin established the Wisconsin Child Psychiatry Consultation Program. The program provides educational support to primary care providers with mild to moderate pediatric mental health concerns via phone or email consultation with board-certified child and adolescent psychiatrists, as well as offering on-demand didactic training sessions and assistance locating therapeutic resources.

Objective: We sought to assess participating primary care clinicians' satisfaction with consultations and their perceptions of program services, specifically its impact on self-reported diagnostic decision-making and patient outcomes.

Methods: Primary care providers' responses to both post-consultation and annual surveys were analyzed to determine the program's impact. Five survey questions used a 5-point Likert scale, and 1 "select-all-that-apply" question was included on the post-consultation survey.

Results: Overall, 99.2% of respondents were satisfied with their most recent consultation. Additionally, mean Likert scale scores assessing provider confidence after program enrollment in the areas of diagnosing (mean 3.7, SD 0.8), prescribing medications (mean 3.6, SD 0.9), and managing child mental health problems (mean 3.5, SD 0.9) were all significantly greater than provider confidence before enrollment ($P < 0.0001$ for all).

Conclusions: Our study revealed that most primary care providers utilizing the Wisconsin Child Psychiatry Consultation Program find it a valuable resource for diagnostic decision-making and improving patient outcomes. This suggests that expanded utilization of the program should be encouraged.

INTRODUCTION

The incidence of mental health problems in children has been increasing during recent decades, with approximately 15.7% of US high school students having made a suicide plan in 2019, up from 10.9% in 2009.[1,2] Wisconsin has especially struggled with child mental health, as nearly 16% of children had at least 1 major depressive episode in 2019, a 1.33% increase over 2 years.[3]

The rising cases of child mental health problems are particularly concerning because of a shortage of child and adolescent psychiatrists (CAPs).[4] The nationwide shortage has led to long appointment wait times for children with psychiatric concerns, with a study conducted in Ohio finding a 50-day median wait time for new patient appointments.[5] Wisconsin has not been immune to the CAP shortage, as all counties in the state are classified as having an insufficient supply of CAPs. Furthermore, of the 168 CAPs in Wisconsin, 67% are located in 3 counties (Dane, Waukesha, and Milwaukee), with no CAPs practicing in 44 of Wisconsin's 72 counties.[6]

Because of the CAP shortage, primary care providers (PCPs) play a central role in diagnosing and treating pediatric mental health problems and prescribing almost 85% of psychotropic medications taken by children.[7,8] However, many PCPs feel uncomfortable treating child mental health problems or have insufficient training in caring for these patients.[9,10] Therefore, the American Academy of Pediatrics recommends that they consult CAPs to diagnose and treat complex mental health problems in children and adolescents.[11]

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As a result of the CAP shortage and PCP discomfort in treating child mental health problems, the Medical College of Wisconsin (MCW) developed a child psychiatry access program called the Wisconsin Child Psychiatry Consultation Program (WI CPCP) in 2015, after receiving funding from the Wisconsin Department of Health Services.[12] The program in Wisconsin is part of the National Network of Child Psychiatry Access Programs, which promotes collaboration with other child psychiatry access programs such as the successful Massachusetts Child Psychiatry Access Project.[13,14]

The WI CPCP is available to all PCPs who care for pediatric patients in the state. The program supports its participating PCPs by providing consultative support, accredited continuing medical education, and resource support in all 5 regions of the state: Western, Northern, Northeast, Southeast, and Southwest. Consultative support is available to participating PCPs via phone or email on weekdays from 8 AM to 5 PM.[12] These consultations connect PCPs with a pediatric psychologist or board-certified CAP who can provide information on screening and diagnosis, medication management, and treatment recommendations.[15] Intake coordinators answer initial phone calls and emails to determine which type of mental health expert is best suited to serve the PCP's needs. Since its inception, the program has conducted more than 6400 mental health consultations for conditions such as attention deficit-hyperactivity disorder, anxiety, depression, and disruptive behavior.[12]

Despite providing thousands of child mental health consultations to PCPs, to our knowledge, there has been no research on the program and its promise of improving mental health care for children in Wisconsin. Therefore, the purpose of this study was to examine the effectiveness of the WI CPCP and evaluate how those who utilize the program's consultation services view its impact on diagnostic decision-making and patient outcomes.

METHODS

To evaluate the WI CPCP, 2 separate surveys were used: a post-consultation survey and an annual survey. Survey data and data related to PCP demographics, including credentials (physician, physician assistant, and nurse practitioner) and medical specialty (family medicine, pediatrics), were collected and managed using REDCap electronic data capture tools hosted by the Medical College of Wisconsin. Survey results were matched with PCP demographics using a record number. Response rates were defined as the number of surveys submitted divided by the total number of surveys sent.

We conducted a mixed methods study of the survey data using quantitative and qualitative analyses. The Medical College of Wisconsin's Institutional Review Board approved use of these data for this evaluation.

Post-Consultation Survey

Following each consultation, PCPs were emailed an optional survey regarding their satisfaction with their most recent consultation. Data were collected from April 1, 2021, through November 31, 2021.

For this study, we analyzed 6 post-consultation survey questions. Five questions used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Two questions measured PCP satisfaction with the encounter and whether they planned to utilize the WI CPCP again in future practice. Three questions were used to assess the potential impact of program services on patient care: whether PCPs agree that the consultation (1) resulted in a correct diagnosis or medication change earlier than without the WI CPCP, (2) helped postpone or forestall a child psychiatric referral or hospitalization, and (3) reduced patient risk of self-harm or suicide. Results of each were summarized by the percent of responses that agreed or strongly agreed with each statement and then stratified by PCP demographics as appropriate using analysis of variance.

The remaining question asked, "What would you have done regarding this patient if you did not have access to the Wisconsin Child Psychiatry Consultation Program?" with "select-all-that-apply" choices and an optional space for free-response comments if the respondent selected "other." The percentage of each response chosen was summarized. A phenomenological analysis of the free responses was used to derive an understanding of how the participants interpreted their experience using the program.

Annual PCP Survey

All PCPs participating in the program also were invited to complete an annual survey. From this survey, we analyzed 3 questions that used a 5-point Likert scale (1=strongly disagree to 5=strongly agree). These questions asked PCPs to rate their confidence in diagnosing child mental health problems, prescribing medications for child mental health problems, and management of child mental health problems. We used retrospective questions, probing PCP's confidence before and during their participation in the WI CPCP. Mean scores for each confidence question were calculated. The before and after means were then compared against each other for each respective question using 2-tailed paired-samples *t* tests in R v 4.1.1. (R Core Team, Vienna, Austria). PCP demographics, such as credentials and specialty, were not included in the analysis.

Ultimately, effectiveness of the WI CPCP was defined and measured by an increase in PCP confidence in the diagnosis and management of child mental health problems, including prescribing medications. after program enrollment.

RESULTS

Consultation Satisfaction

From April 1, 2021, through November 31, 2021, there were 708 consults and 242 responses (34.2%) to the post-consultation survey from 147 unique PCPs. PCPs used the consultation service and returned a post-consult survey an average of 1.6 times (range 1-11).

PCP Satisfaction

Nearly all (98.3%) of the respondents (198 physicians, 99%; 9 physician assistants, 100%; 31 nurse practitioners, 100%) agreed or strongly agreed that the consultation was satisfying. Overall, credentials had a significant effect only on satisfaction scores ($F[2276] = 15.5$, $P < 0.0001$]. Post-hoc comparisons using the Tukey-Kramer honest significant difference test indicated that the mean satisfaction score was higher among physicians (mean 4.9, SD 0.49) compared to physician assistants (mean 4.5; $F[2276] = 15.5$, $P < 0.01$) or nurse practitioners (mean 4.5; $P < 0.0001$).

Future Practice

Participants were asked to what extent they agreed that they would incorporate WI CPCP consultations into their future practice. Of the 237 responses, 96.2% (175 pediatric responses, 96.2%; 53 family medicine responses, 96.4%), agreed or strongly agreed that they would incorporate consultations into their practice in the future. There was no significant difference in the percentage of agreement between physicians, physician assistants, and nurse practitioners.

Consultation Effects

Hospitalization and Referral

There were 237 responses to the question regarding the extent to which participants agreed that consultation forestalled patient hospitalization or referral: 68.8% of respondents (120 pediatric, 66.3%; 43 family medicine, 76.8%) agreed or strongly agreed (Figure 1A). There was no significant difference in the percentage of agreement between physicians, physician assistants, and nurse practitioners.

Diagnosis and Medication Change

There were 217 responses regarding the extent to which PCPs agreed that consultation resulted in an earlier correct diagnosis or medication change: 70.5% of respondents (115 pediatric, 70.6%; 38 family medicine, 71.7%) agreed or strongly agreed (Figure 1B). There was no significant difference in the percentage of agreement between physicians, physician assistants, and nurse practitioners.

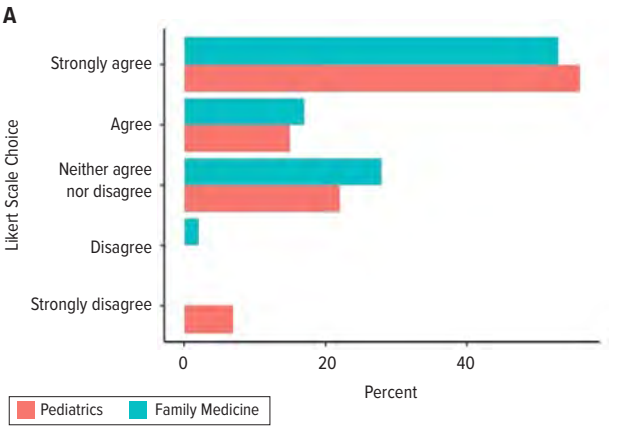
Self-Harm or Suicide Risk in Patients

There were 219 responses regarding the extent to which PCPs agreed that consultation reduced the risk of self-harm or suicide: 46.6% of respondents (71 pediatric, 43.3%; 31 family medicine, 56.4%) agreed or strongly agreed (Figure 1C). There was no significant difference in percentage of agreement between physicians, physician assistants, and nurse practitioners.

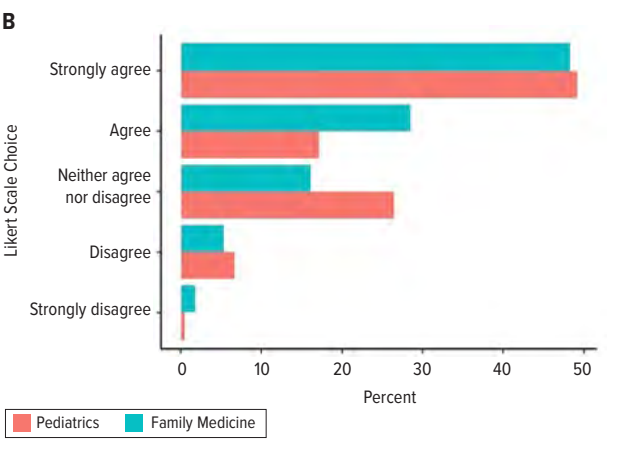
Wisconsin CPCP Alternatives

The post-consultation survey also asked which alternatives PCPs might have pursued if WI CPCP consultation had not been available. They could choose multiple options from a list of alternatives provided. There were 436 responses as follows: refer

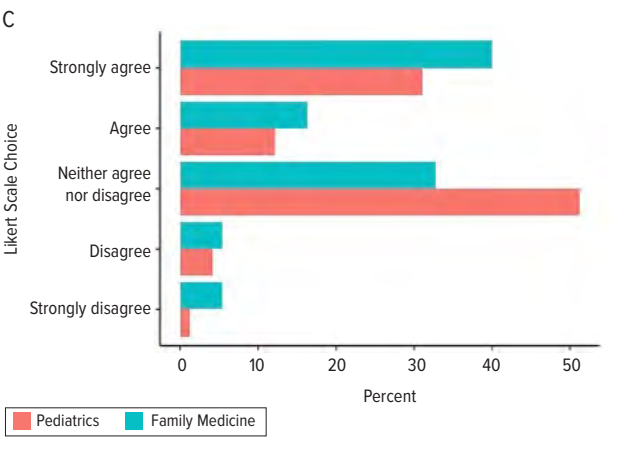
Figure 1. Responses to Survey Questions by Specialty[a]



A. Percentage of responses when asked to what extent participants agreed that WI CPCP consultation forestalled patient hospitalization or referral.



B. Percentage of responses when asked to what extent participants agreed that WI CPCP consultation resulted in an earlier correct diagnosis or medication change.



C. Percentage of responses when asked to what extent participants agreed that WI CPCP consultation reduced the risk of self-harm or suicide

Abbreviation: WI CPCP, Wisconsin Child Psychiatry Consultation Program.

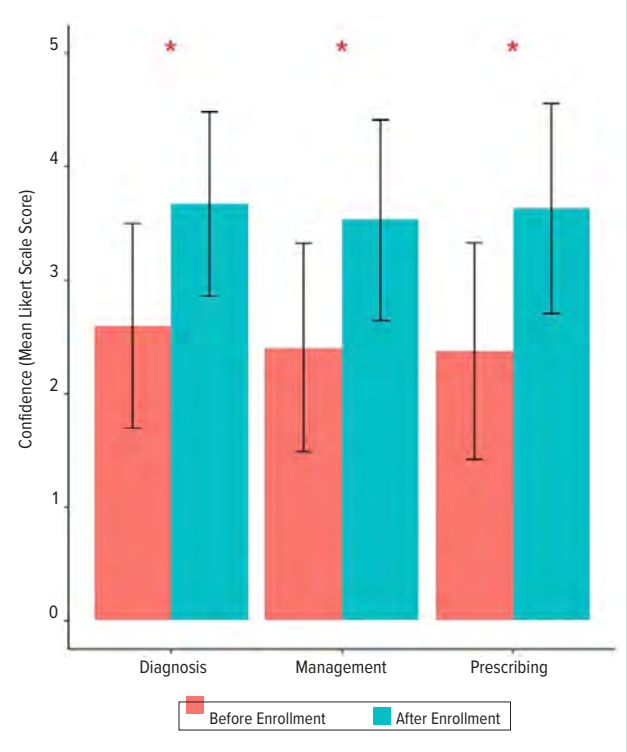
[a]Responses included physicians, physician assistants, and nurse practitioners as there was no significant difference in percentage of agreement.

to mental health (n=117, 26.8%), consult another professional (n=85, 19.5%), research on own (n=85, 19.5%), change medications (n = 66, 15.1%), monitor the patient (n = 27, 6.19%), continue medications (n = 22, 5.04%), send to the emergency department (n = 10, 2.29%), not applicable (n = 8, 1.83%), and other (n = 16, 3.67%). Of the 16 qualitative responses, 13% (n = 2) indicated that they would have given potentially incorrect advice, and 19% (n = 3) expressed that they would have been forced to wait long periods of time for psychiatry referral appointments.

PCP Confidence

As of March 28, 2022, the annual WI CPCP satisfaction survey had been sent to 1065 participating PCPs, with 118 responses (response rate = 11%). Overall scores for PCP confidence in diagnosing child mental health problems improved after enrollment in the program (mean pre-enrollment: 2.597 ± 0.90 vs mean post-enrollment: 3.67 ± 0.81; t(227) = -9.56; $P < 0.0001$). PCP confidence in prescribing medications for child mental health problems improved after enrollment (pre-enrollment mean: 2.38 ± 0.95 vs post-enrollment mean: 3.63 ± 0.92; t(231) = -10.2; $P < 0.0001$). Finally, PCP confidence in management of child mental health problems improved after enrollment (mean pre-enrollment: 2.42 ± 0.91 vs mean post-enrollment: 3.52 ± 0.87; t[225] = -9.27; $P < 0.0001$). PCP confidence before and after program enrollment is summarized in Figure 2.

Figure 2. Mean Likert Scale Scores Assessing Primary Care Providers' Confidence in Diagnosis, Prescribing, and Management of Child Mental Health Problems Before and After Enrollment in the Wisconsin Child Psychiatry Consultation Program



Responses included all primary care providers regardless of credentials or specialty.

*Represents a statistically significant difference in mean confidence scores before and after WI CPCP enrollment ($P < 0.0001$). Error bars represent standard deviation.

DISCUSSION

The WI CPCP is striving to address the lack of CAPs practicing in Wisconsin by working to improve the capacity of PCPs to effectively assess and treat pediatric mental health conditions. Importantly, program participants report that it is helping to positively impact patient outcomes, specifically by forestalling hospitalization and/or referral. With referral wait times often exceeding 3 months, a reduction in the need for escalation of care is one way that the WI CPCP is working to improve child mental health in the state. Additionally, participating PCPs indicated that they are making evidence-based, informed decisions quicker than they would have without consultation, and a subset of PCPs indicated that consultation helped to reduce the patient's risk of self-harm/suicide. Finally, PCP confidence in diagnosing, managing, and prescribing medications for child mental health problems increased significantly after program participation, demonstrating that the WI CPCP is effective as defined by our study. Overall, the vast majority of PCPs utilizing this service are satisfied with the consultation recommendations they received and plan to continue incorporating these consultations into their practice.

Despite these widely positive findings, this study has several limitations. First, our study design did not allow us to accurately track the Rural-Urban Commuting Area (RUCA) codes of enrolled providers. Because there may be a difference in results based on geographic location, future studies should examine RUCA codes to evaluate satisfaction and clinical confidence in the program. Furthermore, understanding the program's effectiveness in rural settings is important as rural areas are disproportionately affected by the CAP shortage.[16]

Another limitation of this study was a relatively low response rate among program participants, which may be due to PCPs' demanding work schedules or the increasing demand to participate in such studies.[17] Additionally, the study relied on self-reported data, and future studies should examine the impact the COVID-19 pandemic had on the program. Finally, the study did not control for the impact of credentials or specialty on PCP confidence before and after program enrollment.

CONCLUSIONS

As the world continues to evolve with an increasing virtual footprint, programs like the WI CPCP will continue to thrive and have a positive impact. This study demonstrates that primary care providers were highly satisfied with the WI CPCP and felt more confident caring for pediatric patients with mild to moderate

mental health issues. These findings can be used to initiate discussions as to how the program can continue to increase its outreach throughout the state.

Funding/Support: This work was supported by the Wisconsin Department of Health Services, grant 435100-G22-148197-290, and Health Resource and Services Administration, Pediatric Mental Health Care Access Program, U4CMC32324-04-01.

Financial Disclosures: None declared.

Acknowledgements: The authors would like to thank Gabriella Hangiandreou, MD, for her review of the data and comments on the manuscript.

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'We Need to Really Up Our Game' – Trainee and Clinician Perspectives on Adverse Childhood Experiences Screening

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ABSTRACT

Introduction: Despite the negative health effects of adverse childhood experiences, few pediatricians regularly screen for them. We sought to investigate clinician and trainee knowledge and practices regarding adverse childhood experiences in Wisconsin clinics.

Methods: We undertook a sequential mixed methods study. We administered a cross-sectional, web-based survey to medical trainees and clinicians associated with the University of Wisconsin-Madison or subscribing to the Wisconsin chapter of the American Academy of Pediatrics. The survey was developed and pretested by experts in medical education and survey methodology. Data were analyzed descriptively and categorically. We then conducted semistructured interviews using thematic analysis and inductive and deductive coding to characterize facilitators and barriers to screening.

Results: Survey respondents included 110 medical students, 103 attending physicians, 51 residents, and 10 advanced practice providers. Respondents were familiar with adverse childhood experiences, yet only 26% had adequate knowledge to impact their clinical practice. More residents (69%) and medical students (50%) received education about adverse childhood experiences than attending physicians (20%). Few respondents (13%) regularly screen for adverse childhood experiences, but the majority (80%) expressed interest in screening. Nine respondents completed interviews, revealing 3 themes: (1) knowledge is not enough; (2) demand for a multilevel approach; and (3) impact of systems of oppression.

Conclusions: Wisconsin trainees and clinicians have limited experience with adverse childhood experiences resulting in low screening rates but express a strong desire to learn more. Increasing screening practice will require targeted efforts to enhance clinician experiential learning, minimize systemic barriers, and address systems of oppression.

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INTRODUCTION

Exposure to childhood trauma is a widespread public health concern with long-lasting effects across the lifespan. Discrete childhood trauma experiences – or adverse childhood experiences (ACEs) – include 10 types of negative childhood events, such as various forms of abuse, neglect, and family dysfunction.[1] These include physical, sexual, or emotional abuse; physical or emotional neglect; mental illness, substance use, incarceration, or interpersonal violence of a relative; and parental divorce. ACEs are concerningly common, with 61% of US adults having experienced at least 1 ACE, and 1 in 6 adults experiencing 4 or more ACEs.[2] ACEs are also more prevalent among children with marginalized identities. Children with lower socioeconomic status; those who identify as female; and those who identify as lesbian, gay, bisexual, transgender, queer or questioning, intersex, asexual, and more (LGBTQ+) youth are more likely to experience ACEs than peers without these identities.[3,4]

Without loving, supportive adults, traumatic experiences can lead to toxic stress – prolonged activation of the body's stress response system – which can have profound effects on children's future health and well-being.[5] A graded relationship exists between the number of categories of childhood exposure and future adult risk behaviors and disease.[1] Increased ACEs exposure is linked to increased risks for chronic conditions, including heart disease, diabetes, depression, obesity, stroke, and cancer, as well as increased rates

of alcohol misuse, intravenous drug use, and suicide attempts.[6] Importantly, experiencing ACEs not only increases morbidity but also can profoundly affect mortality. Those who have experienced 6 or more ACEs have an average lifespan 20 years shorter than those who have not experienced ACEs.[7] Finally, children who experience ACEs are at risk for negative social and economic outcomes. ACEs are associated with increased interaction with the juvenile justice system and decreased graduation and employment rates.[8-10] Trauma has the potential to impact every aspect of a young person's future well-being, and, as such, actions must be taken to support youth and promote their flourishing as they transition into adulthood.

This increasing recognition of the prevalence and impact of ACEs highlights the need for integrating ACEs content into medical training.[11,12] However, broader integration within routine clinical care and medical training curricula has been limited.[11] Furthermore, while various health care professionals who serve children can screen for ACEs—family medicine and pediatric physicians, residents, advanced practice providers (APPs), and supervised medical students—differences in familiarity, comfort, and practice among clinician types have not been well characterized. We sought to investigate clinicians' and trainees' familiarity, comfort, and clinical and educational experiences with ACEs screening with pediatric patients in Wisconsin.

METHODS

This sequential mixed methods study included a survey followed by semistructured interviews. Surveys were designed to elicit trainees' and clinicians' perspectives of and experiences with ACEs screening. Semistructured interviews were then conducted with a sample of survey participants to enrich survey findings and investigate identified barriers and facilitators to screening. The institutional review board at the University of Wisconsin School of Medicine and Public Health (UWSMPH) determined this study to be exempt from review.

Survey Design

We electronically distributed a cross-sectional, web-based survey to eligible participants in summer 2020. Eligible trainee participants included medical students and pediatric and family medicine residents affiliated with UWSMPH programs. Eligible clinician participants included APPs, family medicine physicians, and pediatricians affiliated with UWSMPH or subscribed to the Wisconsin chapter of the American Academy of Pediatrics. We sent an initial email introducing the study and survey followed by reminder emails to participate. The survey was open to respondents for 1 month.

Survey Development

Based on our prior comprehensive review of the literature,[11] we developed preliminary domains of inquiry. Next, we convened a panel of 3 pediatricians with survey, education, and ACEs expertise to develop and refine survey items, content, and design. We then pilot tested the survey with stakeholder trainees and clinicians, made modifications, and established the final version. The survey included 21 questions—primarily close-ended questions with multiple choice and 5-point Likert response options.

Final domains included training and education, physician familiarity and comfort, and current ACEs screening practices. We specifically queried (a) receipt of prior ACEs educational training (multiple choice), (b) familiarity with ACEs and the foundational Kaiser study[1] (Likert scale), (c) desire for additional ACEs education (multiple choice), (d) current screening practices (multiple choice), and (e) comfort with discussing ACEs in practice (Likert scale). We also obtained demographic information, including gender, practice location and rurality, years in practice, specialty or interest area, average daily number of patient encounters, and primary insurance coverage of children in their practice. Participants could choose to provide their email address at the conclusion of the survey if interested in completing a follow-up interview.

Data Management and Statistics

Study data were collected and managed using UW-Madison Qualtrics XM Survey Hosting Service (Qualtrics XM). Clinicians were categorized into 4 groups for analysis: medical students, residents, APPs (nurse practitioners, physician assistants, other), and attending physicians. To accurately characterize the diverse racial and ethnic identities represented and maintain respondent anonymity, we dichotomized respondents as "underrepresented in medicine" (UIM) or not, with UIM defined as those underrepresented in the medical profession relative to the general population, including African-American/Black, Hispanic/Latino, American Indian/Alaska Native, or Native Hawaiian/Pacific Islander respondents.[13] Practicing respondents were defined as those already in medical practice, including residents, attending physicians, and APPs. In questions of interest in future ACEs education, responses were dichotomized as "interested" ("somewhat," "moderately," or "extremely" response selections) versus "not interested" ("not interested" or "neutral" response selections). In questions of comfort with screening, responses were similarly dichotomized. Descriptive statistical analyses were performed to describe overall trends in ACEs perspectives and practices based on participants' level of training, years of experience, and practice type. Data were tabulated and summarized separately for each group and comparisons made among groups using either chi-square tests or Fisher exact test (for categorical factors) or the nonparametric Kruskal-Wallis test for ordered responses with follow-up pairwise comparisons based on Nemenyi's procedure.[14] P values < 0.05 were considered statistically significant. Analyses were conducted using R Statistical Software version 4.0.3 (R Core Team).

Qualitative Interviews

Of 274 survey participants, 114 (42%) stated interest in completing a follow-up interview. We grouped participants according to training background and then randomly invited a convenience sample of medical students, residents, APPs, and attending/independent physicians to participate. Of those approached, all agreed to participate. They were offered a $50 gift card as compensation.

Clinicians completed interviews lasting on average, 30 minutes, using Zoom version 5.17.0 (Zoom Communications). Interviews were conducted using a semi-structured interview guide designed to elicit participants' experiences and perspectives of ACEs and screening and enrich understanding of survey findings. The interview guide was informed by literature review, survey findings, and stakeholder and expert opinion including 1 medical student (H.S.), 2 pediatric residents (P.C., S.W.A.), and a pediatrician with extensive qualitative training and experience (M.M.). Interviews were conducted by a medical student (H.S.) or pediatric resident (P.C., S.W.A.). All interviews were audio-recorded, transcribed verbatim, deidentified, and entered into Dedoose software version 10.0.34.

Table 1. Comparison of Respondent Characteristics

Characteristic[a]	Medical Students N = 110	Residents N = 51	Attending Physicians N = 103	APPs N = 10
Sex, n (%)				
Female	65 (61)	38 (76)	71 (70)	10 (100)
Male	42 (39)	12 (24)	31 (30)	**0**
Underrepresented in medicine racial or ethnic identity, N (%)[b]				
Yes			22 (8)	
No			252 (92)	
Practice setting, n (%)				
Rural	N/A	2 (4)	4 (4)	1 (10)
Suburban		5 (10)	16 (16)	2 (20)
Urban		43 (86)	81 (80)	7 (70)
Years in practice, n (%)				
0–5 years	N/A	N/A	18 (18)	3 (30)
6–10 years			14 (14)	5 (50)
11–20 years			25 (24)	1 (10)
>20 years			45 (44)	1 (10)
Average number of patients seen per day, n (%)				
0–10 patients	N/A	N/A	51 (53)	10 (100)
11–20 patients			37 (39)	0
>20 patients			8 (8)	0
Practice discipline, n (%)				
General pediatrics	N/A	28 (55)	55 (53)	1 (10)
Pediatric subspecialty		10 (20)	30 (29)	4 (40)
Family medicine		13 (25)	18 (18)	5 (50)

[a]Participants were not required to answer every question; responses may not total N for each group.
[b]URiM identity not provided at the level of medical students, residents, attendings, and APPs to ensure anonymity.

Analytic Approach

We performed a thematic analysis of the interview data using inductive and deductive approaches. Pursuant to data immersion, the primary author (H.S.) and second coder (M.T.) read all deidentified clinician interviews and created memos concurrently. Next, H.S and M.T. utilized line-by-line, inductive coding to create a preliminary codebook to capture clinicians' experiences with ACEs and their impressions of survey results. H.S., M.T., and a third coder, T.R.H., participated in regular consensus meetings to discuss discrepancies and revise the codebook. When new codes emerged, coders reviewed the earlier transcripts to ensure that all new codes also were captured from prior iterations (constant comparative approach). Consensus was reached on code definition refinement after repeating this process for 6 transcripts. The finalized codebook was then compared to the Theoretical Domains Framework, a single framework informed by 33 behavioral theories clustered into 14 domains that serve as mediators of behavior.[16,17] Any domains included within the Theoretical Domains Framework and not represented by our inductively developed codes were added to the codebook (deductive coding).[18] Using the finalized codebook, H.S. and M.T. coded the remaining transcripts.

RESULTS

Quantitative Results

Respondents' Characteristics

There were 330 survey respondents. Those who failed to state their credentials or who did not complete the survey were excluded, leading to 274 for analysis: 110 (40%) medical students, 103 (38%) attending physicians, 51 (19%) residents, and 10 (4%) APPs (Table 1). Participants were not required to answer every question, so some items had lower response totals. Most respondents were female (67%) and not UIM (92%). Practicing respondents overwhelmingly served urban populations (86% of residents, 80% of attendings, and 70% of APPs) and included those in general pediatrics, pediatric subspecialty, and family medicine disciplines. Just over half of attending physicians identified as general pediatricians (53%), and 55% of residents were in a general pediatrics residency. This contrasts with APPs, only one of whom (10%) practiced general pediatrics and half of whom practiced family medicine. Of clinicians out of training, the largest group of attending physicians (44%) had been in practice for over 20 years, and the largest group of APPs (50%) had been in practice for 6 to 10 years.

Knowledge of and Education About ACEs

Most respondents (93%) had heard of ACEs; however, familiarity varied across groups (Figure 1). All residents and APPs had heard

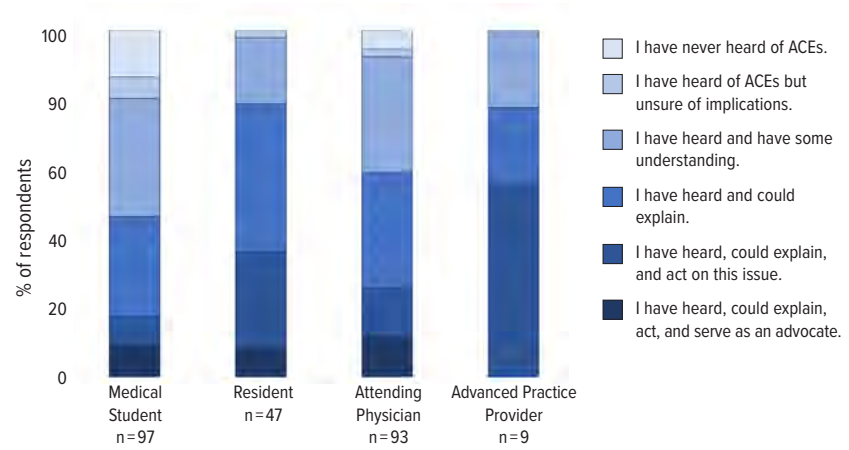
of ACEs, but 13% of medical students and 5% of attending physicians indicated that they had never heard of ACEs. Degree of familiarity significantly differed among the 4 groups ($P=0.001$). APPs were most commonly prepared to address ACEs, with over half (56%) stating that they could act on ACEs in their practice compared to 37% of residents, 26% of attending physicians, and 17% of medical students. When asked about their familiarity with the landmark Centers for Disease Control and Prevention-Kaiser Permanente study on ACEs,[1] most respondents had heard of the study (80%). Familiarity differed significantly between groups ($P<0.001$), with 78% of APPs, 74% residents, 57% of attending physicians, and 39% of medical students stating that they were familiar with the study.

When asked about their ACEs educational experiences, 41% of all respondents reported having learned about ACEs during their training. Residents were most likely to have received education about ACEs (69%), followed by medical students (50%), APPs (43%), and attending physicians (20%). Of those who had received ACEs education, all were aware of the association between increased ACEs and poor health outcomes later in life. Additional topics most addressed in their education included the prevalence of children affected by ACEs (64% of respondents) and physiologic changes associated with toxic stress (58% of respondents). Only 39% learned how to screen for ACEs. Finally, when asked about their future educational interest in ACEs, all APPs, 97% of medical students, 93% of residents, and 91% of attending physicians expressed a desire to learn more (Figure 2).

ACEs Screening in Practice

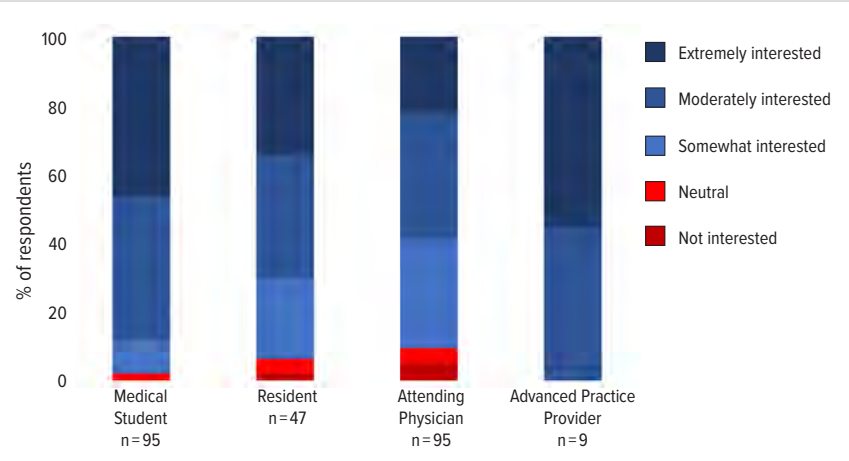
Few participants regularly screened for ACEs. One medical student (4%), 11% of residents, and 18% of attending physicians reported that they regularly screened for ACEs, and no APPs did so. For those who screened at least "sometimes" in their practice, just under half (44%) screened

Figure 1. Participant Familiarity with Adverse Childhood Experiences (ACEs)



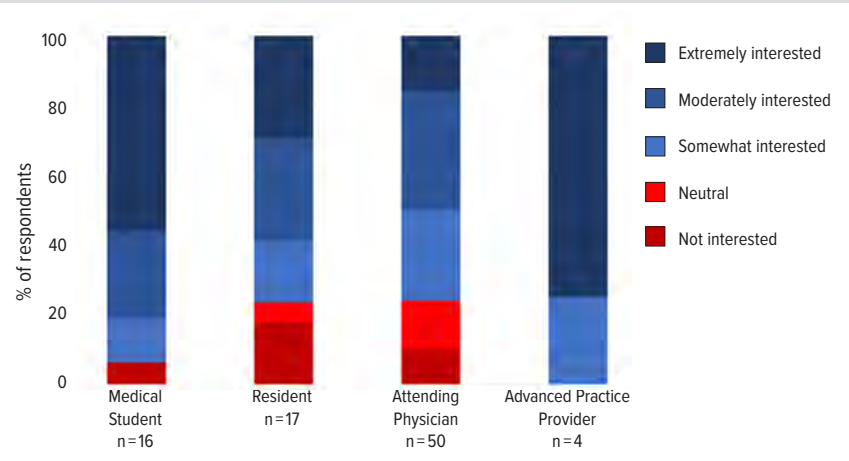
Across groups, survey respondents (N=246) demonstrated familiarity with ACEs, though familiarity differed among the 4 groups ($P=0.001$). However, few felt they had enough education to apply and act on ACEs knowledge in their clinical practice or as a clinical advocate.

Figure 2. Participant Interest in Learning More About Adverse Childhood Experiences (ACEs)



The majority of respondents (N=246) across groups indicated interest in learning more about ACEs. Interest in learning about ACEs differed by group ($P<0.001$).

Figure 3. Respondent Interest in Screening for Adverse Childhood Experiences (ACEs)



Of those not already screening for ACEs (n=87), most respondents across groups indicated interest in incorporating screening into their practice. The degree of interest in screening for ACEs differed among the 4 groups ($P=0.014$).

Table 2. Illustrative Quotes Supporting Thematic Analysis of Barriers to ACEs Screening

Theme 1: Knowledge Insufficient for Action
Quote 1: "A lot of times, it's not even that [doctors] don't feel like ACES aren't important, but they don't feel like they can do anything about it, and so you just kind of avoid the areas you feel helpless in." (Medical Student)
Quote 2: "I think a lot of people are really uncomfortable talking about topics that might make other people uncomfortable. And they just don't feel like they're able to talk about really difficult experiences like abuse and neglect, and then there's also not always a clear way to talk about it…like, okay, if I open this can of worms…if I potentially upset this person…" (Medical Student)
Quote 3: "I hear a lot of people being uncomfortable with the possibility of retraumatizing people if they bring up ACEs in an insensitive way." (Resident)
Quote 4: "I think a lot of people know how ACEs affect patients, but how to sort of do something with that in a practical sense is challenging." (APP)
Quote 5: "I think without any training or mentorship and like how to do it, you probably aren't going to find a lot of people who are really comfortable just bringing that sort of thing up with patients." (APP)
Theme 2: Multisystem Approach to ACEs Screening
Quote 6: "That's another element of why some pediatricians would say, look, I've got to see 25 to 30 patients a day, whatever it is. Where am I going to fit in the half hour conversation with this poor kid who's really in trouble?" (Attending Physician)
Quote 7: "EHR is a big one, right? We don't have it built into workflows, we don't have nurses handing out forms at the door. Also, I know there's like there's different ACE screeners - there's a 10-question one, and then there's the revised one that has maybe 20 or so. So I think you'd have to figure out within your organization or wherever you are working, which one are we going to pick and why and where we are going to record it, like, all that sort of stuff." (APP)
Quote 8: "It has got to be something that's not really burdensome, but it also has to capture the importance of it…I know everybody kind of has a screen fatigue." (Attending Physician)
Quote 9: "One of the ways to really do it is to attach it to the developmental surveillance screening or behavioral health surveillance – and that the parents have noticed as well that a screening becomes part of it, you know, either through a developmental or behavioral lens. I just think something specific to the ACEs." (Attending Physician)
Quote 10: "I think the least amount of burden would be the model of sending it home to people or sending it through My Chart, like communication happens to patients before a well child visit and then having them score it themselves and just send the number…I think, generally speaking, it would be less burdensome to the system as it exists right now to first introduce it as something that parents or the child, if they're old enough, does beforehand and then just submits the number and then you kind of choose whether to just use it as data or to do something about it further." (Resident)
Quote 11: "I think having providers who are very passionate about this and good at it. Encourage medical students and residents to not just be there for these kinds of discussions, but also to participate and to engage them in conversation afterwards about what they noticed and things like that." (Resident)
Quote 12: "I think advocacy from people probably like [research team] to the AAP, people who have more degrees in weight behind their name. At this point in their career like 50- to 60-year-old people who say, 'Hey, AAP board, this needs to happen. And here's some ideas for how to do it and let's have a study group about it' and the AAP has clinical practice guidelines for all kinds of things, and they could make something for this." (Attending Physician)
Theme 3: Systems of Oppression
Quote 13: "My favorite answer to this would be just diversifying the medical field in general, you know? If [clinicians] interact with more people from various backgrounds, I think they'd be more interested to know about [ACEs], know more about their perspectives, they'd be more interested in serving patient populations that are more diverse, I guess, so, yeah. I guess I think that that would truly be the ultimate way." (Medical Student)
Quote 14: "I think the other piece is going to be really important to look at any racial inequity and changes, so we adapt the screening in any way or the follow up. I think that's the lens. We're just starting to see we've missed a lot of the boat on and it certainly does have real life consequences and importance." (Attending)

Abbreviations: ACEs, adverse childhood experiences; APP, advanced practice provider; AAP, American Academy of Pediatrics.

for 1 or 2 ACEs. Only 18% of attending physicians, 11% of residents, and no medical students or APPs screened for more than 6 ACEs. The number of ACEs screened did not significantly differ across groups. About two-thirds (66%) of respondents who screened indicated the process was not standardized. Among those who screened for ACEs, the most offered resources in response to a positive screen were counseling referral (92%), social work referral (80%), and early intervention referral (80%).

Among the 87 respondents not screening for ACEs in their practice, all APPs, 94% of medical students, 76% of residents, and 76% of attending physicians expressed interest in starting to screen (Figure 3). Comparing across groups, degree of interest differed significantly, with attending physicians indicating the lowest level of interest ($P = 0.014$).

Participants reported limited comfort talking with patients about ACEs. Only 11% of residents, 13% of medical students, 22% of APPs, and 25% of attending physicians indicated feeling very comfortable doing so. Participants' comfort levels were not associated with receipt of prior ACEs education.

Qualitative Results

Nine qualitative interviews were conducted with 2 medical students, 3 residents, 1 APP, and 3 attending physicians. Three major themes emerged from interview transcripts reflecting barriers to ACEs screening: (1) knowledge is not enough, (2) demand for a multilevel approach, and (3) impact of systems of oppression. Representative quotes are shown in Table 2.

Knowledge is Not Enough

Knowledge alone was insufficient to generate action in ACEs screening, and clinician emotions specifically could pose a barrier to implementing screening. Some described a tension between wanting to screen and wanting to avoid negative emotions, such as helplessness (quote 1). Interviewees were uneasy with the potentially sensitive nature of ACEs and feared creating discomfort for

families (quote 2) or "retraumatizing" patients who disclose ACEs (quote 3). Interviewees also distinguished the difference in being conceptually knowledgeable about ACEs and practically knowing how to screen and properly respond to a positive screen (quotes 4 and 5).

Demand for a Multilevel Approach

Interviewees proposed strategies for ACEs screening integration, emphasizing the need for a multilevel approach. They stressed health care barriers requiring intervention, including time constraints (quote 6), lack of standardized screening protocol (quote 7), and screening fatigue (quote 8). Interviewees suggested coupling an ACEs screen with other developmental or behavioral screens (quote 9) sent to families prior to visits to minimize time constraints and screening fatigue (quote 10). Additionally, interviewees suggested having champions for ACEs screening, both on the clinic level and more broadly through advocacy organizations, to accelerate ACEs screening integration (quotes 11 and 12).

Impact of Systems of Oppression

Interviewees discussed how systemic inequities and discrimination affect if and how clinicians screen for ACEs. Clinicians from homogeneous backgrounds were perceived as less aware or interested in addressing ACEs that diverse patient populations may encounter (quote 13). Interviewees also noted how a patient's exposure to ACEs, screening, and available resources is influenced by systemic inequities (quote 14).

DISCUSSION

In this mixed methods study investigating trainee and clinician knowledge and practices regarding ACEs, we found that Wisconsin clinicians were familiar with ACEs but few could clinically apply their knowledge through screening or intervention. Respondents were interested in learning more about ACEs and implementing screening, but feelings of discomfort, barriers across health care systems levels, and perpetuation of systems of oppression were prominent impediments.

Our survey revealed that most respondents were familiar with ACEs and the science behind them, but few indicated that they could actualize that knowledge to their practice. Interviewees expressed that education regarding ACEs and trauma-informed care, at large, is still lacking in medical education. Feelings of clinician discomfort—stemming from not knowing how to screen or respond in a trauma-informed and beneficial way—prevented screening. Consistent with prior research demonstrating the value of standardized patient learning cases to enhance ACEs screening, medical education institutions should focus on increasing experiential learning opportunities to educate trainees about ACEs and trauma-informed care content and prepare them to apply this knowledge to practice.[16]

While only a fraction of practicing respondents regularly screened for ACEs, they overwhelmingly expressed interest in starting to screen. Interview participants described various systemic barriers that could impede ACEs screening despite their interest. When considering how to better integrate ACEs screening into practice, interviewees stressed the need for interventions across health care levels, and champions for screening were noted specifically as a resource to catalyze screening implementation. While our sample of responding APPs was small and prevents our ability to derive associations, our findings suggest these APPs may be more familiar with the landmark ACEs study and more prepared to intervene upon ACEs. APPs also indicated a high level of interest in screening and additional ACEs education. Prior literature has shown that APPs may be an important human resource to champion and bolster local screening.[17]

Finally, interviewees discussed the role that systems of oppression may play in ACEs screening and the impact ACEs have on families. They described the need for a more diverse health care workforce, citing that clinicians with primarily privileged identities may be less aware of or invested in the importance of ACEs screening. ACEs education and training will benefit from explicit discussions of the role of implicit bias and systemic oppression in the screening process, a family's experience of ACEs, and resources available for intervention. This finding complements other research stressing the need for culturally informed, preventive interventions aimed to address these disparities in ACEs exposure among minoritized youth.[19]

Limitations

This project has several limitations. First, while our study uniquely benefits from including and comparing perspectives of medical students, residents, APPs, and attending physicians, our focus on those practicing in Wisconsin limits generalizability to other locations and health systems. Similarly, our sample consisted primarily of medical students and clinicians who were not underrepresented in medicine and were serving in urban areas, several of whom were pediatric subspecialists. Perspectives from diverse clinicians, in primary care, and located in rural areas may be lacking. Future studies must focus on recruiting diverse populations. Trainees and clinicians who responded also may have had more (or less) experience with or interest in ACEs and screening than nonrespondents. While our small number of interviews limited our ability to achieve saturation, the addition of these interviews was vital to enrich our understanding of survey findings. In addition, our use of inductive and deductive approaches with application of the validated Theoretical Domains Framework strengthens the analysis of our limited sample size.[20,21] Childhood trauma—an event or series of events experienced as harmful or life threatening to an individual with lasting effects on their functioning and well-being—extends beyond the originally investigated ACEs.[22] Identifying ACEs is one part of a larger goal to identify youth who have experienced trauma, provide trauma-informed intervention when appropri-

ate, and promote their resilience through strengthening of positive relationships.

CONCLUSIONS

While ACEs are a prevalent public health concern with long-lasting effects, medical trainees receive inadequate education regarding ACEs, and few clinicians regularly screen for ACEs. Trainees and clinicians are interested in learning more about ACEs and screening, but lack of clinical competence and feelings of discomfort impede many from doing so. For individuals to feel confident to screen, experiential learning must be incorporated into ACEs education and training, and APPs may be well positioned to serve as local champions of ACEs screening. Finally, more research is needed to inform best practices regarding ACEs screening and intervention, and health care systems must utilize these practices to create protocols that meet the needs of the diverse patient populations they serve.

Financial Disclosures: None declared.

Funding/Support: Dr Condit received a trainee research grant from the University of Wisconsin School of Medicine and Public Health Department of Pediatrics, which was used to compensate interview subjects.

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An Innovative Course for the Clinical Years: A Look Back at the Last Decade

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Background: In the traditional 4-year medical school model, the final 2 years are the clinical years. These years bear challenges and experiences distinct from the preclinical part of medical school.

Methods: We implemented a longitudinal, multifaceted, 2-year course involving advising, Objective Structured Clinical Examination, and discussions to help students at a private, Midwestern medical school navigate the clinical years, ensure graduation competencies are met, and prepare for residency. Participants were third- and fourth-year medical students from 2013 to 2022. The course, titled "Continuous Professional Development," was run by a core group of faculty representing a variety of specialties.

Results: At the end of each academic year, students completed evaluations on the components of the course and the course as a whole. Feedback was generally positive, with students rating the one-on-one advising and short sessions related to clerkship and residency transitions particularly beneficial.

Conclusions: Students value educational content specifically tailored to their clinical experience. While having a single course responsible for multiple programs and sessions appears to be uncommon for undergraduate medical education, our course shows that it is possible and can be done effectively with a relatively small cohort of faculty.

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BACKGROUND

The traditional 4-year medical school model in the United States is comprised of 2 preclinical years followed by 2 clinical years. The preclinical years are centered on the foundational sciences and basic doctoring skills.[1] The clinical years, which include clerkships, electives, and acting internships, are focused on direct patient experiences. It is during the clinical years that students generally decide upon a specialty.

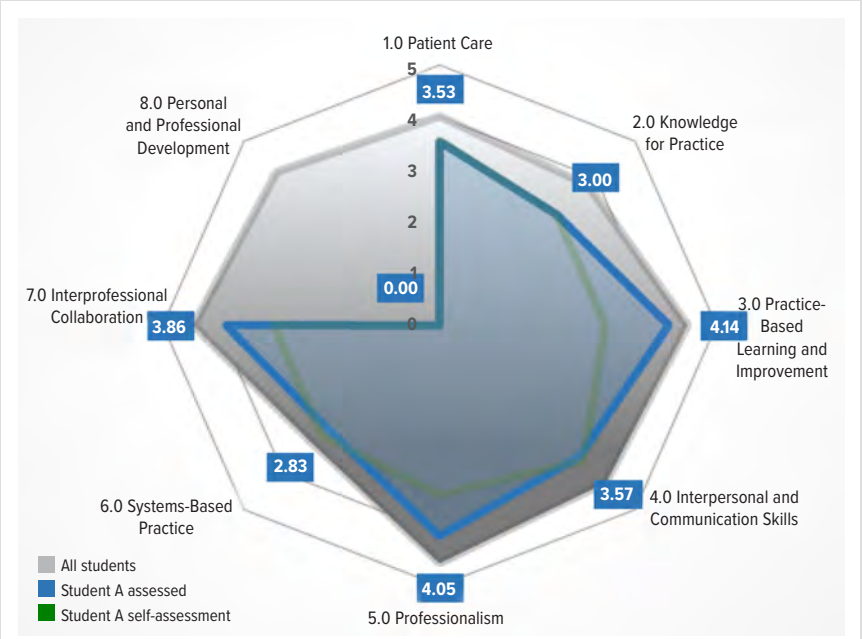
While some aspects of the preclinical years extend into the clinical years, such as standardized testing, numerous unfamiliar responsibilities arise. Inherently, the clinical years present unique challenges and distinct pressures when compared to the preclinical years.[2,3] As such, students need to learn how to balance newly imposed and frequently shifting clinical responsibilities, including duties to patients and other members of the health care team, on top of academic obligations, personal life, and career planning. This new clinical environment can lead to feelings of uncertainty and insecurity.[4] For many, the clinical years are also the first time students are integral parts of the health care team. Their actions have real and direct effects on patients, staff, and colleagues. Coping and processing these experiences while maintaining professionalism and empathy can be complicated and warrants dedicated curricular attention.[5,6]

Navigating the clinical years and the path towards a specialty can be confusing and stressful. In fact, the Liaison Committee on Medical Education (LCME) includes both academic and career advising as 1 of the 12 accreditation standards of medical schools.[7] While the type and structure of programs varies by institution, students generally find their purpose beneficial.[8]

At the Medical College of Wisconsin (MCW), a private allo-

pathic medical school in the Midwest with 3 campuses throughout Wisconsin, the Continuous Professional Development (CPD) course was created to assist and support students through these critical clinical years. The purpose of this paper is to describe the evolution, delivery, and feasibility of the CPD course.

Figure 1. Medical College of Wisconsin Global Competencies Labeled Numerically



METHODS

Course Description

The CPD course was launched in July of academic year (AY) 2013-2014 and has run continuously since. It is required for both third- and fourth-year medical students, and the course's overall goal is to ensure students meet MCW's 8 global competency milestones necessary for graduation that align with the Association of American Medical Colleges competencies[9] (Figure 1). The course consists of several required components described in more detail below: individual student advising, Observed Structured Clinical Examinations (OSCEs), the administration of 4 "mini courses," and residency matching preparation through mock interviews. The course is graded as satisfactory/unsatisfactory, which is determined by attendance at mandatory sessions and completion of assignments. Each class has 215 to 225 students.

Individual Student Advising

Individual advising is a core aspect of the course to oversee students' progress. Each rising third-year student is assigned a CPD advisor, who is one of the course's 8 directors. CPD advisors have access to student's academic transcripts, clerkship evaluations, National Board of Medical Examiners (NBME) scores, and OSCE performances. Additionally, CPD advisors are provided with a graph that displays the student's competency progression on each of MCW's 8 global competencies (Figure 1). The graph shows 3 aspects of the student's competency data: (1) actual competency data as generated by attending physicians, preceptors, and residents who are clinically evaluating the students; (2) the class average on each competency; and (3) the student's self-reported score on each competency. Students are rated on a scale of 1 to 5, with 5 being fully competent for that specific competency. Data generated from clinical evaluations are updated with the completion of major clerkships (anesthesia, family medicine, internal medicine, obstetrics/gynecology [OB-GYN], pediatrics, psychiatry, and surgery). Students self-report their score twice a year, before meeting with their advisor. CPD advisors show students the generated graphs and use these data to normalize the students' experiences by highlighting their strengths, areas for improvement, how they compare to the rest of the class, and how they perceive themselves.

Each CPD director advises 60 to 70 third- and fourth-year medical students during the academic year. At minimum, advisors meet with their third-year medical students (30-35 students) once a semester for 20 to 30 minutes to review exam scores, clerkship evaluations, OSCE reports, and the competency graph and to help plan and navigate the residency application process. Additionally, students may bring up concerns with their advisor. Advisor preparation and material review per student meeting amounts to 30 to 60 minutes. Extra meetings are held at the request of either students or advisors. The semiannual meetings allow advisors to address student concerns, ensure that students are meeting core competencies, and are on track to fulfill graduation requirements.

OSCE Program

During the clinical years at our institution, the OSCE program is overseen by the CPD course directors, whose responsibilities include the development, administration, and grading of OSCEs throughout the third year. Students complete three 3-station OSCEs during their third year: Super OSCE A—Surgery, OB-GYN, and Anesthesiology; Super OSCE B—Family Medicine, Pediatrics, and Psychiatry; and Internal Medicine OSCE. The OSCE cases are administered at our institution's simulation center utilizing standardized patients who grade students on history, physical examination, and communication skill. The CPD directors grade student documentation of history, physical exam, differential diagnosis, and diagnostic management plan using a rubric.

Mini Courses

The CPD course also includes 4 week-long "mini courses"

throughout the third and fourth years. These sessions include a variety of topics in medicine, professionalism, and career planning not otherwise covered formally in the curriculum. The courses run for a week each at 4 time points during the clinical years and span from the end of second year to just before medical school graduation.

Transition to Clerkship, the first mini course, presents a series of interactive workshops to prepare students for their clerkship experiences. Typical topics include a clerkship directors panel, microaggressions and macroaggressions, social media use (as a medical student), opioid use, writing case reports, academic success, and the clinical learning environment. Winter Intersession occurs midway through the third year after students have completed several clinical rotations and, thus, have some clinical experiences to connect to course material. Common topics covered include academic support, psychological safety, ethics, electronic communication, mindfulness, gallows humor, resilience, narrative writing, and the residency application process. The third mini course is Summer Intersession, which runs between the end of the third year and start of the fourth year. Here, the focus shifts to residency applications and more advanced clinical topics. The director of Student Career Services covers areas related to the Electronic Residency Application Service (ERAS), letters of recommendations, and curriculum vitae preparation. Other sessions include writing a personal statement, a residency panel, breaking bad news, reducing stigma in the treatment of opioid misuse, and working with vulnerable populations (eg, veterans and lesbian, gay, bisexual, transgender, queer/questioning [LGBTQ+]). The final mini course is Transition to Residency, which focuses on topics pertaining to professionalism and clinical scenarios relevant to incoming interns, as this course is held during April/May of the students' graduating year.

Topics are determined by input from all stakeholders: CPD faculty, undergraduate medical education (UME) leadership, clerkship directors, and students. Most importantly, competencies not covered elsewhere are addressed through these mini courses.

With the emergence of the COVID-19 pandemic, all mini courses were adjusted to permit virtual content delivery. Additionally, teaching methods were expanded to include reflection, asynchronous, and dynamic learning. Table 1 provides a complete list of topics for all 4 mini courses.

Table 1. Topics Covered in the Mini Courses

Transition to Clerkship	Transition to Residency
• Clerkship director panel	• Cross cover curriculum
• Micro- and macroaggressions	• Chief resident panel
• Social media use	• Health equity/social determinants of health
• Opioid use	• Radiology for interns
• Writing case reports	• Neurology for interns
• Academic success	• Infectious disease for interns
• Clinical learning environment	• Acid/base
Winter Intersession	• Geriatrics
• Academic support	• Shock
• Psychological safety	• Ethics
• Ethics	• Ophthalmology
• Electronic communication	• Hepatology
• Mindfulness	• Delirium and psychosis
• Gallows humor	• 1-minute preceptor and feedback
• Resilience	• LCME and Graduation
• Narrative writing	• Medical Examining board
• Residency application process	• Specialty breakout sessions
Summer Intersession	
• ERAS	
• Letters of recommendations	
• Curriculum vitae	
• Personal statement	
• Residency panel	
• Breaking bad news	
• Reducing stigma in opioid misuse treatment	
• Vulnerable populations	

Abbreviations: ERAS, Elcetronic Residency Application Service; LCME, Liaison Committee on Medical Education

Mock Interviews and Supplemental Offer and Acceptance Program

Lastly, the CPD course seeks to provide students with necessary tools for residency recruitment via mock interviews. The CPD course coordinator, with assistance from the CPD directors, recruits faculty and conducts a "match-making" activity, whereby students get to participate in a simulated residency interview with a faculty member from the student's intended specialty. The students are given immediate feedback regarding their interviewing strengths and weaknesses, along with the faculty member's assessment of the student's competitiveness in their desired specialty. Recommendations are made for those students who may benefit from additional support in interview skills. The CPD advisors also provide background and guidance for students who participate in the Supplemental Offer and Acceptance Program (SOAP). On SOAP day, CPD advisors are paired with a student either in person or virtually. They provide emotional support and help students through the process as they develop a plan for the week.

Course Logistics

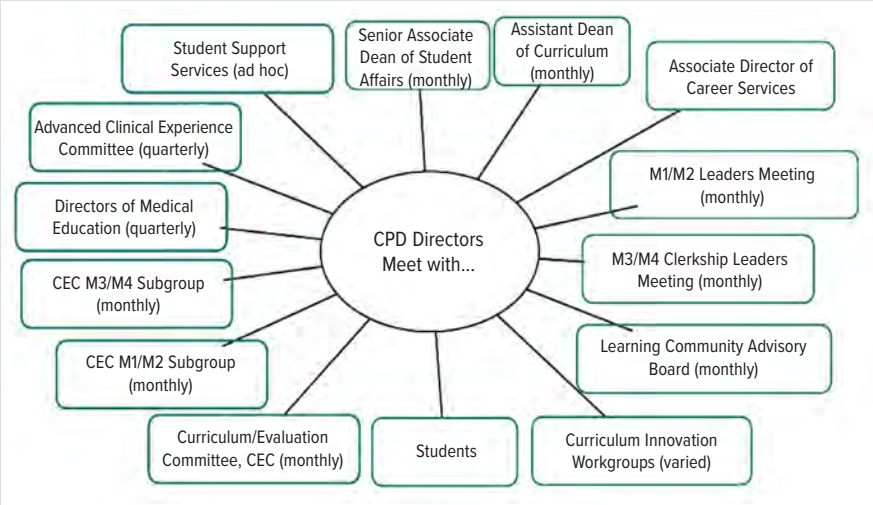
Originally, the CPD course was led by 4 full-time faculty co-directors representing a range of specialties (pediatrics-emergency medicine, OB-GYN, internal medicine, and family medicine) and who each was allocated 0.25 full-time equivalent (FTE). In July of AY 2021-22, course leadership was expanded to 8, in order to more effectively implement and grow all aspects of the coures. Each was allotted 0.25 FTE and continued to represent a range of specialties, including the addition of physical medicine and rehabilitation, psychiatry, pediatrics, and emergency medicine.

CPD faculty applied, interviewed with UME leadership, and were approved by the Clinical Evaluation Committee. They were chosen based on their UME background, which included various course director roles, experience working with medical students in the clinical and research realms, and advising to various degrees. While there was no formal training, CPD faculty attended UME conferences, educational presentations, and workshops for contin-

ued professional development. They were kept updated and informed on residency-related affairs by MCW's Academic and Student Services.

In addition to individual student and group meetings, CPD directors meet with medical school committees and leaders on a regular basis. These include the Curriculum and Evaluation Committee, clerkship leaders, and the senior associate dean of student affairs (Figure 2). Interfacing with educational leaders enables CPD to assist with concerns about specific students and offer recommendations. The course is supported by a full-time educational coordinator.

Figure 2. Committees and People CPD Directors Meet With for the Course



Abbreviations: CPD, Continuous Professional Development; CEC, Curriculum Evaluation Committee.

Program Evaluation

Students complete a standardized institutional course evaluation at the end of each academic year that serves as the course's summative evaluation. Since the creation of the course in 2013, a total of 1399 evaluations have been submitted. The survey measures students' satisfaction on multiple CPD components: the overall course, individual CPD advisor feedback and accessibility, each specific mini course, mock interviews, and the OSCEs. Evaluations were done in Online Access to Student Information and Scheduling (OASIS) (Schilling Consulting, LLC). This is an advanced web-based system that manages scheduling, grades, and evaluations, among other functions. Exploration of evaluations was done within the platform, which analyzed quantitative data into sums and means. Open-ended questions asked students what they liked and disliked about the course. All CPD directors reviewed the free responses together at the end of each academic year. Basic thematic analysis was utilized to group responses.

Survey questions on CPD advisor feedback, CPD advisor accessibility, and whether the course supported student development used a Likert Scale of 1 to 6, with 6 = strongly agree, 4 = somewhat agree, 3 = somewhat disagree, 1 = strongly disagree. Survey questions on the short courses, individual meetings with CPD advisor, OSCEs, mock interviews, and the course overall used a Likert Scale of 1 to 5, with 5 = outstanding, 3 = acceptable, and 1 = unsatisfactory

Table 2. Representative Student Feedback Used to Improve the CPD Course

Mini Course
• Some of the sessions were very helpful, others felt like they would have been more useful before starting M3 year.
• Some of the lectures would have been more valuable earlier, while others were duplications, and others were not entirely relevant
Observed Structured Clinical Examinations (OSCE)
• The relaying of meaningless numbers (unweighted OSCE score, overall assessment of our performance) was needlessly anxiety provoking and did not direct me in any way in how I should improve.
• The time from OSCE to feedback was way too long.
Advisor
• Individual CPD meetings were not as detailed or specific to my goals as I would've liked.
• They had way too many students [to] really provide individual guidance.
Mock Interviews
• Mock interviews should be earlier in the year.
• More prompt return of this feedback would be more helpful.

CPD, Continuous Professional Development.

RESULTS

Students shared positive and constructive feedback regarding the CPD course and its individual components. The constructive feedback was instrumental in shaping the course. Representative quotes are in Table 2.

Most students reported that the course supported their professional development. Similarly, students indicated they valued the feedback from their CPD advisors and appreciated their accessibility. Full results are shown in Table 3.

Students rated the individual meetings with CPD advisors the highest compared to the other CPD components. Notably, the CPD elements most relevant to students beginning a new stage in their training—specifically the transitions to clerkship and residency and mock interviews—also were rated highly. Full course ratings are in Table 4.

DISCUSSION

The clinical years of medical school bring new challenges compared to the preclinical years. To meet these complex needs, the CPD course assumes an assortment of roles: ensuring student meet core competencies, individual career advising, longitudinally identifying patterns of behavior that warrant attention, and facili-

tating ongoing collaboration and interaction with stakeholders at the School of Medicine. The course ultimately strives to prepare students for successful careers in medicine. After functioning for nearly a decade, our data show that the majority of third- and fourth-year medical students value the CPD course and each of its components.

CPD was set to expand into the preclinical years. However, like some medical schools across the country, our institution is transitioning away from the traditional structure of 2 preclinical years followed by 2 clinical years. The new model will see the components of CPD (mini courses, OSCEs, advising) placed within the new curriculum, with each directed by different educational leaders versus a single faculty group. Nonetheless, the experiences of CPD over the past decade provide valuable lessons as the new curriculum takes shape.

Students found the advisory aspect of CPD particularly important, as demonstrated by their rating. In medical schools across the country, there is a spectrum of programs to address students' desire for mentorship and advising. Programs are diverse in their goals, structure, and execution. Common types include those that focus on career aspirations, personal growth, and a combination of areas, such as stress management, career planning, and professionalism.[8,10-12] Some are informal, while others are more systematic with comprehensive faculty development.[11-13] Even the manner in which students receive the program is variable, from one-to-one to small groups. While the individual advisor meetings within the CPD course were rated highly, they were time-intensive for faculty advisors, who reviewed all available evaluations, OSCE reports, and grades for each student advisee prior to the semiannual meetings. Despite this effort, constructive feedback from some students found that these meetings did not meet all of their expectations. This led to the creation of a preparatory sheet advisors used to ensure a more personalized meeting where both academic performance and students' concerns were addressed.

In this way, CPD was able to successfully fill a considerable need within medical education, as the advising of medical students has long been noted as either essential or beneficial.[14,15] The new curriculum continues to pair students with faculty—now with fewer students per faculty, which students favored in their feedback.

In addition to the advisory aspect, CPD managed several other mini courses to assist students as they progress from the preclinical to clinical years. Though common among other US medical schools, the format may be variable.[16] CPD's short, week-long courses have different names and structures at other institutions, but their vision and goal of addressing medically applicable but orphaned topics are comparable.[17,18] Our students rated the Transition to Clerkship course and Transition to Residency highest amongst the mini courses. This is not surprising, as transitions within medical education naturally invoke some amount of uncertainty and apprehension.[19] Thus, having sessions that target this clinical shift can ease some of the trepidation. The new curriculum will subsume many of the sessions conducted in the mini courses, with a particular focus on longitudinal topics.

Table 3. Student Rating of Continuous Professional Development (CPD) Course

	4 or Higher	5 or Higher	Average Rating (SD)
Useful feedback during CPD meeting	88%	70%	4.8 (1.2)
CPD advisor accessibility	95%	82%	5 (0.9)
Professional development was supported by this course	92%	72%	4.8 (1.1)

6 = strongly agree, 4 = somewhat agree, 3 = somewhat disagree, 1 = strongly disagree.

Table 4. Student Rating of Continuous Professional Development (CPD) Course

Components	3 or Higher	4 or Higer	Average Rating (SD)
Transition to Clerkship course	93%	61%	3.7 (0.9)
Winter Intersession	89%	52%	3.5 (0.9)
Summer Intersession	85%	49%	3.4 (1.0)
Transition to Residency	90%	64%	3.7 (0.9)
Individual meetings with CPD director	92%	71%	3.9 (1.0)
Observed Structured Clinical Examinations	92%	62%	3.7 (0.9)
Mock interviews	88%	65%	3.8 (1.1)
Overall course rating	91%	69%	3.8 (0.9)

5 = outstanding, 3 = acceptable, 1 = unsatisfactory.

The OSCE program also was rated well by students. This is consistent with the literature, which notes students generally find OSCEs useful.[20] With that information, in the new curriculum, OSCEs begin in the first year, providing students early clinical practice and feedback. Fourth-year mock interviews were rated favorably, similar to other published studies.[21,22] In general, residency mock interviews are largely specialty-run, meaning specialties organize practice interviews for students interested in that particular specialty.[22,23] CPD, however, took on the challenge of faculty recruitment across all specialties, which alone was a large operation. This was in addition to organizing and scheduling the multi-month interviews.

CPD represents a unique combination of programming related to professional development. But it should also be noted that each piece that comprises the CPD course is an independent entity. It is uncommon to have 1 course manage so many diverse medical education components specific to the clinical years. The amount of time and effort required to run any one of CPD's parts alone is considerable, much less all of them.

From an institution standpoint, it is possible that it was financially advantageous to have a small group of faculty run CPD and all of its parts. From an educational perspective, having a core group of faculty intimately involved in all components also had

benefits. The routine meetings with educational leaders provided CPD information about students who may need extra help. This allowed CPD advisors to assist when needed and to be another layer of support for those students. Furthermore, because CPD advisors represent not only a range of specialties but also have other academic and clinical roles, faculty recruitment for mini course sessions and mock interviews was broadened. Finally, OSCEs assess professionalism through communication and clinical skills. With CPD advisors' involvement, feedback to students could be more meaningful, coming from a person who knows them wholistically.

The evolution of CPD was guided by all stakeholders. The OSCEs, for example, were originally run by individual clerkships. The variability of how they were conducted led to their eventual centralization in CPD. Once rehomed, the OSCE program expanded with new cases, created uniform scoring rubrics, and provided more detailed analyses of students' scores. Student feedback helped refine one-on-one advising, shaped many sessions within the mini courses, and gave OSCE and mock interviews specific areas to improve.

CONCLUSIONS

Unsurprisingly, students value educational content specifically tailored to their clinical experience. While having a single course responsible for multiple programs and sessions appears to be uncommon for undergraduate medical education, our CPD course shows that it is possible and can be done effectively with a relatively small cohort of faculty. CPD in its current form will sunset; however, the lessons learned from its decade of existence provide an abundance of insights for both institutions with the traditional UME structure as well as those shifting into a longitudinal model.

Funding/Support: None declared.

Financial Disclosures: None declared.

Statements and Declarations: The views reflected in this manuscript are those of the authors and do not represent the views of the Department of Veterans Affairs. A portion of this manuscript was presented at the Annual 2022 International Association of Medical Science Educators in Denver, Colorado, June 4-7, 2022.

Acknowledgements: The CPD team would like to thank Jennifer Klumb and Heather Aschoff for supporting the program.

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Wisconsin Young Adults' Attitudes, Beliefs, Motivations, and Behaviors Surrounding E-Cigarette Use and Cessation

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Introduction: Electronic cigarette (e-cigarette) use is prevalent among young adults, yet cessation treatment options are limited and underutilized.

Methods: Wisconsin residents aged 18 to 24 who had vaped nicotine in the past month (N = 480) completed an online survey assessing vaping initiation, past quit experiences, future quit intentions, and treatment knowledge and preferences. The survey also assessed perceived physical and mental health harms of vaping nicotine and other products (eg, cannabis, cannabidiol).

Results: Most young adults had made a prior e-cigarette quit attempt, commonly motivated by concerns about addiction, cost, and health problems. Though 80% want support to quit, preferred methods of support were highly variable. The same methods (eg, medication, friends/family, health care provider, therapist) that were most endorsed as the form of support young adults were most likely to use were also among the most endorsed forms of support that young adults would not want to use. Nearly 40% of participants reported vaping cannabis and perceived vaping cannabis as significantly less harmful than vaping nicotine or tobacco for physical and mental health.

Conclusions: Vaping cessation resources that are responsive to young adults' needs and preferences are needed. The high variability in treatment preferences suggests that multiple strategies need to be offered; there is no one-size-fits-all approach. Cannabis vaping is prevalent, and an important area for future research is to examine the impact of cannabis vaping on nicotine vaping dependence, cessation, and treatment use. Strategies to reach, motivate, and engage young adults in e-cigarette cessation and cessation treatment should highlight their concerns about addiction, costs, health harms, and desired treatment options.

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INTRODUCTION

The prevalence of electronic cigarette (e-cigarette) use (ie, vaping) has increased dramatically over the past decade. In 2018, the US Surgeon General declared e-cigarette use among young people an epidemic.[1] Young adults (aged 18-24) are consistently the age demographic with the highest prevalence of e-cigarette use. In 2021, 11.0% to 14.5% of young adults in the US reported currently using e-cigarettes, a rate more than 5 times higher than the rate of adults aged 45 and older.[2-4] Prevalence of current e-cigarette use some days or every day among young adults in Wisconsin in 2022 was 18.9%.[5] While e-cigarette use may be a viable method of harm reduction to help people stop smoking combustible cigarettes,[6-8] over half of young adults who vape have never smoked cigarettes regularly, suggesting that they typically are not using e-cigarettes as a smoking cessation strategy.[2,3] E-cigarettes are not harmless, particularly for young people; long-term health consequences remain uncertain.[9-12]

Among young adults who vape, approximately 1 in 5 attempted to quit in the past year, and a majority report plans to quit eventually.[13] Given the high rates of e-cigarette use among young adults, there is a need to develop and disseminate evidence-based treatments to help them quit.[13] Only 3 clinical trials have rigorously evaluated e-cigarette cessation interventions. The "This Is Quitting" text-message support program by the Truth Initiative has demonstrated modest but clinically significant efficacy in helping young adults quit vaping (self-abstinence: OR 1.39; 95% CI, 1.15-1.68).[14] The combination of counseling and the smoking

Table 1. Participant Characteristics (N = 480)

Demographic Characteristics	
Age, Mean (SD)	21.0 (1.9)
Gender, n (%)	
Female	237 (46.4%)
Male	207 (43.1%)
Nonbinary/third gender	14 (2.9%)
Transgender	17 (3.5%)
Other	5 (1.0%)
Race, n (%)	
White	355 (74.0%)
Black/African American	64 (13.3%)
Asian	16 (3.3%)
American Indian or Alaskan Native	13 (2.7%)
Native Hawaiian or Other Pacific Islander	3 (0.6%)
More than 1 race	18 (3.8%)
Other	11 (2.3%)
Ethnicity, n (%)	
Latino/Hispanic	69 (14.4%)
Sexual orientation, n (%)	
Heterosexual	319 (66.5%)
Bisexual	98 (20.4%)
Gay or lesbian	35 (7.3%)
Asexual	9 (1.9%)
Another	19 (4.0%)
Education level, n (%)	
Less than high school	49 (10.2%)
High school	212 (44.2%)
GED	26 (5.4%)
Some college or technical school	133 (27.7%)
4-year college	60 (12.5%)
Rural-Urban Area Classification,[a] n (%)	
Large rural	44 (9.2%)
Small town/rural	89 (18.5%)
Suburban	38 (7.9%)
Urban core	298 (62.1%)
Wisconsin region, n (%)	
Northeastern	72 (15%)
Southeastern	234 (48.8%)
Southern	97 (20.2%)
Western	77 (16.0%)
Vaping Behavior	
Age started vaping, Mean (SD)	17.0 (2.7)
Years vaping, Mean (SD)	4.0 (2.7)
Vaping frequency, n (%)	
>2 times/day	266 (55.4%)
1–2 times/day	86 (17.9%)
4–6 days/week	47 (9.8%)
1–3 days/week	34 (7.1%)
<1 day/week	47 (9.8%)
Has tried to quit vaping nicotine, n (%)	377 (78.5%)
Vaping other products, n (%)	
Cannabis	188 (39.2%)
Cannabidiol (CBD)	90 (18.8%)
Essential oils	26 (5.4%)

[a]Eleven ZIP codes were not classified using RUCA package, thus N = 469

cessation medication varenicline (vs placebo plus counseling) also demonstrated efficacy for vaping cessation, but this trial was not conducted specifically with young adults (mean age 52 years).[15] Recently, cytisinicline, a plant-based compound with similar properties to varenicline, demonstrated efficacy for vaping cessation (vs placebo plus counseling in both medication conditions).[16] However, cytisinicline is not available in the US as approval by the Food and Drug Administration (FDA) is still pending. Young adults tend to have lower uptake of treatment approaches that historically have been promoted for cigarette smoking cessation. Efforts are needed to develop new resources to reach and support young adults to quit vaping.

In September 2022, the Wisconsin Department of Justice finalized a multistate settlement with JUUL Labs to hold JUUL accountable for marketing e-cigarettes to young people.[17] The current study, funded by the Wisconsin JUUL settlement, was an online survey to ascertain how and why young adults in Wisconsin started vaping, their interest in quitting, cessation treatments they have tried or are interested in trying, and how and where they would like to learn about vaping cessation treatment. These results will inform ongoing efforts to develop strategies to reach, motivate, and engage young adults in e-cigarette cessation.

METHODS

We surveyed 480 eligible young adults during August and September 2023. Centiment, a nationwide survey company, invited eligible participants to complete an online survey via email, text message, or through a web portal. Centiment actively recruits and maintains survey panels, obtaining extensive background profile information to allow for targeted survey recruitment. Centiment shares the survey with its panel members and uses rigorous methods to ensure the consistency of survey responses. Eligible participants were aged 18 to 24, resided in Wisconsin, and reported that they do not smoke cigarettes but do vape nicotine or use e-cigarettes with nicotine.

Participants provided informed consent electronically and then completed an anonymous online survey that assessed vaping practices, beliefs, attitudes, and preferences using standardized assessments and newly developed items. The full survey is available online at https://osf.io/cyx4u/. Survey questions included items assessing vaping history (eg, age of initiation, contexts, motivations), other products vaped (eg, cannabis, cannabidiol [CBD]), vaping frequency, typical vaping contexts/situations, and likes/dislikes about vaping. Survey questions also assessed perceived harmfulness of vaping nicotine, cannabis, and other products to physical and mental health as well as knowledge of specific negative effects of vaping before they started vaping and what information they wish they had known before they started vaping. Finally, the survey assessed what vaping cessation resources or treatments they had used in the past, would want to use in the future, and would not want to use in the future, as well as where they would want to

learn about vaping cessation treatment options. Participants were compensated $12.50. This study was approved by the University of Wisconsin Institutional Review Board.

We conducted descriptive analyses using IBM SPSS version 29.0.2.0 (IBM) and R version 4.4.1 (R Foundation for Statistical Computing) using RStudio IDE version 2024 (Posit). Geographic distribution is classified by Rural-Urban Commuting Areas (RUCA) ZIP codes using the R package ruca.[17] We conducted a series of paired-samples *t* tests to evaluate differences in the perceived harmfulness of vaping nicotine, tobacco, cannabis, and CBD.

RESULTS

Participant Demographic Characteristics

Of the 480 participants, the mean age was 21.0 years, and 50% of participants identified as female. The most common racial identities were White (74%) and Black/African American (13%); 86% were non-Hispanic/Latino; 67% identified as heterosexual and 33% identified as lesbian, gay, bisexual, transgender and queer/questioning (LGBTQ+) (Table 1). The sample was geographically diverse with 62.1% residing in urban areas, 27.7% residing in rural areas, and 48.8% residing in southeast Wisconsin (Table 1).

Vaping Initiation, Context, and Motivations

On average, participants started vaping at age 17.0 (SD 2.7) (Table 1). In addition to nicotine, 39% of respondents had vaped cannabis products. Most (73%) reported vaping daily and over half (55%) vaped 3 or more times per day. The most common situations for vaping were when alone (66%), before bed (59%), upon waking (56%), after meals (54%), when socializing (54%), and when drinking alcohol (50%). When asked what they like about vaping, the most common responses were taste (63%), relaxation effect (62%), and buzz or lightheadedness (58%). However, individuals reported they disliked how vaping was bad for their health (67%), expensive (66%), addictive (53%), disapproved by their family (33%), and how others view them for vaping (29%).

Vaping Perceptions and Knowledge

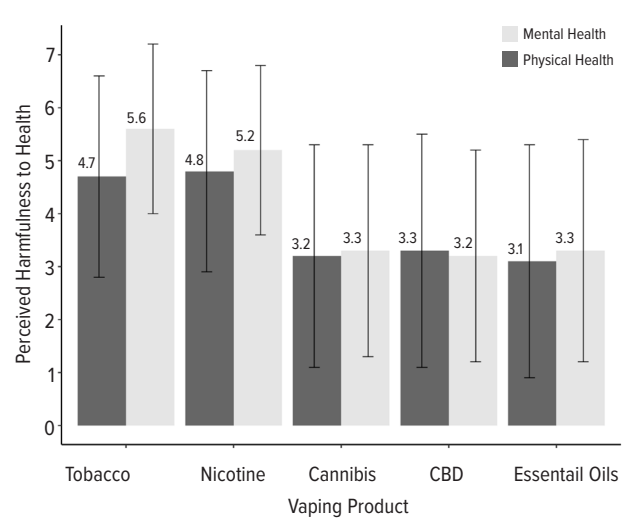
Most participants (92%) had some knowledge of the negative effects of vaping before they began vaping. However, a majority wished that before they began vaping, they had known about addiction, asthma, exposing others to secondhand vapor, explosion of devices, mental health-related issues, and how expensive vaping is (Table 2). Participants perceived vaping tobacco and nicotine to be moderate-to-severely harmful for physical and mental health (Figure 1). Vaping tobacco was perceived to be significantly more harmful than vaping nicotine for physical health (Cohen's d = 1.5, $t(479) = 5.4$, $P < .001$), but not mental health, ($t(479) = -.70$, $P = .49$). Vaping cannabis was perceived to be significantly less harmful than vaping nicotine for physical health (Cohen's d = 2.4, $t(479) = 17.2$, $P < .001$) and mental health (Cohen's d = 2.4, $t(479) = 12.9$, $P < .001$). There were no significant differences in perceived harmfulness of vaping cannabis or vaping CBD for physical or mental health, Ps > .05.

Table 2. Knowledge of Vaping Harms, N = 480

Desired Knowledge on Harms to Health Prior to Initiation	N (%)
Explosion of device	357 (74.4)
Addiction	355 (74.0)
Exposing others to my vapor	355 (74.0)
Asthma	351 (73.1)
How expensive vaping is	334 (69.6)
Mental health related issues	330 (68.8)
Nose and throat damage	321 (66.9)
Increased risk of heart disease	132 (27.5)
Lung scarring	131 (27.3)
How difficult it would be to quit vaping	128 (26.7)
None of the above	93 (19.4)

Note: Knowledge of the negative effects of vaping was assessed by "What information about negative side effects of vaping nicotine do you wish you had known before you started?"

Figure 1. Perceptions of Physical and Mental Health Harms From Vaping Different Products



Note: Survey questions related to health harms were rated on a 7-point Likert scale (1 = not at all harmful to 7 = extremely harmful). Two questions assessed: "How harmful do you think vaping each of these products is to your [physical or mental] health?" Bars represent means and error bars represent standard deviations.

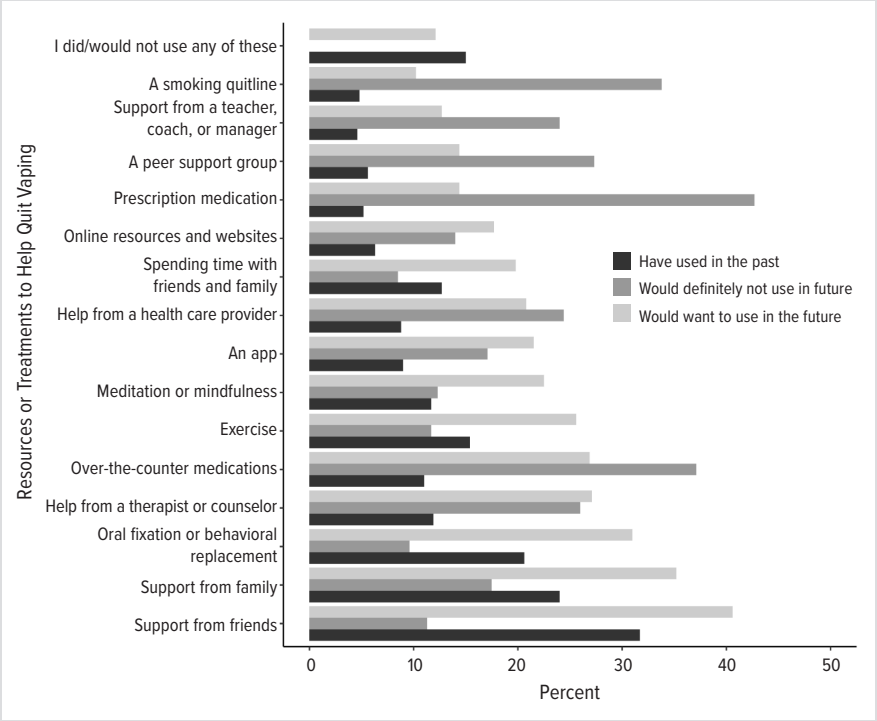
Vaping Quit and Treatment Preferences

Most participants (67%) intended to quit vaping in their lifetime (25% at some point, 11% in the next 10 years, 31% in the next year), 26% had no specific plans, and 7% planned to continue vaping indefinitely. Most participants (79%) had attempted to quit vaping previously, but only 15% successfully quit at some point before returning to vaping. Among participants who had

tried to quit (N = 377), the most common reasons for quitting were addiction (53%), cost (43%), physical health problems (36%), and mental health problems (25%).

The most common resources to quit vaping that participants used in the past or preferred for the future were social support (friends and family), behavioral replacements (eg, gum, food, drinks), mental health therapist or counselor, or over-the-counter medications (eg, nicotine patch, gum) (Figure 2). The least commonly used or preferred resources were quitlines; peer support groups; or support from teachers, coaches, or managers. A minority reported that they had not (15.0%) or would not (12.1%) use any of these resources. Further, many participants reported that they would not use prescription (42.7%) or over-the-counter medications (37.1%), quitlines (34%), peer support groups (28%), mental health therapists (26%), or health care providers (24%). The most common fears related to quitting vaping nicotine products were not succeeding in quitting (44%), withdrawal symptoms (42%), and quitting causing mental health problems (36%).

Figure 2. Quit Vaping Experiences and Treatment Preferences



Note: Figure bars reflect percentage of respondents who endorsed each category. Survey questions about resources and treatment were "What resources or treatments have you used to quit vaping nicotine?", "What resources or treatments would you want to use if you were to quit vaping nicotine in the future?", "What resources or treatments would you definitely not use if you were to quit vaping nicotine?". All questions included instructions to "check all that apply." Some responses above are shortened for display purposes; full response options included "prescription medication (varenicline, bupropion)," "over-the-counter medications (such as nicotine patch, gum, lozenge)," "help from a therapist, counselor or mental health provider," "an oral fixation or behavioral replacement like gum, food, or drinks."

The most common places participants have found information about quitting vaping were social media (42%), health care websites (33%), friends (29%), and family (29%) (Table 3). Participants would like to get information from health care websites (36%), a health care provider (31%), friends (27%), or social media (25%). Among those who desire information from social media (N=118), the preferred apps were TikTok (72%), Instagram (47%), YouTube (47%), or Facebook (36%).

Table 3. Quit Vaping Information

Where to Find Information About Quitting Vaping	Has Found Information	Would Like to Find Information
Non-governmental and non-health care website	95 (19.8%)	80 (18.3%)
Government website	71 (14.8%)	88 (18.3%)
Health care websites	160 (33.3%)	171 (35.6%)
A health care provider	121 (25.2%)	150 (31.3%)
Family	138 (28.7%)	104 (21.7%)
Friends	137 (28.5%)	128 (26.7%)
Peers who also vape	100 (20.8%)	92 (19.2%)
Social media	199 (41.5%)	118 (24.6%)
I did not search for information/I would not seek help for quitting vaping	100 (20.8%)	103 (21.5%)

Note: Survey questions about where to find information were "Where have you found information about quitting vaping nicotine?" and "Where would you like to go for information about quitting vaping nicotine?" All questions included instructions to "check all that apply."

DISCUSSION/CONCLUSIONS

Young adults in Wisconsin who vape nicotine reported a wide range of experiences, beliefs, motivations, and preferences surrounding vaping and vaping cessation. Many respondents reported vaping behaviors that are indicative of addiction (eg, daily vaping, vaping upon waking, vaping alone). Almost 4 out of 5 young adults have tried to quit in the past, primarily due to concerns about not wanting to be addicted, high cost, and developing or worsening physical and/or mental health problems. They appear to be knowledgeable about the potential negative physical and mental health consequences of vaping and perceive the harms of vaping nicotine or tobacco as worse than vaping other products (eg, cannabis, CBD).

Young adults want to use support or treatment to stop vaping nicotine. There were highly variable—and often contradictory—responses in preferred type of resources and support for vaping cessation. For instance, similar numbers of participants would and would not want to work with a therapist or counselor to quit

vaping. Many young adults are interested in structured support (eg, doctors, therapists, smartphone apps). However, there was a clear segment of respondents who are not interested in traditional tobacco treatments or professional assistance (eg, medication, quitline coaching) and prefer informal support and treatment approaches (eg, family/friends, behavioral replacements). Parents and friends remain primary sources of support for many young adults who want to quit vaping; public health educational efforts are warranted to provide them with the knowledge, skills, and confidence to effectively support their peers or children on their journey to stop vaping. Novel digital approaches, such as mobile apps or brief, online, single-session interventions, also may complement traditional treatment in ways that are appealing to young adults.[19,20] No one-size-fits-all cessation intervention approach emerged that would meet the needs and preferences of all young adults. Therefore, it is important to increase public health education to inform young adults of the variety of currently available effective interventions and prioritize developing new vaping cessation interventions to help this demographic (ie, the group that is vaping at the highest rate) quit vaping in support of health-promoting behavior change.

Young adults want to learn about treatment resources online (eg, health care websites, social media) and from their health care providers. However, similar numbers of young adults do not want to learn about treatment from these same sources, suggesting that diverse and complementary outreach and education approaches are necessary to reach the broadest population. Public health campaigns and educational messages (eg, Tobacco is Changing,[21] Real Talks Wisconsin[22]) can address young adults' primary concerns about quitting (eg, failure, withdrawal, mental health problems) and promote evidence-based programs like the This is Quitting texting program and possibly prescription medications like varenicline (and cytisinicline if approved by the FDA for vaping cessation).[14,15] However, the messaging will need to address the barriers that many young adults have to using any form of medication.

Nearly 40% of young adults who vaped nicotine also reported vaping cannabis. Respondents perceive vaping nicotine or tobacco to be moderately-to-highly harmful to both physical health and mental health. However, consistent with national trends, vaping cannabis and CBD were perceived to be significantly less harmful than vaping nicotine.[23] Future research is needed to understand whether vaping cannabis presents a barrier to nicotine vaping cessation motivation and treatment use and should also examine integrated treatments targeting co-use of vaping nicotine and cannabis for young adults.[24]

There remains a need to develop new tools and resources that address the unmet needs and preferences of young adults who vape. Young adults want options – in terms of where they learn about treatment resources, ways to access support, who treatment or support is provided by, and the types or modalities of resources that are available. The variability in preferences highlights the importance of having multiple strategies to inform this age group about the effective resources that currently are available, while continuing to pursue the creation and dissemination of novel interventions. The results of this study will inform ongoing efforts to develop strategies to reach, motivate, and engage young adults in vaping cessation.

Funding/Support: Funding for this study was provided by Wisconsin Department of Health Services, MSN276077.

Financial Disclosures: Megan Piper, PhD, reports receiving consulting fees from Temple University, New York University, University of South Carolina, and University of Waterloo and grand rounds speaker payments or honoraria from University of Alabama Birmingham and Roswell Park.

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Post-infection Symptomatology of Human Metapneumovirus Infection

Dorothy Kenny, MD; Samuel Martin, MD; David Quimby, MD

Introduction: Though there has been much discussion about post-acute sequelae of SARS-CoV-2 infection, there has been limited study on symptoms following infection with other respiratory viruses.

Methods: In this retrospective chart review, we reviewed the medical records of 92 patients admitted to the hospital with a diagnosis of human metapneumovirus for 17 of the common symptoms associated with post-acute sequalae of SARS-CoV-2 that were either new or worse than baseline in the time frame of 90 to 270 days after diagnosis.

Results: Of those patients hospitalized with human metapneumovirus, 55.4% had at least 1 new or worsening symptom more than 3 months after diagnosis. The most common symptoms noted were shortness of breath (29.3%) followed by fatigue and cough (17.3% each).

Conclusions: Our data suggest that other respiratory viruses – not just SARS-CoV-2 – may carry a significant burden of post-infection sequelae.

INTRODUCTION

Since the discovery and spread of the SARS-CoV-2 virus, there have been reports of patients with persistent symptoms after recovering from initial infection. This condition, commonly referred to as long COVID or post-acute sequelae of SARS-CoV-2 infection (PASC), can present as 1 or more symptoms, such as fatigue, post-exertional malaise, brain fog, headache, sleep issues, loss of smell/taste, shortness of breath, chest pain, or muscle/joint pain.[1,2] The reported prevalence of PASC varies widely and may be anywhere from 10% to 45%.[2-4] Symptoms can persist for months and can occur even after mild infection.[3,5] Although the ultimate mechanisms are unclear, PASC is thought to occur for a variety of reasons, including direct tissue injury from acute infection, persistence of SARS-CoV-2 in tissue reservoirs, reactivation of latent viruses, induction of autoimmunity, or impact on the host microbiome due to immune dysregulation.[1,6]

Though there has been much discussion about PASC, there has been limited study on long-term sequelae following infection with other respiratory viruses. This makes study of PASC challenging as it is not entirely clear how the prevalence of this condition compares to other viral infections.

Human metapneumovirus (HMPV), discovered in 2001, can cause mild to severe illness; groups at risk for severe illness include infants and young children, older adults, and patients who are immunocompromised. While most patients are infected by 5 years of age, reinfection frequently occurs throughout life.[7] HMPV causes significant morbidity and mortality in older patients, with 1 study reporting 60% of infected older patients requiring hospitalization.[8] Current treatment is supportive, and there are no vaccines available at this time.[7]

To determine the prevalence of post-infectious sequelae from HMPV, we performed a retrospective chart review of adult patients hospitalized with this pathogen.

METHODS

Patients with a diagnosis of HMPV based on polymerase chain reaction (PCR) testing (FilmArray Respiratory Panel, Biomerieux) from January 1, 2018, through June 24, 2022, were reviewed. The researchers manually reviewed medical records to determine baseline demographics as well as new-onset or worsening severity of 17 symptoms that have been associated with PASC during the time period of 90 to 270 days following diagnosis of

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HMPV infection. (See Table 1 for list of symptoms.) Anosmia and ageusia were not evaluated as these typically were not associated with non-SARS-CoV-2 viral infections prior to the pandemic. If symptoms were present prior to the HMPV diagnosis, patients must have had documented worsening based on patient report or clinician documentation during the study period to be counted as positive. For those individuals with no records available prior to HMPV diagnosis, the medical record needed to clearly state that subsequent symptoms were new or worsening since the infection to be counted as positive.

Given the small number of patients involved, data on baseline chronic diagnoses (eg, hypertension, diabetes, chronic obstructive pulmonary disease) were not extracted as it would be unlikely to lead to statistical significance; the goal of the study was to determine overall prevalence of post-infectious symptoms not to risk-stratify the probability of developing such symptoms. Laboratory testing, radiologic or other diagnostic testing, and billing/diagnosis codes were not extracted. As this was a retrospective study, impact of symptomatology on patient quality of life could not be determined. Data on mortality during the index hospitalization, mortality in the follow-up period, and all-cause hospitalization in the follow-up period also were collected.

Patients were excluded from the analysis if no data were available, if they had a diagnosis of SARS-CoV-2 infection prior to the HMPV infection or during the follow-up period, or if they were less than 18 years of age at diagnosis.

The Creighton University Institutional Review Board approved the study and determined that patient consent was not necessary (approval number 2003266-01).

RESULTS

During the study period, 138 patients were diagnosed with HMPV. One patient was excluded due to diagnosis of SARS-CoV-2 during the period under review. No follow-up data were available for 45 patients, leaving 92 patients for analysis. Fifty-nine (64.1%) were female, 77 (84.0%) were White, 11 (12.0%) were Black, and 6 (6.5%) were Hispanic. The mean age for included patients was 64.4 years (range 20-94, SD 16.6). None of the included patients had other viruses co-detected with respiratory panel testing at the time of HMPV diagnosis. One patient (0.7%) died during the index hospitalization. Sixteen (11.7%) died prior to the end of the study period (270 days after diagnosis); 40 (29.2%) patients had at least 1 repeat hospitalization prior to the end of the study period.

Of the 17 symptoms evaluated (Table 1), the most common symptom was shortness of breath (29.3%), followed by fatigue and cough (17.3% each). At least 1 new or worsening symptom was recorded for 55.4% of patients (Table 2).

Table 1. Symptoms Following Human Metapneumovirus (HMPV) Infection in the Study Population

Symptom	No. of Patients (%)
Shortness of breath/difficulty breathing	27 (29.3)
Cough	16 (17.4)
Fatigue	16 (17.4)
Joint/muscle pain	9 (9.8)
Sleep problems	8 (8.7)
Chest pain	6 (6.5)
Abdominal pain	6 (6.5)
Depression/anxiety	4 (4.3)
Lightheadedness/dizziness	4 (4.3)
Heart palpitations	3 (3.3)
Neuropathy	3 (3.3)
Diarrhea	2 (2.2)
"Brain fog"/memory issues/concentration difficulty	1 (1.1)
Fever	1 (1.1)
Headaches	1 (1.1)
Post-exertional malaise	1 (1.1)
Rash	1 (1.1)

Table 2. Number of Different Symptoms Following Human Metapneumovirus (HMPV) Infection in the Study Population

No. of Different Symptoms	No. of Patients (%)
0	41 (44.6)
1	18 (19.6)
2	14 (15.2)
3	14 (15.2)
4	4 (4.3)
5	1 (1.1)

DISCUSSION

Though there is variation in the symptoms experienced with PASC, the most commonly reported are fatigue, shortness of breath, and loss of smell/taste.[3,9-12] In our study of HMPV, the most common symptoms were shortness of breath, fatigue, and cough. A majority of patients (55.4%) had at least 1 symptom for longer than 3 months after the diagnosis; 35.8% reported 2 or more symptoms during the follow-up period.

The mechanisms leading to symptoms of PASC are unclear. Studies have noted immune dysregulation as a potential contributor due to increased pro-inflammatory cytokines and autoantibodies seen in COVID-19 patients. Notably, similar findings have been seen in myalgic encephalitis and chronic fatigue syndrome, which have been associated with viruses such as Epstein-Barr virus, cytomegalovirus, and SARS-CoV-1.[4,6,13] Proposed causes for physical symptoms of PASC have included tissue injury from acute infection, neuroinflammation, muscle mitrochondrial dysfunction, ongoing inflammation due to dysregulated immune response, and different psychological or environmental factors.[6,14]

Direct comparison of the frequency of long-term sequelae from different viruses is somewhat lacking in the literature. In a study comparing those hospitalized with COVID-19 and influenza, Al-Aly et al found a higher burden of new diagnoses post-dismissal in those with COVID-19.[15] One study completed prior to the onset of the COVID-19 pandemic reported a higher prevalence of lower respiratory tract symptoms at 3 months post-discharge for

respiratory syncytial virus and HMPV compared to influenza.[16] Over 50% of patients in our study had at least 1 symptom still present more than 90 days after diagnosis of HMPV, suggesting that pathogens other than SARS-CoV-2 may lead to long-term issues.

Limitations

Our study has several limitations. As a retrospective chart review, we were limited to information that was documented on follow-up visits. Eligibility for inclusion was based on those who underwent viral PCR testing; this was restricted to those admitted to the hospital. Patients not ill enough to warrant hospital admission were therefore not included in the analysis. The patients under review were limited to a single academic medical center, possibly limiting generalizability. Lack of follow-up data on all patients could lead to incorrect assessment of the true prevalence of post-infection sequelae. For example, it might be assumed that patients with ongoing symptoms would be more likely to seek medical care, while those without symptoms would not seek such care; exclusion of the latter (as was done in this analysis) would lead to an overestimation of true prevalence of the frequency of post-infection symptoms. A final limitation is lack of a control group. While these data demonstrate the frequency of symptoms following hospitalization for HMPV infection, it is impossible to determine how much of the symptomatology was due to the viral infection versus hospitalization for other reasons.

CONCLUSIONS

Although relatively small, retrospective, and with limitations as outlined, this study suggests that respiratory viral pathogens other than SARS-CoV-2 in hospitalized patients can carry a significant burden of post-infection sequelae. Obtaining data on prevalence of such symptoms for patients with a variety of respiratory viral infections can help delineate how SARS-CoV-2 is similar or differs from other pathogens. By examining patterns across pathogens, we may be able to identify commonalities, which could help determine the pathophysiology and, eventually, better management strategies. With a variety of different causative factors, however, there is likely no single intervention that will be beneficial for all patients with PASC or sequelae from other infections; it is probable that individualized management will be necessary.

Further investigation into this area can include other viral pathogens. Prospective trials would provide better data on post-infectious sequelae, avoiding many of the biases inherent in a retrospective review. Outpatients can be included in such trials, which would lead to data on those not medically ill enough to warrant acute hospital admission. If studies are performed in a prospective manner, information also can be obtained on impact of quality of life from ongoing symptoms. Gathering such data would lead to a better-crystalized profile of post-infectious syndromes from respiratory viruses.

Funding/Support: None declared.

Financial Disclosures: None declared.

Acknowledgements: The authors would like to thank Uyen-Vy (Melanie) Nguyen for assistance with the literature search.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Chlamydia and Gonorrhea Infection Rates in Wisconsin, 2010-2022

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Introduction: Chlamydia and gonorrhea are the most commonly reported bacterial communicable diseases in Wisconsin, with rising incidence rates despite effective treatments. Examining demographic trends can inform public health strategies.

Methods: We analyzed Wisconsin Electronic Disease Surveillance System data (2010-2022) to assess chlamydia and gonorrhea incidence by sex, age, and race.

Results: From 2010 through 2022, chlamydia rates in Wisconsin rose 4.9% (415.5 to 435.9 per 100 000), while gonorrhea rates increased 62.8% (90.7 to 147.7 per 100 000). Among females 15 to 24 years old, chlamydia rates declined 12.0% (3308.5 to 2912.8 per 100 000) but increased 30.1% (203.1 to 264.2 per 100 000) among females 25 years old and older. Gonorrhea rates rose 6.3% (574.7 to 610.6 per 100 000) in females 15 to 24 years old but nearly doubled (47.4 to 82.0 per 100 000) for those 25 and older. Among males 15 to 24 years old, chlamydia rates increased 10.7% (1046.4 to 1158.8 per 100 000) and increased 47.7% in males 25 years old and older (130.7 to 193.1 per 100 000). Gonorrhea rates rose 52.2% in males 15 to 24 years old (295.7 to 450.1 per 100 000) and rose 226.8% in males 25 years old and older (40.7 to 133.0 per 100 000). In 2010, chlamydia rates were 14 times higher and gonorrhea rates nearly 40 times higher among Black individuals compared to White individuals, narrowing to 11 and 30 times higher, respectively, by 2022.

Conclusions: Chlamydia and gonorrhea incidence rates have risen across most populations in Wisconsin but disproportionately affect Black individuals, with the largest racial disparities seen in the nation. While chlamydia rates remained stable among young females, they increased among males and older adults. Gonorrhea rates surged across nearly all groups. These findings highlight the need for targeted interventions to expand screening, address structural barriers to health care, and reduce disparities.

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INTRODUCTION

Chlamydia and gonorrhea are sexually transmitted infections (STIs) caused by the bacterium *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. These infections are a public health challenge because they often are asymptomatic, and untreated infections can lead to serious health outcomes in adults, such as pelvic inflammatory disease, infertility, and ectopic pregnancy, as well as conjunctivitis and pneumonia in newborns.[1] Due to their prevalence and potential adverse health outcomes, the United States (US) federal government has mandated reporting since the 1940s for gonorrhea and since the 1980s for chlamydia to track and mitigate disease burden.[1,2] Despite these efforts and the availability of effective treatments, chlamydia and gonorrhea remain the most commonly reported bacterial communicable infections in the US. National rates for both infections continue to rise steadily and, in the Midwest, rates are often higher than in other regions.[3] In addition to being representative of the broader Midwest due to its demographic and geographic characteristics, Wisconsin's notable racial disparities in health care outcomes make it an important case study for understanding trends in STI incidence.[4] In this study, we aimed to analyze the trends in incidence rates of chlamydia and gonorrhea in Wisconsin from 2010 through 2022, examining demographic disparities to inform future research and targeted public health interventions.

MATERIALS AND METHODS

We conducted a descriptive analysis using data from the Wisconsin

Electronic Disease Surveillance System (WEDSS) from January 2010 through December 2022. The dataset included all unique records of patients positive, confirmed, and reported cases of chlamydia and gonorrhea in Wisconsin during these dates. Records included demographic data (age group, sex, and race) and date of diagnosis. We calculated frequencies and percentages for categorical variables, such as sex, race, and age group. The data collected in WEDSS for ethnicity are reported as a binary, "Hispanic" or "non-Hispanic," characterizing individuals who identify as non-Hispanic Black or non-Hispanic-White together into the more general "non-Hispanic" category. This lack of granularity limited our ability to draw meaningful conclusions from these data, and we therefore focused our demographic analysis using only racial identity. Incidence rates of chlamydia and gonorrhea were calculated per 100 000 population from 2010 through 2022, with population data sourced from the Wisconsin Interactive Statistics on Health Query system for each respective year included. Yearly rates were further stratified by age group, sex, and race. To protect anonymity, counts and rates where the count is less than 5 were suppressed. Only data specific to cisgendered men and women are reported. While Wisconsin collects data on gender-diverse individuals (including transgender, nonbinary, gender nonconforming, or any other identification), counts are too low to report and maintain confidentiality. Additionally, population denominators for gender-diverse individuals are not available at the national or state level, so rates could not be constructed for these groups.

RESULTS

Chlamydia Trachomatis

Case Counts and Incidence Rates in Wisconsin

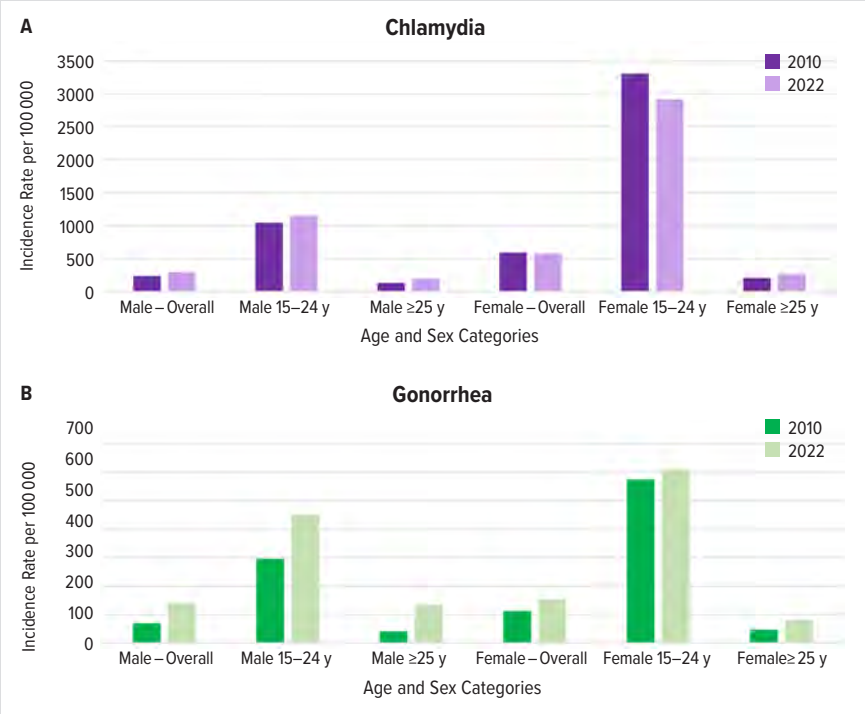
From 2010 through 2022, chlamydia cases in Wisconsin rose from 23 644 cases (415.5 per 100 000 people) in 2010 to 25 684 (435.9 per 100 000) in 2022 – a 4.91% increase. Cases peaked in 2019 at 504.4 per 100 000 and then declined from

Table 1. Demographics for Chlamydia and Gonorrhea Incidence, 2010 and 2022

	Chlamydia			Gonorrhea		
	STI Count	Population	Incidence Rate	STI Count	Population	Incidence Rate
			2010			
Total	23 644	5 690 538	415.5	5162	5 690 538	90.7
Age Group						
<5	24	357 812	6.7	7	357 812	2.0
5–9	–	349 757	–	–	349 757	–
10–14	273	369 838	73.8	71	369 838	19.2
15–19	7847	399 334	1965.0	1637	399 334	409.9
20–24	9055	395 451	2289.8	1757	395 451	444.3
25–29	3676	374 933	980.4	810	374 933	216.0
30–34	1483	362 950	408.6	388	362 950	106.9
35–39	665	371 694	178.9	211	371 694	56.8
40–44	287	332 796	86.2	113	332 796	34.0
45–49	152	351 958	43.2	73	351 958	20.7
50+	117	1 923 499	6.1	83	1 923 499	4.3
Unknown	64	–	–	12	–	–
Ethnicity						
Non-Hispanic	18 697	5 352 652	349.3	4368	5 352 652	81.6
Hispanic	1842	337 886	545.2	233	337 886	69.0
Unknown	3105	–	–	561	–	–
Race						
White	9860	5 037 561	195.7	1177	5 037 561	23.4
Black/AA	10 175	367 725	415.0	3416	367 725	929.0
AIAN	447	60 403	740.0	89	60 403	147.3
Asian	353	132 830	265.8	36	132 830	27.1
NHOPI	37	2522	1467.1	–	2522	158.6
Other	673	89 497	752.0	177	89 497	197.8
Unknown	2099	–	–	331	–	–
Sex						
Female	16940	2 866 332	591.0	3204	28 66 332	111.8
Male	6699	2 824 206	237.2	1957	28 24 206	69.3
			2022			
Total	25684	5 892 539	435.9	8705	5 892 539	147.7
Age Group						
<5	13	312 622	4.2	–	312 622	–
5–9	–	339 916	–	–	339 916	–
10–14	201	363 289	55.3	94	363 289	25.9
15–19	6651	383 560	1734.0	1777	383 560	463.3
20–24	9446	411 840	2293.6	2437	411 840	591.7
25–29	4448	367 885	1209.1	1566	367 885	425.7
30–34	2451	365 650	670.3	1160	365 650	317.2
35–39	1228	372 740	329.5	686	372 740	184.0
40–44	616	370 650	166.2	399	370 650	107.6
45–49	271	329 307	82.3	202	329 307	61.3
50+	358	2 275 080	15.7	380	2 275 080	16.7
Unknown	–	–	–	–	–	–
Ethnicity						
Non-Hispanic	21 022	5 444 388	386.1	7663	5 444 388	140.8
Hispanic	3546	448 151	791.3	774	448 151	172.7
Unknown	1116	–	–	268	–	–
Race						
White	12 112	5 103 755	237.3	2406	5 103 755	20.0
Black/AA	10 182	390 428	2607.9	5557	390 428	1423.3
AIAN	530	71 555	740.7	134	71 555	187.3
Asian	470	190 698	246.5	76	190 698	39.9
NHOPI	65	3612	1799.6	6	3612	166.1
Other	1674	132 491	1263.5	399	132 491	301.2
Unknown	651	–	–	127	–	–
Sex						
Female	16 929	2 937 233	576.4	4135	2 937 233	140.8
Male	8672	2 955 306	293.4	4549	2 955 306	153.9

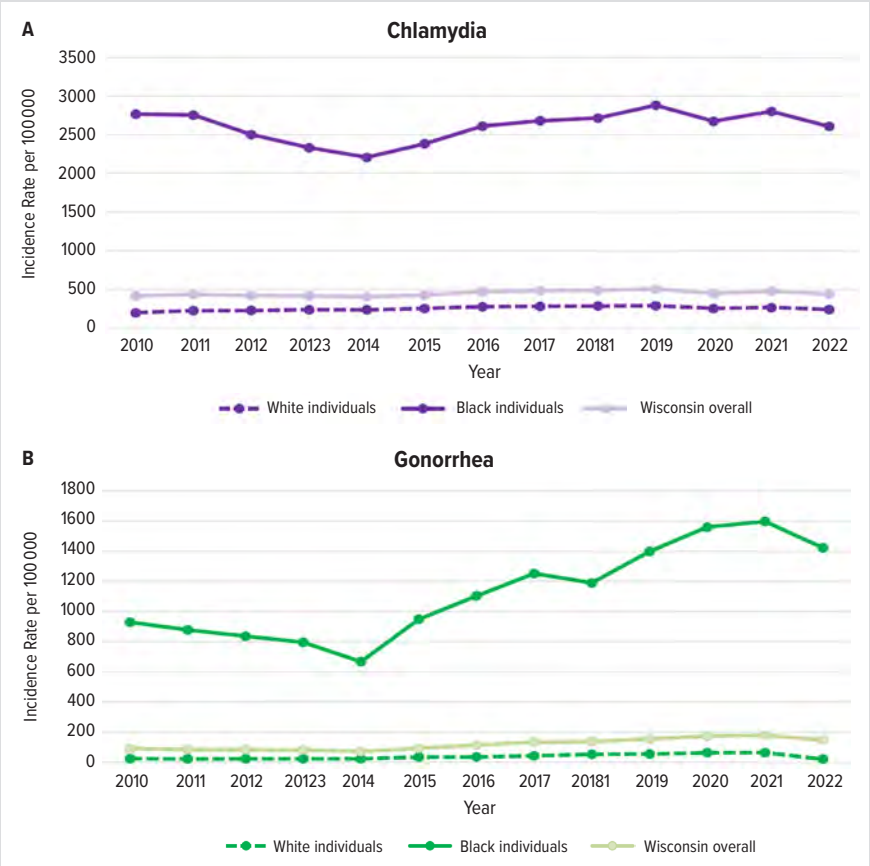
Abbreviations: STI, sexually transmitted infection; AA, African American; AIAN, American Indian and Alaska Native; NHOPI, Native Hawaiian or Other Pacific Islander.
Full demographic data for all years, 2010-2022 available in Supplemental Table 1. Counts <5 were suppressed to protect anonymity. Only data specific to cisgendered men and women are reported.

Figure 1. Chlamydia (A) and Gonorrhea (B) Incidence Rates in Wisconsin from 2010 and 2022 by Sex and Age



Abbreviation: y, years.

Figure 2. Trends in Chlamydia (A) and Gonorrhea (B) Incidence Rates by Race vs Overall Rates in Wisconsin, 2010-2022



Incidence rates per 100 000 are shown for chlamydia (A) and gonorrhea (B) by race, specifically for Black/African American and White individuals and for the overall Wisconsin population, 2010–2022.

2021 to 2022 (Supplemental Table 1). A breakdown of chlamydia incidence rates in Wisconsin by sex, age group, and race in 2010 and 2022 shows the following trends (Table).

By Sex and Age Group: From 2010 through 2022, the incidence of chlamydia in Wisconsin was consistently higher in females than males, though the rate for females decreased by 2.49% (from 591.0 per 100 000 in 2010 to 576.3 per 100 000) during this period, while the rate for males increased by 23.69% (from 237.2 per 100 000 in 2010 to 293.4 per 100 000) (Figure 1). Among females aged 15 to 24 – the age group for which the Centers for Disease Control and Prevention (CDC) recommends routine screening[5] – chlamydia rates decreased by 11.96% (from 3308.5 to 2912.8 per 100 000), while rates increased by 30.08% (from 203.1 to 264.2 per 100 000) in those 25 and older (Figure 1). For males, chlamydia incidence rates increased in both age groups but with a steeper rise among those 25 and older. The rate rose by 10.7% in males aged 15 to 24 (from 1046.4 to 1158.8 per 100 000) and by 47.7% in males 25 and up (from 130.7 to 193.1 per 100 000) (Figure 1).

By Race and Ethnicity: When examining chlamydia rates by race, the largest differences observed in infection rates were consistently between Black or African American and White individuals (Figure 2). In 2010, chlamydia rates for Black or African American individuals (2767.0 per 100 000) were 14 times higher than for White individuals (195.7 per 100 000). By 2022, this gap narrowed to 11 times higher, driven by a 5.75% decline in rates for Black or African American individuals (2607.9 per 100 000) and a 21.26% increase in rates for White individuals (237.3 per 100 000).

Neisseria gonorrhoeae

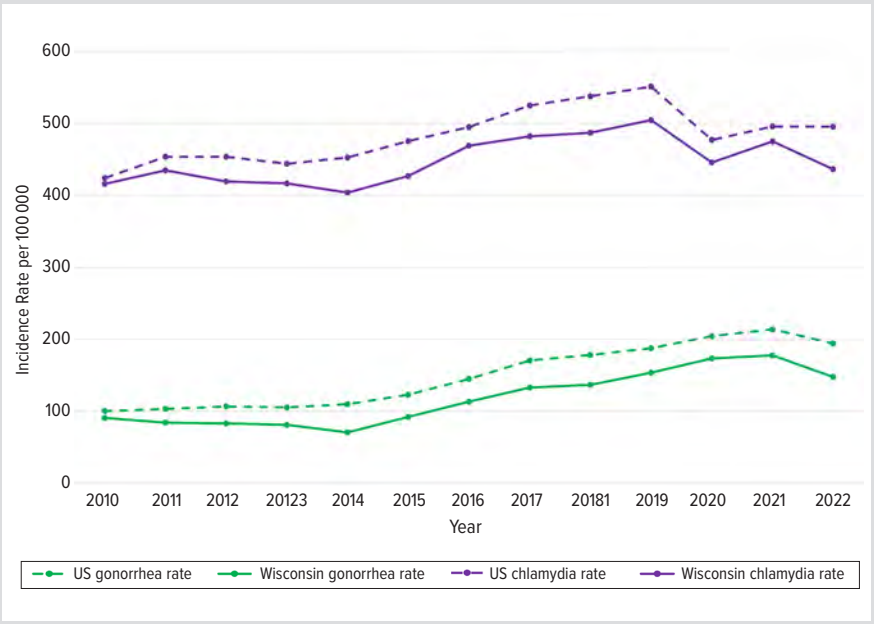
Case Counts and Incidence Rates in Wisconsin

From 2010 through 2022, gonorrhea cases in Wisconsin rose from 5162

reported cases (90.7 per 100 000 people) in 2010 to 7009 (147.7 per 100 000) in 2022 – a 62.84% increase. The highest case count and incidence rate was in 2021, with 10 456 reported cases (177.8 per 100 000), followed by a decline in 2022 to 8705 cases (147.7 per 100 000). A demographic breakdown of gonorrhea infections by sex, age group, and race from 2010 through 2022 shows the following trends (Table).

By Sex and Age Group: In 2010, gonorrhea incidence rates were 1.61 times higher in females (111.8 per 100 000) compared to males (69.3 per 100 000). By 2014, rates equalized between females (70.4 per 100 000) and males (70.5 per 100 000) and have remained higher in males since. In 2022, rates were 1.09 times higher in males (153.9 per 100 000) following a 122.08% increase in infection rates, while female rates decreased by 25.94% to 140.8 per 100 000. (Figure 1). Gonorrhea rates among females 24 and under rose 6.25% (574.7 to 610.6 per 100 000) from 2010 to 2022 and nearly doubled for those aged 25 and older, increasing by 73.0% (47.4 to 82.0 per 100 000) over the same time frame. For males aged 15 to 24, gonorrhea rates increased by 52.2% (295.7 per 100 000 to 450.1 per 100 000) and 226.8% (40.7 per 100 000 to 133.0 per 100 000) for males 25 and older from 2010 to 2022.

Figure 3. United States and Wisconsin Rates of Chlamydia and Gonorrhea, 2010–2022



Incidence rates per 100 000 for chlamydia (purple) and gonorrhea (green) in Wisconsin (solid line) and in the United States (dashed line) from 2010 through 2022.

By Race and Ethnicity: The largest differences in gonorrhea infection rates by race observed were consistently between Black or African American and White individuals. In 2010, gonorrhea incidence rates for Black or African American individuals (929.0 per 100 000) were nearly 40 times higher than for White individuals (23.4 per 100 000). By 2022, this gap narrowed to 30 times higher, driven by a 101.3% rise in rates for White individuals (47.1 per 100 000) and a 53.2% increase in rates for Black or African American individuals (1423.3 per 100 000) (Figure 2).

DISCUSSION

We found that overall rates for both chlamydia and gonorrhea in Wisconsin rose over the study period, 2010-2022. Rates did not rise equally for all demographics; rates for females aged 15 to 24 – those recommended for routine screening by the CDC[5] – stayed stable, while rates for all other demographics showed substantial increases. The racial disparities in Wisconsin between Black and White individuals were particularly notable for both infections and, in 2022, were the largest in the nation. The underlying factors driving these changes are likely multifactorial and reflect both true shifts in infection prevalence and changes in screening practices and access. For example, the 2010 CDC recommendation for annual chlamydia and gonorrhea screening for sexually active females under 25, as well as expanded health care access following open enrollment for the Affordable Care Act in 2014, likely contributed to increased diagnoses nationally due to heightened screening efforts.[5,6] In contrast, the COVID-19 pandemic in 2020 disrupted national health care services and decreased access to routine STI screening, leading to a temporary decline in reported cases and rates.[7-10]

Wisconsin gonorrhea and chlamydia STI trends mirror national patterns, but the state consistently reports lower overall rates compared to national averages (Figure 3, Supplemental Table 3). These lower rates may be due to a genuinely lower disease prevalence, potentially influenced by factors such as differences in population density and the impact of targeted public health initiatives. However, variations in testing access and practices also may play a role. Wisconsin was 1 of only 10 states that didn't expand Medicaid under the Affordable Care Act, which limited health care coverage for low-income individuals and reduced access to routine testing.[11] In addition to health care coverage constraints, public health funding plays a critical role in supporting STI prevention initiatives. Investing in preventive interventions reduces STI rates at the population level.[12-17] The CDC serves as the primary source of such funding for state and local health departments, and for Wisconsin, the CDC is the only source of funding as there are no state funds allocated

to STI prevention. Wisconsin ranked 34th out of 51 states and districts in per capita funding allocated by the CDC for STI prevention and control (Supplemental Table 2). This lower CDC funding level – coupled with limited health care coverage – limits Wisconsin's testing and prevention efforts, exacerbating barriers to timely diagnosis and treatment.

Demographic differences in chlamydia and gonorrhea rates by age, sex, and race in Wisconsin align with national trends but are more pronounced for race.[3] Chlamydia and gonorrhea rates show stable or slower increases among females under 25 – a group prioritized for routine screening – indicating effective early detection in this demographic. In contrast, higher rates of increase among males and individuals over 25 point to potential gaps in screening.[3] Expanding routine screening to these groups may enhance early detection, reduce undiagnosed cases, and curb infection spread. While age- and sex-based trends highlight important gaps in screening coverage, the stark racial disparities in STI rates represent an even more pressing public health challenge in Wisconsin.

Racial disparities in chlamydia and gonorrhea incidence are well-documented.[3,18-20] In 2022, US chlamydia rates among Black or African American individuals were 6.04 times higher than those among White individuals, while gonorrhea rates were 8.05 times higher.[20,21] Wisconsin recorded the largest racial disparities in the nation for both chlamydia and gonorrhea infection rates in 2022, with chlamydia rates 12.5 times higher among Black or African American individuals than among White individuals and gonorrhea rates 34.5 times higher. Notably, these disparities were nearly double the rates observed in the states with the next highest rates, underscoring the extreme and disproportionate burden faced by Black communities in Wisconsin.[18,19] These racial disparities and state comparisons were calculated using all reported cases from CDC data aggregated by the Kaiser Family Foundation, hence the racial disparities do not match perfectly the rates we reported in our results because we used suppressed data to protect anonymity.[18,19] While some of this gap may be due to differences in screening practices, the magnitude of Wisconsin's disparity suggests more complex, underlying social and economic factors. Racial disparities in STIs have long been linked to issues such as poverty, limited access to health care, and differences in sexual health behaviors shaped by social networks.[21,22] These disparities are rooted not only in differences in health care access but in broader manifestations of structural racism, including residential segregation, economic deprivation, and inadequate health services that disproportionately affect Black communities.[23]

Given Wisconsin's uniquely high racial disparity, further research is critical to understanding these inequities, making the state an important case study for addressing structural drivers of STI disparities. Addressing these disparities will require a combination of targeted funding, expanded access to health care, and community-specific interventions to improve screening and treatment. Wisconsin's lower per capita public health funding for STI prevention may represent a critical opportunity for intervention. Increasing targeted public health spending has been shown to effectively reduce STI rates at the population level.[12-17] Focused investment in Wisconsin's most affected communities could play a pivotal role in mitigating these racial disparities.

Strengths and Limitations

This study has several strengths. The longitudinal analysis (2010-2022) provides a robust assessment of trends over more than a decade, offering insights into both long-term patterns and demographic variations and disparities. The use of WEDSS data ensures reliability, as it includes all laboratory-confirmed cases of chlamydia and gonorrhea reported in the state.

However, limitations must be acknowledged. As a descriptive analysis, this study is unable to establish causation between observed trends and specific policy changes or behavioral shifts. Surveillance data also rely on passive case reporting, which is influenced by screening practices and health care access. For instance, increases in reported cases may reflect greater testing availability rather than true increases in disease prevalence. Additionally, racial and ethnic classifications in WEDSS are limited, preventing a more granular analysis of disparities beyond broad racial categories. Lastly, data for gender-diverse individuals were not reportable due to small sample sizes and the lack of reliable population denominators, underscoring the need for improved surveillance efforts in this population.

CONCLUSIONS

Chlamydia and gonorrhea infections continue to pose public health challenges in Wisconsin, with rates for both infections rising over the past decade. The burden of these diseases is distributed unevenly across different demographic groups: while younger females historically have exhibited higher incidence rates, the most rapid increases recently have been observed in males and individuals over the age of 25. The stable rates of infection among females under 25 – likely due to CDC routine screening recommendations – contrast with rising rates across other groups, underscoring the potential benefit of expanding universal screening to include males and those over 25. Future work could focus on narrowing the age ranges with the most benefit from universal screening. Additionally, the striking racial disparities in chlamydia and gonorrhea incidence in Wisconsin, which far exceed national averages, highlight the urgent need for focused attention, resources, and research to understand and address factors that drive these inequities. These research findings support the need for expanded screening and targeted investigations and interventions to better control the spread of STIs and promote health equity across all demographic groups in Wisconsin and beyond.

Financial Disclosures: None declared.

Funding/Support: Laura Jacques was supported by the Wisconsin Department of Health Services Reproductive Health Family Planning Title X Project, FPHPA00656; Elise S. Cowley is a Medical Scientist Training Program (MSTP) student supported in part by MSTP grant T32GM140935.

Appendices: Supplemental tables available at www.wmjonline.org

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Wisconsin Adolescents' Attitudes, Beliefs, Motivations, and Behaviors Surrounding E-Cigarette Use and Cessation

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ABSTRACT

Introduction: Electronic cigarettes (e-cigarettes) are the most common tobacco product used by adolescents, yet no evidence-based cessation treatment for adolescents exists.

Methods: Wisconsin residents aged 13 to 17 (N = 227) completed an online survey assessing e-cigarette use, knowledge, motivations around using and quitting, and recommendations for cessation intervention content.

Results: Most of our sample never vaped (76.2%), reporting concerns with health effects and addiction as motivations preventing initiation. Among adolescents who used e-cigarettes, friend use was the main motivation for initiation, and mental health symptoms promoted ongoing use. Motivations for quitting included health harms, cost, and addiction.

Conclusions: This study identified various topics that motivate and demotivate e-cigarette use among adolescents. This information can be incorporated into prevention and treatment strategies tailored to adolescents.

INTRODUCTION

Electronic cigarettes (e-cigarettes) have been the most popular tobacco product used by US middle and high school students since 2014.[1] Use of e-cigarettes exposes adolescents to various toxicants, carcinogens, and fine particles and places them at risk of complications from nicotine, including dependence, deficits in attention and cognition, and mood disorders.[2]

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There are limited evidence-based vaping cessation interventions for adolescents, leaving clinicians, parents, and adolescents to do the best they can to support vaping cessation.[3,4] Most adolescents report using no assistance in vaping cessation attempts.[5] Thus, there is an urgent need to develop vaping cessation interventions that are effective and appealing to young people.

In September 2022, the Wisconsin Department of Justice finalized a multistate settlement with JUUL Labs to hold JUUL accountable for marketing e-cigarettes to young people.[6] The current study, funded by the Wisconsin JUUL settlement, was designed to examine adolescents' (1) vaping risk perceptions and knowledge; (2) motivations for initiation, ongoing use, and cessation; and (3) preferences for prevention and cessation intervention content and delivery. Results from this study will inform future prevention and cessation intervention development.

METHODS

In December 2023, eligible participants aged 13 to 17 years who resided in Wisconsin completed an online survey. Eligible individuals were invited by Centiment, a nationwide survey company, to complete an online survey via email, text, or through a web-based portal. Centiment actively recruits and maintains survey panels, obtaining extensive background profile information to allow for targeted survey recruitment.[7] Centiment also uses rigorous methods to ensure the consistency of survey responses by panel members.

Participants were presented with a survey description and provided informed assent prior to completing the survey. Survey questions were compiled from national surveys assessing youth tobacco use,[8,9] in addition to original survey questions. Participants

were categorized by vaping status: never vaped, formerly vaped (reported prior vaping but no use in past 30 days), and currently vape (e-cigarette use within the past 30 days). Based on their vaping status, participants answered questions about motivations for vaping or not vaping, future vaping or quit plans, type and frequency of use, quit attempts, and quit strategies. The full survey is available online at https://osf.io/jn7xy/. Participants received $17.50 for survey completion.

This study was approved by the University of Wisconsin Institutional Board. Descriptive statistics and analyses were performed using R version 4.3.1 (R Core Team) in RStudio version 2023.06.1 (RStudio Team) and SPSS Statistics version 27 (IBM Corp). A coder (JK) used inductive coding to categorize open text responses.

RESULTS

A total of 227 adolescents participated in the study. The mean age of participants was 15.8 years old, and 65.6% identified as female, 69.6% White, 11.5% Black/African American, 67.8% heterosexual, 54.2% from an urban ZIP code, and 53% were in 11th or 12th grade (Table 1). Most participants reported no lifetime vaping (n = 173, 76.2%); 54 (23.8%) respondents reported vaping at least once. Youth who currently vape (n = 28, 12.3%) reported vaping a mean of 16.8 days during the last 30 days (SD 11.9, mode = 30); 39% reported daily use, and 42.9% reported vaping 10 or more times per day. Most adolescents who formerly vaped (60%) reported not having vaped in the past year.

Vaping Risk Perceptions and Knowledge

Participants (n = 227) reported vaping was "very" or "extremely" harmful to physical health (84%) and mental health (73%). In comparison to smoking cigarettes, 22% reported vaping was less harmful, 44% reported vaping and smoking were equally harmful, and 34% reported vaping was more harmful. Almost all (91%) reported that becoming addicted to vaping was "somewhat" or "very" likely. The most common themes among responses to the open-ended question, "What are the harms of vaping that you are most worried about?" were lung health/damage, cancer, nonspecific health effects, addiction, and mental health disorders (depression or anxiety). Participants indicated that their main sources of information on vaping risks included the internet/social media (78%), school (77%), parents/family (62%), doctors/health care (57%), and TV (45%). Only 10% of respondents knew of any programs to help adolescents quit vaping.

Vaping Initiation

Individuals with a history of vaping reported that "friend use" was the most common reason for initiation (75.9%), with curiosity (55.6%), family member use (25.9%), and flavors (20.4%) also motivating initiation. No participants reported initiating e-cigarettes to quit cigarettes or another tobacco product (Table 2).

Table 1. Participant Demographics, N = 227

Age, Mean (SD)	15.8 (1.3)
Age, n (%)	
13	18 (7.9%)
14	29 (12.8%)
15	25 (11.0%)
16	49 (21.6%)
17	100 (44.1%)
Grade, n (%)	
6–8	35 (15.4%)
9–10	61 (26.9%)
11–12	128 (53.4%)
College	2 (0.9%)
Gender, n (%)	
Male	62 (27.3%)
Female	149 (65.6%)
Nonbinary, transgender, gender nonconforming	15 (6.6%)
Race, n (%)	
White	158 (69.6%)
Black/African American	26 (11.5%)
Asian	11 (4.8%)
American Indian or Alaskan Native	3 (4.8%)
Native Hawaiian or Other Pacific Islander	2 (0.9%)
More than 1 race	22 (9.7%)
Unknown, not reported, or Other	10 (4.4%)
Latino/Hispanic, n (%)	32 (14.1%)
Geographic distribution, n (%)	
Large rural	20 (8.8%)
Small town/rural	43 (18.9%)
Suburban	21 (9.3%)
Urban	123 (54.2%)
Sexual orientation, n (%)	
Heterosexual	154 (67.8%)
Bisexual	37 (16.3%)
Gay or Lesbian	13 (5.7%)
I don't know	16 (7.0%)
None of these describe me	6 (2.6%)
Vaping behavior, n (%)	
Never user	173 (76.2%)
Former user	20 (8.8%)
Current user	28 (12.3%)

Note: Geographic distribution is classified by Rural-Urban Commuting Areas (RUCA) ZIP codes using the R package ruca.[10]

Among individuals who reported never vaping, 97% indicated they would "probably not" or "definitely not" try vaping in the next 12 months. Similarly, 94% also reported "probably not" or "definitely not" when asked, "If one of your best friends were to offer you a vape, would you try it?" When these adolescents were asked, "Why do you think you have never tried vaping," the most common themes from the 169 free-text responses were health concerns and addiction.

Current Vaping

Among individuals who currently vape, the most common reasons for ongoing vaping were "because I feel anxious, stressed, or

depressed" (39.3%); "a friend uses them" (35.7%); "I can use them unnoticed at home or at school" (28.6%); "flavors" (25%); and "to get a high or buzz from nicotine" (25%) (Table 2). Respondents perceived they were moderately addicted to vaping (mean 4.3, SD 3.3 on 10-point scale: 0 = "not at all" to 10 = "extremely"). The most common sources for obtaining e-cigarettes were "have someone else buy them" (46.4%) and "from a friend" (39.3%). Only 21.4% reported buying e-cigarettes for themselves. Of those who purchased their own e-cigarettes, gas stations and smoke shops were the most common purchase locations.

Table 2. Factors That Motivate Vaping

Motivations for Initiation Among Ever Users	Motivations for Continued Use Among Current Users
Friend use – 75.9%	Feeling anxious, stressed, or depressed – 39.3%
Curiosity – 55.6%	Friend use – 35.7%
Family member use – 25.9%	Able to use unnoticed at home or school – 28.6%
Flavor availability – 20.4%	To get high or a buzz from nicotine – 25.0%
Feeling anxious, stressed, or depressed – 16.7%	Flavor availability – 25.0%
Able to use unnoticed at home or school – 16.7%	Addiction – 21.4%
Use them to do tricks – 14.8%	Use them to do tricks – 21.4%
Use seen on TV, online, or in movies – 14.8%	Cost less and easier to get than cigarettes – 10.7%

Table 3. Factors That Motivate Quitting Vaping

Former Users' Motivations for Quitting	Current Users' Motivations for Quitting
Health harms – 40%	Health harms – 52.2%
E-cigarettes are not cool – 40%	Addiction – 52.2%
Addiction – 25%	Cost – 43.5%
Vaping impact on sport/other performance – 15%	Fear of "getting caught" – 26.1%
Cost – 10%	Issues with my health – 21.7%
Issues with my health – 10%	Vaping impact on sport/other performance – 17.4%
E-cigarettes are illegal – 10%	Impact on school performance – 13.0%
Impact on school performance – 10%	Difficulty obtaining – 13.0%

Quitting Vaping

Among youth who formerly vaped, the primary motivations for quitting were "e-cigarettes are harmful to my health" (40%), "e-cigarettes are not cool" (40%), and "e-cigarettes are addictive" (25%) (Table 3). These adolescents perceived they had been minimally addicted to vaping (mean 1.7, SD 2.4 on 10-point scale: 0 = "not at all" to 10 = "extremely"), and 70% did not use any resources to quit vaping.

Among youth who currently vape, 82.1% were thinking seriously about quitting vaping, 65% reported considering quitting in the next 6 months. Primary reasons for wanting to quit were health harms (52.2%), addiction (52.2%), and cost (43.5%) (Table 3). Respondents reported that if they were to quit today, they would want help from "friends" (43%), "parents or family members" (40%), or to "quit by myself, without help from others" (28%). Only 14.2% reported they would want a health care professional to help.

Vaping Prevention and Treatment Intervention Design

Participants were asked, "If you could design a message to encourage teenagers not to vape, what would your main message be?" The most common themes included (1) negative health consequences, (2) addiction, (3) social unacceptability, and (4) mental health consequences. In addition, participants were asked about messaging they would not pay attention to, and respondents suggested avoiding simple, nonspecific phrases like "just don't vape" or "it's bad for you" and avoiding messages delivered by adults instead of youth.

DISCUSSION

This survey of 227 Wisconsin adolescents assessed vaping risk knowledge, motivations for initiation, ongoing use, quitting, quit strategies, and potential content for a prevention and cessation intervention. Health harms and addiction were identified as common themes that youth perceive as powerful motivators for both discouraging initiation and promoting quitting. Most participants reported never using e-cigarettes (76%), primarily due to concerns about health harms and addiction. Among youth who formerly used e-cigarettes, concern about health harms was the most common motivation for quitting. Adolescents recommended incorporating the themes of health harms, addiction, and mental health consequences in the design of cessation interventions. These findings are consistent with prior literature[11] and suggest these themes be incorporated into interventions to prevent initiation or escalation of use, as well as to motivate quitting among adolescents.

E-cigarette use by a friend was identified as the main reason for initiating use and was a common reason for ongoing use. This is consistent with prior work[12] and highlights the importance of individuals having effective "refusal skill" strategies to counteract peer pressure. In addition, while anxiety, stress, and depression were not common reasons for initiating use, they emerged as important motivations for ongoing use. An intervention that can help users identify healthier coping strategies to address these symptoms may reduce the influence that mental health symptoms have on promoting continued use.

Most youth who currently vape endorsed a desire to quit vaping, but only 10% of the sample was aware of any vaping cessation resources. Developing an intervention that can reach adolescents who vape is critical. Participants reported receiving information about e-cigarettes from social media or other online platforms,

which suggests these venues can serve to disseminate a vaping cessation intervention.

This study has several limitations. The population was a small convenience sample based on an existing participant pool and, thus, may not be representative of adolescents in Wisconsin, though our sample did show geographic diversity. Additionally, given that e-cigarette use is illegal for adolescents, respondents may have reported lower rates of use and future use intentions. Further, since the majority of the sample had never vaped (76%), the overall results may be less reflective of the attitudes of youth with experience vaping.

CONCLUSIONS

Our study identified several themes that motivate e-cigarette initiation and ongoing use among adolescents, including peer pressure and mental health symptoms. Factors that discouraged e-cigarette initiation and motivated quitting included concerns about health harms, addiction, cost, and social unacceptability. These themes can be incorporated into vaping prevention and cessation interventions for adolescents.

Funding/Support: Funding for this study was provided by Wisconsin Department of Health Services, MSN276077.

Financial Disclosures: Megan Piper, PhD, reports receiving consulting fees from Temple University, New York University, University of South Carolina, and University of Waterloo and grand rounds speaker payments or honoraria from University of Alabama Birmingham and Roswell Park.

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Epidemiology of Xylazine-Positive Fatal Overdoses in Milwaukee County, Wisconsin, 2019-2023

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ABSTRACT

Background: Xylazine association with fentanyl poses an emerging threat to public health. We conducted a retrospective study to analyze xylazine-related fatal overdoses in Milwaukee County, Wisconsin from 2019 through 2023.

Methods: Using medical examiner data, we compared fatal xylazine overdoses (n = 243) with fentanyl overdoses without xylazine (n = 1946). Demographic, polysubstance, temporal, and geographic characteristics were analyzed.

Results: Xylazine fatalities have surged since 2019, exhibiting different polysubstance profiles than fentanyl overdoses without xylazine. We identified 8 geospatial clusters contributing to 64% of xylazine overdoses.

Discussion: We encourage localized interventions to address the xylazine-fentanyl syndemic. Policy measures such as Wisconsin Act 217, which legalized xylazine testing materials, promote evidence-based harm reduction tools to mitigate the risks associated with xylazine's increasing prevalence in the Midwest.

BACKGROUND

The opioid overdose crisis is exacerbated by the ever-shifting supply of highly potent adulterants. Xylazine—a powerful veterinary tranquilizer not approved for human use—poses a public health threat through its association with illicitly manufactured fentanyl.[1-2] The National Center for Health Statistics reports that the age-adjusted rate of drug overdose deaths involving xylazine increased 35 times from 2018 through 2021.[1] Xylazine is suspected to prolong the euphoric effects of opioids for people who use drugs; however, xylazine may exacerbate typical adverse opioid effects, including respiratory depression, and elevate fatal overdose risk.[3] Since xylazine is not an opioid, its toxic effects are unresponsive to naloxone (Narcan) administration, endangering individuals who intentionally or unintentionally use substances laced with xylazine.[3]

In this brief report, we investigate the epidemiological characteristics of xylazine-positive fatal overdoses in Milwaukee County, Wisconsin from 2019 through 2023. We compare these cases to an active comparator group—fentanyl-positive overdose deaths without xylazine—focusing on demographics, polysubstance profiles, and geospatial distribution. Findings from this preliminary study may inform future research and community engagement initiatives that seek to understand and address this emerging trend in the Midwest.

METHODS

Data on fatal overdose deaths occurring from January 2019 through December 2022 were obtained from the Milwaukee County Medical Examiner's Office on October 17, 2023.[4] Data from January 2023 through December 2023 were obtained on April 4, 2024, to account for data lag resulting from pending cases or delayed toxicology reports. Deidentified death records (n = 2932) included all information publicly available through the medical examiner's public access dashboard, with the cause of death based on autopsy and toxicology reports. The Medical College of Wisconsin Institutional Review Board waived the human subjects research review for this retrospective study of decedent data, as it presents minimal risk.

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Table. Demographic, Temporal, and Polysubstance Characteristics of Xylazine-Positive Fatal Overdoses (Cases) and Fentanyl Overdoses (Active Comparators, No Xylazine Present) (N = 1946) in Milwaukee County, Wisconsin, January 1, 2019 – December 31, 2023

	Xylazine (Cases) N = 243 % (n)	Fentanyl (ACs) N = 1946 % (n)	*P* value
Sex			
Male	69.96% (170)	74.46% (1449)	ns
Race/ethnicity			ns
Asian/Pacific Islander	1.23% (3)	0.82% (16)	
Black/African American	35.80% (87)	33.45% (651)	
Eastern Indian	0% (0)	0.31% (6)	
Hispanic/Latino	14.81% (36)	10.28% (200)	
Multiracial	0.82% (2)	0.82% (16)	
Native American	0.82% (2)	1.44% (28)	
White	46.50% (113)	52.88% (1029)	
Age, mean (SD)	45.00 (13.17)	43.58 (12.60)	ns
0–24	3.70% (9)	5.04% (98)	
25–34	22.63% (55)	23.18% (451)	
35–44	25.51% (62)	24.67% (480)	
45–54	18.11% (44)	24.10% (469)	
55–64	23.05% (56)	18.65% (363)	
65+	7.00% (17)	4.37% (85)	
Mode of death			ns
Accident	98.77% (240)	98.30% (1913)	
Suicide	0.82% (2)	0.46% (9)	
Undetermined	0.41% (1)	1.23% (24)	
Year[a]			< 0.001
2019	0.82% (2)	12.38% (241)	
2020	1.65% (4)	20.71 % (403)	
2021	15.64% (38)	23.69% (461)	
2022	23.05% (56)	24.15% (470)	
2023	58.85% (143)	19.06% (371)	
Total Substances: mean (SD)	4.56 (1.36)	2.94 (1.50)	< 0.001
Xylazine	100% (243)	0% (0)	
Fentanyl	97.94% (238)	100% (1946)	
Acetylfentanyl	15.64% (38)	10.69% (208)	< 0.05
Fluorofentanyl	44.86% (109)	19.48% (379)	< 0.001
Any analog	50.21% (122)	27.54% (536)	< 0.001
Nitazenes	6.17% (15)	2.47% (48)	< 0.001
Isotonitazene	2.06% (5)	0.67% (13)	< 0.05
Metonitazene	5.76% (14)	2.16% (42)	< 0.001
Brorphine	0.82% (2)	0.67% (13)	ns
Heroin	22.22% (54)	14.65% (285)	< 0.01
MOUD	5.76% (14)	4.68% (91)	ns
Methadone	2.06% (5)	2.88% (56)	ns
Buprenorphine	3.70% (9)	1.80% (35)	< 0.05
Stimulants	65.84% (160)	57.71% (1123)	< 0.05
Cocaine	62.96% (153)	53.08% (1033)	< 0.01
Amphetamine	2.06% (5)	2.26% (44)	ns
Methamphetamine	10.29% (25)	7.81% (152)	ns
Sedatives	39.92% (97)	44.09% (858)	ns
Ethanol	22.22% (54)	25.64% (499)	ns
Benzodiazepine	14.40% (35)	15.42% (300)	ns
Weak sedative	30.45% (74)	33.76% (657)	ns
Strong sedative	14.40% (35)	15.47% (301)	ns
Any hallucinogen	0.41% (1)	0.15% (3)	ns
Gabapentin	8.23% (20)	8.32% (162)	ns
Antidepressant/antipsychotic	9.47% (23)	3.55% (69)	< 0.001

Abbreviations: ACs, active comparators; ns, not significant; MOUD, medications for opioid use disorder.

[a]2019 through 2022 data were obtained on October 17, 2023; 2023 includes overdose deaths in 2023, as reported when the dataset was obtained on April 4, 2024.

Records of suspected overdoses were screened and included in the "xylazine cases" group if "xylazine" was indicated in the toxicology report. We also extracted an active comparator (AC) group, defined as "fentanyl-positive overdose deaths without xylazine present." This AC group was identified because xylazine is predominantly associated with fentanyl.[1-2] Thus, the AC group restricts comparisons to people who use drugs with similar indications, where we hypothesized no significant differences between the 2 groups except for the presence of xylazine. The significance threshold for all statistical tests was set at $\alpha = 0.05$.

Our analytic dataset included 243 "xylazine cases" and 1946 "fentanyl ACs," which reported information on demographics, timestamps, and toxicology findings. One fentanyl overdose classified as a homicide was excluded. Two hundred forty-one xylazine cases (99.2%) and 1910 fentanyl ACs (98.2%) reported an incident address not corresponding with a hospital and were included in the geospatial analysis. Five overdoses matched hospital locations and were excluded in the geospatial analysis (n = 5, 1 xylazine case).

Geospatial Analysis

Incident addresses were geocoded in QGIS, an open-source geospatial analysis software (QGIS Geographic Information System, Open Source Geospatial Foundation Project). Census tract and county boundary shapefiles were obtained from the Milwaukee County GIS Open Data Portal. Overdoses were joined spatially to census tracts for analysis.

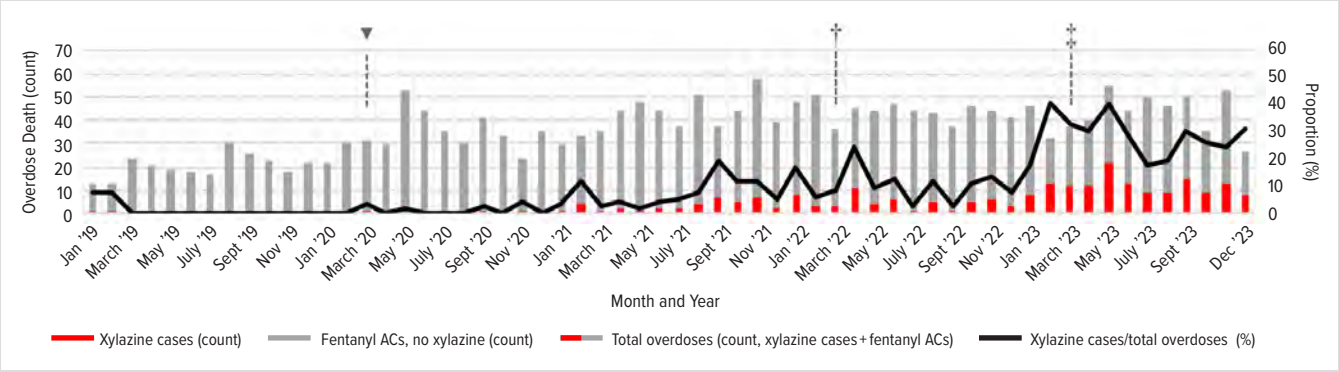
We leveraged a complementary framework in our analysis—visualizing both the "absolute burden" or raw count of xylazine overdoses and the proportion of xylazine overdoses as a subgroup of all fentanyl overdoses. We identified clusters of xylazine cases using the "nearest neighbors clustering map" processing tool, available through the Visualist QGIS plugin version 2019 (Quentin Rossy). To capture localized patterns, cluster size was defined pragmatically as a minimum of 10 cases, with the maximum distance between points set to 2000 meters. We calculated the proportion of fatal xylazine overdoses per census tract as "xylazine cases/(xylazine cases + fentanyl ACs)." Exploring proportions of xylazine cases enabled an adjusted examination of xylazine's geography, considering its ubiquitous co-occurrence with fentanyl.

RESULTS

Demographic and Polysubstance Characteristics

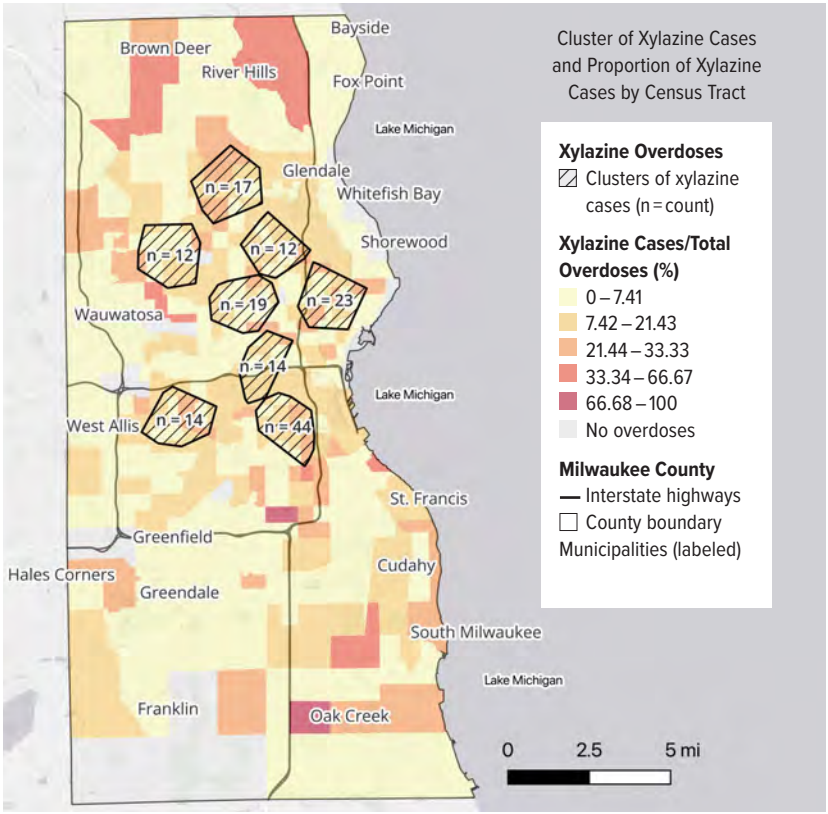
The demographic and polysubstance characteristics of the xyl-

Figure 1. Monthly Counts of Xylazine vs Fentanyl (Active Comparators, No Xylazine) Overdose Deaths in Milwaukee County, 2019-2023



▼Wisconsin announces initial "stay-at-home" order during COVID-19 pandemic (March 2020).
† Fentanyl testing strips decriminalized in Wisconsin (March 2022).
‡ US Food and Drug Administration approves Narcan as first naloxone product available "over the counter" without a prescription (March 2023).
2023 may not be inclusive of all overdose deaths under Milwaukee County Medical Examiner Office's jurisdiction due to cases still pending release when the dataset was obtained on April 4, 2024.

Figure 2. Geospatial Distribution of Fatal Xylazine Overdoses (Cases) in Milwaukee County, 2019-2023



City of Milwaukee , Milwaukee County Land Information, Milwaukee County Medicial Examiner Office, Environmental Systems Research Institute., Developed in QGIS on April 7, 2024.

Fatal overdoses with known incident address location were geocoded, including xylazine-cases (n = 241) and fentanyl ACs (n = 1910). Eight clusters of xylazine-cases were identified using the "nearest neighbors cluster map" function (available through Visualist QGIS Plugin), with the minimum size of clusters set at 10 cases and the maximum distance between points set at 2000 meters. The minimum threshold of 10 for cluster size was pragmatically selected to allow for the identification of multiple, meaningful clusters that sufficiently capture localized patterns. These clusters accounted for n = 155 xylazine cases (64.32% of total xylazine cases included in geospatial analysis). "Total Overdoses" were calculated per census tract as the sum of xylazine cases and fentanyl active-comparators.

azine cases and fentanyl ACs are presented in Table 1. There were 243 xylazine-positive fatal overdoses (70% male, 36% Black, 47% White, 15% Hispanic, 3% other race/ethnicity) and 1946 fentanyl overdoses without xylazine in the AC group (74% male, 33% Black, 53% White, 10% Hispanic, 3% other race/ethnicity). Over 98% of overdoses in both groups were classified as "accidental." Through bivariate analysis, chi-square tests identified year of death as a significant variable ($P < 0.001$). Xylazine cases affected a slightly older population than the AC group (mean age = 45.00 vs 43.58 years, $P > 0.05$, mean difference = 1.42).

Xylazine cases co-occurred with fentanyl almost 98% of the time, reinforcing a strong adulterant association consistent with national trends.[1-2] On average, xylazine cases included significantly more substances than fentanyl ACs (mean = 4.56 vs 2.94, $P < 0.001$; mean difference = 1.62) and exhibited polysubstance profiles distinct from fentanyl ACs. Xylazine cases were significantly associated with psychoactive substances, including fentanyl analogues (50.21% vs 27.54%, $P < 0.001$), nitazenes (6.17% vs 2.47%, $P < 0.01$), heroin (22.22% vs 14.65%, $P < 0.01$), stimulants (65.84% vs 57.71%, $P < 0.05$), and cocaine (62.96% vs 53.08%, $P < 0.01$). Xylazine cases also were associated with prescription medi-

cations, including buprenorphine (3.70% vs 1.80%, $P<0.05$) and antidepressant/antipsychotic medications (9.47% vs 3.55%, $P<0.001$). No significant differences were observed among sedatives across the groups.

Temporal Trends

Xylazine-positive overdoses have grown substantially since 2019. Figure 1 displays the number of overdose deaths by month and study group. A trend line illustrates the proportion of xylazine cases/total overdoses over time. Xylazine-positive fatal overdoses increased approximately 40-fold between January 2021 and December 2023 (n = 6 during 2019-2021, n = 237 during 2021-2023), and xylazine has been reported consistently in overdose deaths every month since January 2021.

Spatial Clusters

Figure 2 presents a map illustrating clusters of xylazine cases superimposed on the proportions of "xylazine cases/total overdoses" by census tract. We identified 8 xylazine clusters, ranging from 12 to 44 cases and totaling 155 cases (64.32% of xylazine cases included in geospatial analysis). Nonetheless, we observed substantial variability in the proportions of xylazine cases relative to total overdoses across census tracts of Milwaukee County. Within the identified xylazine case clusters, the net proportion of xylazine cases/total overdoses was 15.8% (155/981).

DISCUSSION

In this study, empirical evidence highlights epidemiological features underlying fatal overdose deaths in Milwaukee County involving xylazine (cases) and fentanyl (ACs, no xylazine) reported by the Milwaukee County Medical Examiner's Office from January 2019 through December 2023. We encourage this report to be considered within the context of the 2023 Wisconsin Act 217—to decriminalize xylazine testing materials as drug paraphernalia in Wisconsin—which was enacted in March 2024.[5] With Act 217, people who use drugs in Wisconsin are empowered to address xylazine proactively as an adulterant of growing concern.

Within this study's timeframe, the first xylazine-positive overdose death in Milwaukee was reported in January 2019. Over 2 years, xylazine became increasingly prevalent in fatal overdoses and continued to rise through 2023, where it was involved in 27.3% of total overdoses involving fentanyl (139/510). In 2023, there were 4 fatal overdoses involving xylazine without fentanyl (2 involving cocaine and 2 involving cocaine and heroin). The substantial increase in xylazine-positive fatal overdoses since 2019 is consistent with reports from other Midwestern cities.[6] Geospatially, xylazine cases show a distribution similar to fentanyl ACs, reflecting xylazine's frequent association with fentanyl as an adulterant. Nonetheless, our geospatial analysis of xylazine-case clusters and proportions of xylazine cases offers preliminary insights into xylazine's localized geography.

Limitations and Future Directions

This study is limited by its retrospective design, which encompasses only fatal overdoses under the jurisdiction of the Milwaukee County Medical Examiner's Office from 2019 through 2023, as reported when the data were acquired. Recent overdoses may be underestimated due to pending cases or toxicology delays. Prospective research is essential to understanding the true burden of xylazine in this region.

We recommend tailored approaches to addressing the xylazine-fentanyl syndemic unfolding in our diverse metropolitan area. We commend the decriminalization of xylazine testing strips in Wisconsin via Act 217, which will enhance harm reduction services for people who use drugs. Qualitative research suggests that numerous people who use drugs show interest in utilizing testing strips to prevent xylazine exposure.[7] Implementing similar initiatives in Milwaukee may augment community support and health promotion among this population.

Ultimately, a paradigm shift towards harm reduction is essential in Wisconsin. Substance use disorders should be considered as public health issues affecting individuals, families, and communities rather than criminal justice issues. The legalization of fentanyl testing strips in 2022 provided people who use drugs and communities in Wisconsin with new opportunities to reduce overdose risk. Similarly, Act 217 represents a promising step to raise public awareness about the increasing prevalence of xylazine and to expand the availability of evidence-based harm reduction tools.

We encourage precision epidemiology approaches to the polysubstance overdose crisis in Milwaukee. These approaches should consider Milwaukee's public health, demographic, and socioeconomic heterogeneity at the community level, as emphasized by Forati et al.[8] For example, Milwaukee County's harm reduction vending machines might consider integrating xylazine test strips in communities disproportionately affected by xylazine-positive fatal overdoses. Additionally, the Office of Emergency Management's Overdose Dashboard now presents polysubstance overdose trends and profiles, including xylazine."[9] Ultimately, ongoing surveillance of the recreational drug supply, which would require community-engaged partnerships (such as routine testing of drug samples within harm reduction centers), remains an utmost priority to proactively address the risks associated with a constantly shifting polysubstance market.[10]

Funding/Support: None declared.

Financial Disclosures: None declared.

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Assessing the Educational Needs of Wisconsin Primary Care Clinicians Caring for Persons Living With Dementia

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ABSTRACT

Background: Nearly 90% of persons living with dementia experience behavioral and psychological symptoms of dementia (BPSD). Primary care clinicians may require more training to address these symptoms.

Methods: We surveyed Wisconsin primary care clinicians to assess their current approaches, needs, and interest in future educational interventions related to managing BPSD.

Results: Over 60% of clinicians reported lack of ability or training in managing BPSD, while over 75% expressed interest in educational interventions that included discussion of treatment algorithms or virtual didactics.

Discussion: Given the apparent widespread demand and need for educational interventions on BPSD for primary care clinicians, future studies are needed to assess the efficacy of such interventions in improving clinicians' preparedness to care for patients with BPSD.

BACKGROUND

By 2060, there are projected to be 13.9 million people with Alzheimer's disease or related dementias in the United States.[1] As many as 90% of people living with dementia will experience behavioral and psychological symptoms of dementia (BPSD), such as depression, anxiety, psychosis, and sleep disturbances, among other symptoms.[2] Managing BPSD is complex and involves assessing patients' symptoms, evaluating underlying medical conditions, and considering pharmacologic and nonpharmacologic treatment options.[2] Primary care clinicians provide the majority of outpatient care to people living with dementia, with 1 study suggesting that 80% of fee-for-service Medicare beneficiaries with dementia receive most of their outpatient care from a primary care clinician.[3] Yet, clinicians may lack the training needed to appropriately manage BPSD experienced by these patients.[4] To tailor future educational intervention strategies on BPSD management for clinicians, we conducted a brief survey among Wisconsin primary care clinicians to learn current approaches, potential gaps, and continuing education preferences in the care of patients with BPSD.

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METHODS

Sample

As part of a larger effort by our research group to create educational interventions on BPSD management for primary care teams,[5,6] we conducted a survey using a convenience sample of primary care clinicians caring for patients ages 65 and above, primarily in the Wisconsin Research and Education Network, as well as the Wisconsin Medical Society, Wisconsin Academy of Family Physicians, and colleagues of members of the Wisconsin Alzheimer's Institute Dementia Diagnostic Clinic Network.[7] The survey was administered via an anonymous link shared through email and e-newsletters, with all survey data collected using REDCap (Research Electronic Data Capture) software[8] hosted by the Department of Medicine at the University of Wisconsin School of Medicine and Public Health.

Measures

The survey included items assessing clinicians' demographic and

clinical practice characteristics, prior training in dementia and/or BPSD management (yes/no), and perceived gaps in their or their clinic's ability to care for patients with BPSD (yes/no/maybe). Clinicians' current approaches for managing BPSD were assessed by asking if they used pharmacologic approaches, nonpharmacologic approaches, or patient referral, with follow-up questions regarding the specific approaches within those 3 categories as applicable. Confidence in clinical ability to manage BPSD was assessed using a modified confidence subscale from the General Practitioner Attitudes and Confidence Scale for Dementia.[9] Continuing education preferences were assessed via a list of potential educational interventions: onsite or virtual discussion of treatment algorithms; virtual lectures or seminars; onsite or virtual discussion of generic cases; case discussion without patient present; listening to podcasts, reading suggested literature on my own; case consultation with patient present; online didactics without case discussion; and in-person lectures or seminars held on the University of Wisconsin-Madison campus. For each intervention, respondents indicated their likelihood of participating on a 5-point Likert scale from 1 (extremely unlikely to participate) to 5 (extremely likely).

Analyses

Because the focus for this project was to assess the educational needs of primary care clinicians, only those survey respondents who indicated they were physicians or advanced practice providers were included in the study. To facilitate interpretation of continuing education preferences, responses to the 5-point Likert scales assessing the likelihood to participate were collapsed to "willing" (Likert responses 4 or 5), "neutral" (3), and "unwilling" (1 or 2). Descriptive statistics were calculated overall and by BPSD preparedness. Difference in mean confidence was tested via a 2-sided *t* test with statistical significance established as $P<0.05$. Fisher exact tests were used for comparing distributions of categorical variables between low and high BPSD preparedness respondents. Spearman rank correlation coefficients were determined across continuing educational preferences for low and high BPSD preparedness respondents.

The project was approved by the University of Wisconsin-Madison Institutional Review Board.

RESULTS

Clinician Respondents

Seventy-eight individuals reviewed the study's webpage and 56 completed the survey. Of these respondents, 46 indicated they were physicians or advanced practice providers and were the focus of our analyses. The 10 remaining respondents worked in other health professions or had missing data for profession and were excluded. Due to a low number of clinician respondents who stated there were no gaps in care and to prioritize future training targets, we split respondents into 2 groups: "low BPSD preparedness clinicians" (clinicians who reported both "yes" to perceived gaps in ability to provide care and "no" to prior training in dementia/BPSD management) and "high BPSD preparedness" clinicians (clinicians who reported "yes" to having prior training and/or reported "maybe" or "no" to gaps in ability to provide care).

Table 1. Clinician Demographic and Clinical Practice Characteristics by BPSD Preparedness

	BPSD Preparedness		
	Low (N = 22)	High (N = 24)	Overall (N = 46)
Demographics			
Profession			
Physician	19 (86.4%)	20 (83.3%)	39 (84.8%)
Advanced practice provider	3 (13.6%)	4 (16.7%)	7 (15.2%)
Specialty[a]			
Family medicine	17 (77.3%)	16 (66.7%)	33 (71.7%)
Internal medicine	5 (22.7%)	1 (4.2%)	6 (13.0%)
Geriatrics	–	6 (25.0%)	6 (13.0%)
Missing	–	1 (4.2%)	1 (2.2%)
Years practicing in primary care			
<5 years	6 (27.3%)	5 (20.8%)	11 (23.9%)
5–10 years	5 (22.7%)	5 (20.8%)	10 (21.7%)
11+ years	11 (50.0%)	13 (54.2%)	24 (52.2%)
Missing	–	1 (4.2%)	1 (2.2%)
Race			
Asian or Asian American	3 (13.6%)	2 (8.3%)	5 (10.9%)
Black or African American	–	–	–
White	16 (72.7%)	18 (75.0%)	34 (73.9%)
Other	1 (4.5%)	–	1 (2.2%)
Missing/prefer not to answer	2 (9.1%)	4 (16.7%)	6 (13.0%)
Ethnicity			
Hispanic or Latino	–	–	–
Not Hispanic or Latino	19 (86.4%)	20 (83.3%)	39 (84.8%)
Missing/prefer not to answer	3 (13.6%)	4 (16.7%)	7 (15.2%)
Gender			
Female	16 (72.7%)	15 (62.5%)	31 (67.4%)
Male	4 (18.2%)	5 (20.8%)	9 (19.6%)
Missing/prefer not to answer/don't know	2 (9.1%)	4 (16.7%)	6 (13.0%)
Clinical Practice Characteristics			
Patients 65 years and older			
0–5/week	3 (13.6%)	2 (8.3%)	5 (10.9%)
6–10/week	7 (31.8%)	9 (37.5%)	16 (34.8%)
11–20/week	5 (22.7%)	6 (25.0%)	11 (23.9%)
21+/week	7 (31.8%)	7 (29.2%)	14 (30.4%)
Patients with dementia			
0–5/week	18 (81.8%)	16 (66.7%)	34 (73.9%)
6–10/week	3 (13.6%)	5 (20.8%)	8 (17.4%)
11–20/week	–	2 (8.3%)	2 (4.3%)
21+/week	–	1 (4.2%)	1 (2.2%)
Missing	1 (4.5%)	–	1 (2.2%)
Patients with BPSD			
0–5/week	19 (86.4%)	18 (75.0%)	37 (80.4%)
6–10/week	3 (13.6%)	6 (25.0%)	9 (19.6%)

Abbreviations: BPSD, behavioral and psychological symptoms of dementia.
[a]$P=0.01$ by Fisher exact test.
See text for description of "low BPSD preparedness" and "high BPSD preparedness" categories.

The 46 clinician respondents had similar demographic and clinical practice characteristics across levels of BPSD preparedness

(Table 1), except for clinical specialty (all geriatricians had high BPSD preparedness). Among all clinicians, 67% reported "yes" to gaps in care, 61% reported no prior training, and 48% reported both (ie, low BPSD preparedness). Three clinicians had missing confidence data. Low BPSD preparedness clinicians reported less confidence in their clinical ability to manage BPSD than high BPSD preparedness clinicians (mean [SD] = 2.84 [0.5] vs 3.53 [0.7], *t* test $P < 0.001$).

Current BPSD Management Approaches

The pharmacologic, nonpharmacologic, and referral approaches used to manage BPSD are summarized in Table 2. Antipsychotic and antidepressants were the most common pharmacologic approaches among both low and high BPSD clinicians; antidepressant use appeared to be more common and antipsychotic use less common among low BPSD preparedness clinicians; however, the differences were not significant ($P > 0.2$). Low BPSD preparedness clinicians descriptively appeared less likely to use most nonpharmacologic approaches than high BPSD preparedness clinicians, although for both groups, the most selected nonpharmacologic approach was education of patients and/or caregivers. Low BPSD preparedness clinicians were more likely to refer patients to Aging and Disability Resource Centers and other governmental agencies than high BPSD preparedness clinicians.

Continuing Education Preferences

Three clinicians had missing data for the continuing education questions, as they completed a pilot version of these questions. Figure 1 displays preferences for willingness to participate in potential future educational interventions by BPSD preparedness status. The majority of both low and high BPSD preparedness clinicians were willing to participate in discussion of treatment algorithms, virtual lectures or seminars, case discussion without patient present, and listening to podcasts. Clinicians with low BPSD preparedness appeared less willing to read suggested literature on their own than clinicians with high BPSD preparedness (40% vs 74% willing, $P = 0.06$) and more willing to participate in discussion of generic cases than clinicians with high BPSD preparedness (75% vs 48% willing, $P = 0.09$), although the differences were not statistically significant. When exploring correlations of preferred teaching methods, we found that participants who favored generic case discussions also favored discussing treatment algorithms ($\rho = 0.62$, $P < 0.001$). We also noted that low BPSD preparedness participants who prefer discussions of generic cases or discussing treatment algorithms also value virtual lectures ($\rho = 0.53$, $P = 0.019$ and $\rho = 0.49$, $P = 0.038$, respectively).

Table 2. Current BPSD Management Approaches

	BPSD Preparedness		
	Low (N=22)	High (N=24)	Overall (N=46)
Pharmacologic			
Antipsychotics	16 (72.7%)	21 (87.5%)	37 (80.4%)
Antidepressants	21 (95.5%)	20 (83.3%)	41 (89.1%)
Sedative-hypnotics	2 (9.1%)	5 (20.8%)	7 (15.2%)
Stimulants	–	2 (8.3%)	2 (4.3%)
Anticonvulsants	7 (31.8%)	7 (29.2%)	14 (30.4%)
Analgesics	12 (54.5%)	15 (62.5%)	27 (58.7%)
Complementary/alternative	7 (31.8%)	12 (50%)	19 (41.3%)
Other	1 (4.5%)	1 (4.2%)	2 (4.3%)
Missing	1 (4.5%)	2 (8.3%)	3 (6.5%)
Nonpharmacologic			
Education of patients and/or caregivers	21 (95.5%)	23 (95.8%)	44 (95.7%)
Support groups for patients and/or caregivers	12 (54.5%)	13 (54.2%)	25 (54.3%)
Behavioral management plan (ie, strategies for how caregivers should respond to behaviors)	17 (77.3%)	20 (83.3%)	37 (80.4%)
Changes to patients' environment	15 (68.2%)	19 (79.2%)	34 (73.9%)
Other	–	1 (4.2%)	1 (2.2%)
Missing	–	1 (4.2%)	1 (2.2%)
Referral Locations			
Geriatrics	14 (63.6%)	9 (37.5%)	23 (50.0%)
Psychiatry	9 (40.9%)	10 (41.7%)	19 (41.3%)
Psychology/behavioral medicine	8 (36.4%)	6 (25.0%)	14 (30.4%)
Social work	14 (63.6%)	9 (37.5%)	23 (50%)
Aging and disability resource Center or other government agency[a]	17 (77.3%)	10 (41.7%)	27 (58.7%)
Other	5 (22.7%)	2 (8.3%)	7 (15.2%)
Missing	1 (4.5%)	8 (33.3%)	9 (19.6%)

Abbreviation: BPSD, behavioral and psychological symptoms of dementia.

[a] $P = 0.02$ by Fisher exact test.

Number of low BPSD preparedness clinicians and high BPSD preparedness clinicians currently using pharmacologic, nonpharmacologic and referral approaches to manage BPSD.

DISCUSSION

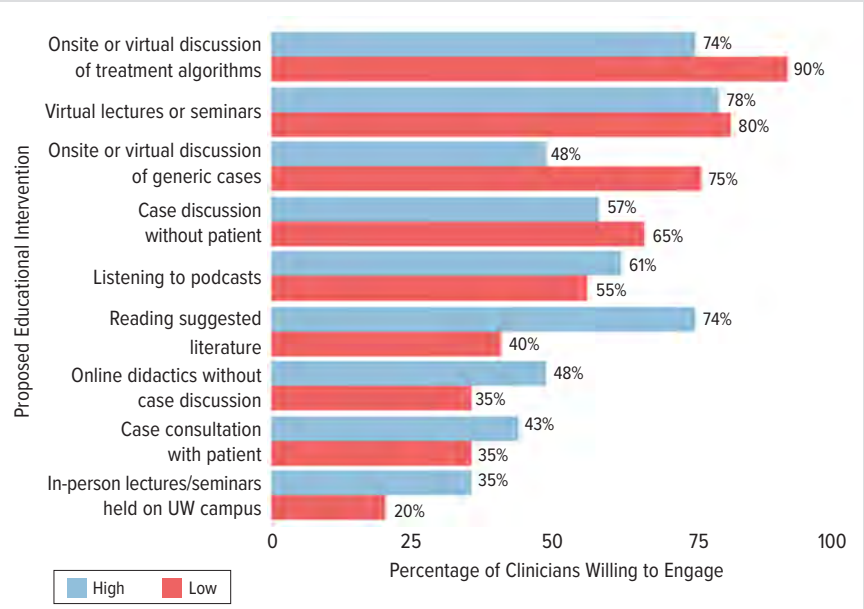
Gaps in care and training indicate a need to improve primary care clinicians' preparedness to treat patients with BPSD. Nearly 50% of clinicians, who reported both gaps in care and no prior training, indicated less confidence in their ability to manage BPSD. Clinicians' current practices in managing BPSD and their willingness to engage in BPSD educational interventions may vary by their BPSD preparedness, suggesting that educational interventions should be tailored to experiences and interests.

A limitation of the present study is a lack of respondents who identified as Black/African American or Hispanic/Latino. This is consistent with national data demonstrating underrepresentation of Black and Hispanic clinicians among physicians and advance practice providers and with state data indicating Black and Hispanic clinicians comprise just 2.9% and 3.2% of the physician workforce in Wisconsin, respectively.[10] Purposeful sampling to reach underrepresented clinicians may have been necessary to recruit a more representative sample.

The results of this study will inform our research group's

ongoing efforts to create and revise educational interventions focused on training all members of primary care clinic teams to better manage BPSD. Our model uses empirically supported methodologies, including academic detailing, to train primary care clinicians in diagnosis and treatment strategies for BPSD,[5] and the DICE Approach, to train nurses, social workers, and other dementia care professionals to assist family caregivers of people living with dementia to intervene at the level of patient and caregiver behaviors and environments to manage BPSD.[6] The results of this study suggest possible strategies to tailor educational interventions to the BPSD preparedness level and interest of the clinician, eg, discussion of treatment algorithms, virtual lectures/seminars, discussion of generic cases, case discussion without a patient present, and listening to podcasts for low BPSD preparedness clinicians; recommendations for literature to review for high BPSP preparedness clinicians; and applied, case-based approaches for all clinicians.

Figure. Willingness to Engage in Future Continuing Education



Abbreviations: BPSD, behavioral and psychological symptoms of dementia.

Percent of low BPSD preparedness and high BPSD preparedness clinicians who indicated they were "extremely likely" or "likely" to participate in each of the 9 educational interventions proposed in the survey. The educational interventions are listed first to last by the percent of low BPSD preparedness clinicians willing to participate in that intervention. See text for description of "low BPSD preparedness" and "high BPSD preparedness" categories.

CONCLUSIONS

This study demonstrated that among Wisconsin primary care clinicians across a range of specialties and years of clinical experience, there is a need to increase clinicians' preparedness to treat patients with BPSD, and there is an expressed willingness by clinicians to engage in a variety of continuing education interventions on managing BPSD.

Funding/Support: This project was made possible by the UW-Madison Institute for Clinical and Translational Research (ICTR) with support from NIH-NCATS Clinical and Translational Science Award (CTSA) 1UL1TR002373 and funds through a grant from the Wisconsin Partnership Program at the University of Wisconsin School of Medicine and Public Health Program, Wisconsin Partnership Program (WPP 5129).

Financial Disclosures: None declared.

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Creating and Implementing Wisconsin's First Emergency Department-Based Universal Opt-Out HIV Testing Program

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ABSTRACT

Background: The Centers for Disease Control and Prevention recommends HIV screening for all patients aged 13 to 64. We sought to improve the health of our patient population by enacting universal HIV screening in our emergency departments.

Methods: Universal opt-out HIV screening was implemented in 7 southeastern Wisconsin emergency departments and included linkage to care for those diagnosed with HIV.

Results: In the first year of this initiative, 57 565 patients were screened for possible testing and 24 417 patients did not opt out (42.4%). In total, 12 406 HIV tests were performed in the first year of the program.

Discussion: Our emergency department opt-out HIV screening initiative identified 23 new cases of HIV, approximately 10% of the average number of incident HIV cases in Wisconsin. We linked 96% of persons newly diagnosed with HIV to HIV medical care.

BACKGROUND

The Centers for Disease Control and Prevention (CDC) recommends HIV screening for all patients aged 13 to 64 in all health care settings, unless it is demonstrated that the diagnostic yield of such screening is less than 1 per 1000 persons screened.[1] Of the estimated 1 189 700 people in the United States living with HIV today, 13% are currently unaware of their HIV status.[2] Lack of awareness of one's HIV status can result in the development of opportunistic infections, HIV-associated cancers, other health complications, and transmission of the virus to others. Individuals aware of their HIV infection should be referred to HIV care to prevent opportunistic infections and other complications of HIV and reduce transmission of HIV to others. Individuals with virally suppressed HIV and preserved CD4+ cell counts have a life expectancy similar to HIV-negative individuals[3] and also cannot transmit HIV to others through sexual contact. Thus, diagnosis of HIV and linkage to HIV care results in improved health outcomes for those living with HIV and reduced HIV incidence.

In US jurisdictions that have implemented widespread screening along with rapid and universal HIV treatment or HIV pre-exposure prophylaxis – such as San Francisco, New York City, and King County, Washington – HIV incidence rates have decreased significantly, up to 70%.[4-6] For example, in San Francisco, HIV incidence declined steadily from 480 new cases in 2010 to 173 cases in 2019.

In Wisconsin, the incidence of HIV remained steady during 2011-2020, with an average of 4.0 (range 3.6 – 4.4) new diagnoses per 100 000 people[7] or 213 to 289 incident cases per year. The majority of incident HIV cases occur in southeastern Wisconsin, with the highest number in Milwaukee County, where 110 to 130 individuals are newly diagnosed with HIV annually, an incident rate of 16 to 19 cases per 100 000 people.

Prior to the initiative discussed in this manuscript, our emergency departments (EDs) conducted HIV testing for patients who presented with symptoms concerning for HIV or prior to starting HIV post-exposure prophylaxis for individuals potentially exposed

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to HIV through occupational or nonoccupational means, resulting in an average of 600 HIV tests per year. To better serve citizen-patients and the public health of the state and to adhere to CDC guidelines, beginning in July 2022, Froedtert Health became the first health system in Wisconsin to conduct universal, opt-out HIV screening in the ED, paired with linkage to HIV medical care for those who were diagnosed with HIV. In this manuscript, we describe the outcomes of this screening initiative after 1 year.

METHODS

Project Design and Rollout

To develop and implement a universal HIV screening initiative, we formed an interdisciplinary team that consisted of individuals from multiple academic and administrative departments, including emergency medicine (departmental leadership, physician representatives, advanced practice providers, nursing leadership), infectious diseases (physician, director of HIV prevention services), pathology and laboratory medicine (microbiology leadership, lab managers), and representatives from risk management, compliance, marketing, and information technology). We conducted a needs assessment by reviewing local and regional HIV incidence and previous ED HIV testing data outlined above. During the assessment process, key stakeholders outside of our multidisciplinary team were given an opportunity to review the proposed program and provide feedback. Importantly, members of the frontline staff, including triage nursing staff members and ED providers (resident physicians, faculty physicians, and advanced practice providers), gave feedback on our procedures as they were developed.

After the initial assessment was completed, multiple in-services were conducted with frontline clinicians, trainees, nurses, and staff members within and outside the ED. While training was delivered to all ED staff, our efforts focused specifically on nurses who perform triage duties and ordering clinicians. Program details also were shared with staff by way of informational pamphlets. Workgroup members functioned as champions for the program and used standardized educational presentations to conduct the training. Nursing staff meetings, departmental emergency medicine educational conferences and faculty meetings, and hospital operations meetings were used as venues to introduce the program. The presentations included the following information: (1) current HIV epidemiology, including the percentage of persons living with HIV currently unaware of their HIV status and the percentage of new HIV transmissions estimated to be from persons currently unaware of their status; (2) CDC guidelines for universal HIV screening, success of other ED screening programs, and rationale for implementation; (3) protocol for opt-out testing, including the expected responsibilities of the triage nursing staff, clinicians, and the HIV social services team; (4) specific discussion on HIV test result delivery and protocol for rapid linkage to HIV care; (5) general overview of HIV care. Presentations were most often co-delivered by a nursing leader and social work staff member.

Table. Demographic Information for All Patients Who Underwent HIV Screening

	All Tests Conducted n = 11 909 (%)	Persons w Positive HIV Tests n = 23 (%)
Gender		
Female	2339 (20)	4 (17)
Male	1162 (10)	17 (74)
Transgender female	16 (0.1)	2 (9)
Transgender male	18 (0.2)	–
Other gender	28 (0.2)	–
Unknown	8346 (70)	
Legal sex		
Female	7065 (59)	5 (22)
Male	4844 (41)	18 (78)
Race		
Black	5651 (47)	17 (74)
White	5150 (43)	3 (13)
Other	1108 (9.3)	3 (13)
Ethnicity		
Hispanic	900 (7.6)	3 (13)
Non-Hispanic	10 969 (92)	20 (87)
Other/unknown	40 (0.3)	
Age		
18–24	1697 (14)	6 (26)
25–34	2853 (24)	9 (39)
35–44	2703 (23)	7 (30)
45–54	2246 (19)	–
55–64	2358 (20)	1 (4)
Over 64	52 (0.4)	
County of residence		
Kenosha	62 (0.5)	1 (4)
Milwaukee	8495 (71)	20 (87)
Ozaukee	200 (1.7)	–
Racine	200 (1.7)	1 (4)
Washington	1011 (8.5)	–
Waukesha	1145 (9.6)	–
Other	796 (6.7)	1 (4)

In hopes of maintaining staff enthusiasm for the project, we wrote anonymized clinical case vignettes about patients who were diagnosed with HIV, including the time to their first HIV medical visit and first suppressed HIV viral load. These vignettes were distributed to frontline staff on a monthly basis and included the names of the clinicians who had seen the patients.

All patients were screened in triage using a prewritten script that was approved by hospital compliance:

> "We screen everyone ages 18 to 64 for HIV if they are having blood work done. This practice is based on the most recent recommendations from the CDC. If you have labs drawn today, we will test you for HIV, unless you ask us not to."

As part of standard triage assessment, nursing staff read the script to patients aged 18 to 64 and documented in the electronic health record (EHR) their decision to opt out or not to opt out of HIV screening. If a patient did not opt out of HIV screen-

ing, an alert prompted HIV order entry when any physician, advanced practice provider, or nurse subsequently ordered a laboratory test that required venipuncture. The alert did not display if patients had HIV documented in their past medical history or problem list, had HIV testing performed within the past 12 months in one of our health system locations, or were assigned the most urgent acuity level. Upon the clinician accepting the prompt to place the order for an HIV test, the test was performed by the lab along with whatever other testing was ordered. For patients who indicated they wished to opt out of HIV screening—also recorded by the triage nurse—no prompt for an HIV test appeared for the ordering clinician.

On a weekly basis, the project team reviewed HIV screening data, including the percentage of patients who did or did not opt out, the number of HIV tests performed, and the number of positive screening tests and confirmatory tests. The team also conducted regular follow-up meetings with frontline staff to address any questions or concerns regarding the process.

Figure 1. Best Practice Advisory Display in Electronic Health Record and Subsequent Action to Enter Order for Screening

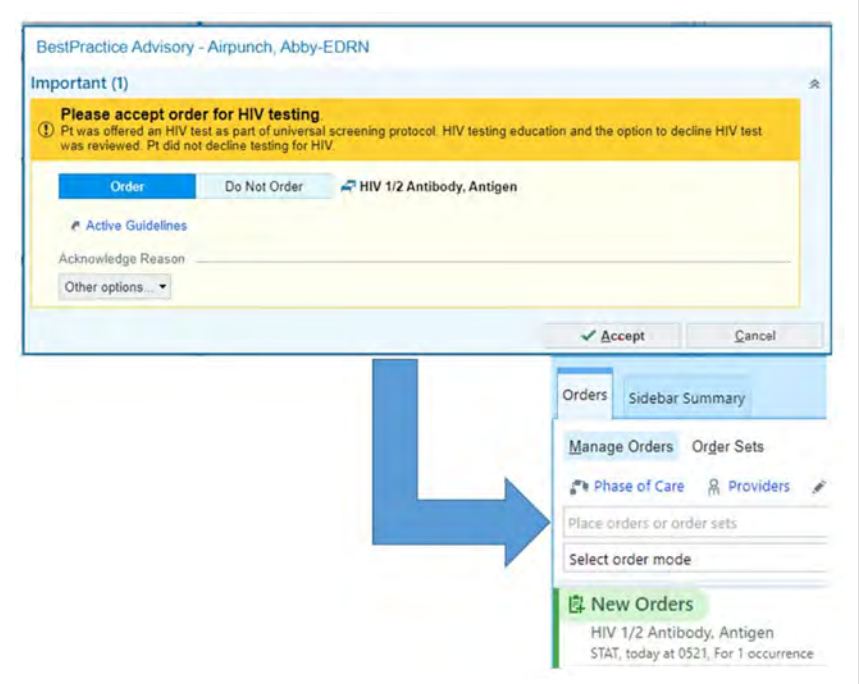


Figure 2. Outcomes of Testing Protocol

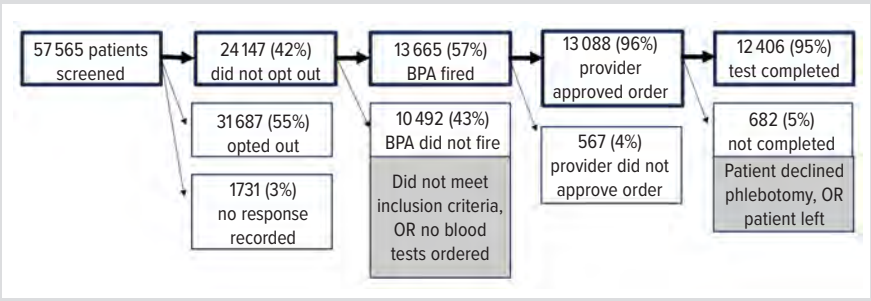
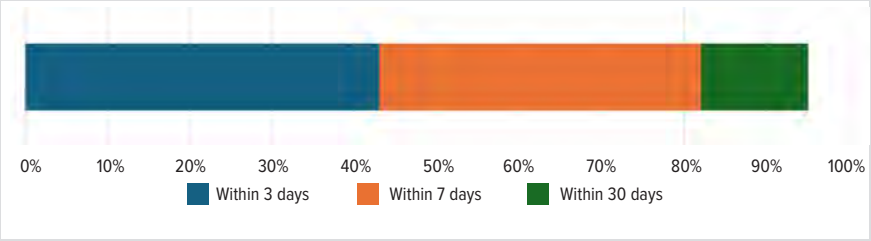


Figure 3. Time Between HIV Diagnosis and Linkage to HIV Medical Care, N=23



Laboratory

HIV testing was performed in the central laboratory (Wisconsin Diagnostics Laboratories, Milwaukee, Wisconsin) using the Roche Elecsys HIV Duo (Roche Diagnostics, Indianapolis, Indiana). The HIV Duo is run on the Cobas e801 system (Roche Diagnostics) and detects HIV-1 p24 antigen and antibodies to HIV-1 and HIV-2 in parallel with independent determinations. Positive results from the HIV Duo are reflexed to the Geenius HIV1/2 Supplemental Assay for Diagnostic Testing (BioRad Hercules, CA) on the Geenius Reader. Patients with a positive HIV Duo but negative Geenius HIV 1/2 Supplemental assay are referred for nucleic acid amplification testing (NAAT) using the Roche Cobas HIV-1 test, which is run on a Cobas 6800 system. Results for all testing are transmitted directly into the electronic health record (Epic Systems Corporation) and are available immediately for viewing by health care providers and patients. Results of HIV screening tests performed at our EDs within hospitals were available within 1 to 2 hours of specimen collection. For HIV tests performed at freestanding EDs (without a lab conducting HIV tests), results of screening tests were available within 24 hours of specimen collection. Confirmatory results using the Geenius HIV 1/2 Supplemental test were reported within 24 hours of specimen collection.

A charge for the HIV screening was included in the patient bill when conducted. As HIV screening is a "Grade A" recommended test by the US Preventive Services Task Force,[8] full payment of its costs by insurance plans is required. For patients without insurance, ED visit charges—including HIV screening charges—are handled individually, based on patient circumstances.

Patient Follow-Up

Prior to this initiative, all positive HIV test results in the health system, including ED results, were routed to the infectious disease clinic's HIV Linkage to Care (LTC) program. The LTC program historically has been, and continues to be, responsible for linking patients with HIV to care. The LTC program contacts patients who are newly diagnosed with HIV within 2 business days to provide result notification, counseling and education, assistance with insurance enrollment, clinic scheduling, resources for overcoming barriers to HIV care engagement, and assistance in obtaining and adhering to antiretroviral therapy and other care for HIV. The increase in number of incident HIV cases from the ED universal screening remained within the capacity of the LTC program to link patients with care.

Patients were provided their HIV screening results in multiple ways. If the patient was still in the ED, positive results were delivered by the treating emergency medicine clinician. During business hours, LTC staff accompanied the treating clinician to deliver a positive result to a patient. If the patient was admitted, inpatient clinicians were part of the result delivery. LTC staff would engage with admitted patients during their admission to provide links to HIV services. Patients who were discharged from the ED prior to receiving their HIV test result would be contacted by LTC to deliver positive test results and to link the patient to HIV services. All patients discharged from the ED who had a screening HIV test performed—regardless of the result—were given printed information on their ED after-visit summary, which also was visible through the patient portal (MyChart) to the EHR. This discharge information included details outlining how results could be viewed, as well as contact information for the LTC program. Patients with negative HIV results were not contacted individually but could access their results through the patient portal. Patients who left against medical advice may not have received instructions on how to access their results.

Data Collection

HIV screening data were exported from the EHR from all 7 EDs across the academic health system for the time period of July 13, 2022, to July 13, 2023. One ED was at an academic medical center, 2 were at community hospitals, and 4 were at microhospitals. (Microhospitals are small hospitals with attached EDs that offer ED services as well as a limited range of inpatient medical services in a small, neighborhood footprint. Our system microhospitals have around 10 ED beds and 10 inpatient beds.) Individual ED annual censuses ranged from 5000 to 76 000 patients, with the total annual visits for all EDs totaling approximately 156 000 visits. All EDs were located within the southeast Wisconsin geographical area. We also tracked the number of days between each newly diagnosed patient's positive HIV test and the day of their first appointment with an HIV medical provider. Data were aggregated and analyzed using R (R Core Team) and Tableau (Tableau Softward, LLC).

Because our project's aim was to deliver universal HIV screening, which is considered a recommended standard of care, we did not pursue institutional review board approval for this project.

RESULTS

Our screening program resulted in an HIV positivity rate of approximately twice the threshold of 0.1% recommended by the CDC to conduct universal HIV screening. From July 2022 to July 2023, 57 565 patients were offered universal opt-out HIV screening in the ED. During this period, 12 406 tests were performed on 11909 unique patients, comprising 21% of those offered screening. In comparison, before this project, roughly 600 HIV tests were performed annually across the system's 7 EDs. Figure 1 shows the distribution of patients who opted out of testing, met inclusion criteria, and went on to complete blood testing.

Gender, legal sex, race, ethnicity, age, and county of residence were collected for all patients who underwent HIV screening, including those testing positive. The data demonstrate that the majority of persons newly diagnosed with HIV by this program identified as men, legal sex as male, Black, and under age 35. The vast majority of tests were conducted in Milwaukee County, based on the geographic footprint of our institutions, as were the majority—20 of 23—of positive test results. Of the 20 Milwaukee County residents who were newly diagnosed with HIV, 3 received their HIV diagnosis through a facility in a county other than Milwaukee County (Figure 2).

Twenty-two of the 23 newly diagnosed patients were linked to HIV care. After their positive HIV test, 43% were linked to care in less than 3 days, 39% were linked to care in 4 to 7 days, and 13% were linked to care in 7 to 30 days (Figure 3). This timing is similar to that of patients seen by our HIV social services program who are referred from sources other than our ED, which averages 130 patients per year.

DISCUSSION

Successful implementation of universal opt-out HIV screening in our health system EDs included interdepartmental planning and coordination and in-service training for frontline clinicians, trainees, and staff members who would implement the program. Early feedback was solicited from stakeholders and used to modify, enhance, and improve program processes. We worked to overcome potential barriers to implementation. First, to counter the perception of increased workload for ED staff, we worked to streamline the test-ordering process as much as possible and emphasized this

in staff trainings. Second, to allay clinicians' worry about how positive test results would be handled and their role in the process, we designed a protocol wherein our HIV social work staff took over the task of delivering HIV test results for those patients who were discharged from the ED prior to test results returning and of linking patients to HIV medical care.

One limitation of the project relates to current legal requirements regarding consent for HIV testing. The state of Wisconsin eliminated the requirement for separate written consent for HIV testing in 2010, but it still requires written documentation in the medical record of a patient's verbal consent or refusal of HIV testing.[9] It was a concern that this unique requirement would serve as a barrier to the screening program in 2 ways. The demands of a busy ED may make compliance with this Wisconsin-specific requirement more difficult, and patients and even clinicians may perceive stigma around HIV testing due to the unique consent. Whether Wisconsin's HIV consent process limited the number of individuals tested is uncertain but seems likely given that 55% of patients offered testing decided to opt out.

Another potential limitation of our protocol is that we tested patients for HIV only if they were having blood samples collected for other testing. We made this decision for 2 main reasons: (1) to potentially increase the acceptability of the program for patients by not drawing blood exclusively for HIV testing, and (2) to avoid the additional phlebotomy services that would be associated with HIV testing in patients not otherwise having blood drawn. The number of tests completed by our program or others considering implementing screening could be increased by completing HIV screening regardless of whether phlebotomy would otherwise be performed.

Nonetheless, our universal opt-out HIV screening program resulted in an HIV positivity rate of about 0.2%, twice the threshold of 0.1% recommended by the CDC to conduct universal HIV screening.[1] Universal HIV screening has been found to be cost-effective at positivity rates at or lower than 0.2%.[10] That our screening initiative yielded this positivity rate in the Milwaukee metropolitan statistical area (MSA), which is ranked 77th-highest among 114 MSAs in the US for HIV incidence, provides evidence that universal screening should be adopted throughout other health systems in southeastern Wisconsin and other metropolitan areas in the state.[11] The Madison, Wisconsin, MSA ranked 97th-highest in HIV incidence, with an incidence rate about 73% of Milwaukee's, and it is likely screening there also would produce positivity rates above the CDC's threshold.[11] Regardless of anticipated positivity rates, it is important to consider that the CDC recommends initiating universal HIV screening until it is demonstrated that positivity rates are less than 0.1%.[1] A community outbreak of HIV in a rural area of Indiana in 2015 resulted in more than 3% of the population being diagnosed with HIV.[12] Universal screening could have played a role in identifying this outbreak at an early stage, potentially averting additional infections.

Anecdotally in conversations with LTC staff, several patients who were newly diagnosed with HIV reported that they previously had not been tested for HIV elsewhere and were not otherwise planning to get an HIV test. This information further supports the impact of universal HIV testing. With new knowledge of their HIV positive status, each patient has an opportunity to address and potentially prevent the negative health consequences of HIV, such as opportunistic infections and certain cancers. They also can prevent transmission of HIV to their sexual partners.

Decreases in the incidence of HIV are attributed to a combination of widely available HIV testing, immediate access to HIV treatment for those who test positive, and HIV prevention for those in whom it is indicated. This study has demonstrated the feasibility of implementing universal opt-out screening in the ED paired with rapid linkage to HIV care services in the state of Wisconsin.

Funding/Support: None declared.

Financial Disclosures: None declared.

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Increasing Health Care Agent Documentation in a Residency Clinic

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ABSTRACT

Background: Health care agent (HCA) documentation as part of advance care planning (ACP) helps clinicians understand patient care wishes. This project aimed to habituate these conversations and increase documentation rates.

Methods: Workflow redesign and novel educational interventions were implemented. Patients aged 50 and older received an HCA education "blue sheet" at check-in as a discussion prompt.

Results: Of 968 visits, patients in 44% received the intervention and 4% added HCA documentation. Chart audits found that 69% of patients had outdated (older than 5 years) ACP/HCA documentation. Clinician and staff found the process helpful, important to patients, and sustainable.

Discussion: This inexpensive intervention increased HCA documentation and highlighted the need to update old ACP documents.

BACKGROUND

Advance care planning helps clinicians understand patient wishes and goals, providing patient-centered care when the patient is unable to participate in decision-making. Our previous efforts to improve advance care planning/health care agent (ACP/HCA) documentation within our suburban, Midwestern family medicine residency clinic included conversations during Medicare wellness visits, new patient intake, when patients inquired, or at the time of a serious diagnosis when clinicians thought there was a high potential ACP/HCA future need. Our clinic system offered patients and families one-on-one calls or group sessions and take-home forms. Recognizing the importance of in-person ACP/HCA discussions, the clinic undertook workflow redesign and patient, staff, and clinician education in 2018.[1,2] Those early efforts were met with staff and clinician support of the workflow as effective, sustainable, and not intimidating, with 90% of clinicians recommending making the process routine since it made these conversations easier.[1] Our clinic's 2019 ACP completion rate for patients aged 65 and older was 57.9%.

The COVID-19 pandemic re-enforced the need to plan for the potential worst-case scenario of rapid heath declines and to have a predetermined health care agent to speak on a patient's behalf, not only for those aged 65 and older.[3,4] In April 2020 as a response to the pandemic, all patients aged 50 and older received a letter asking them to complete ACP documentation and, in its absence, to identify a HCA, which resulted in an increase in clinic documentation by December 2020 to 59.3%. While the clinic rates were already higher than the national ACP average (37%), residents wanted to improve and expand documentation rates for patients aged 50 or older.[5,6] The pandemic re-enforced the need to make conversations about HCA and ACP standardized care.

The goal of this ACP/HCA project was to improve electronic medical record (EMR) documentation rates and to increase residents' experience with ACP/HCA conversations.

METHODS

After a literature search, we created the patient education "blue sheet" (printed on blue paper), a clinic-wide educational session for all 24 clinicians and 12 staff, and workflow modifications

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(ie, asking patients to complete the blue sheet while waiting) using the HCA bundle:[2-3,7-10]

- Clinician script
- EMR "dot phrase" (quick discussion documentation text block via short, keyed phrase)
- Blue patient educational sheet with 5 yes/no questions
- Honoring Choices Minnesota Healthcare Agent Short Form[5,9] – formal documentation of a HCA and detailed ACP with specific care and treatment goals

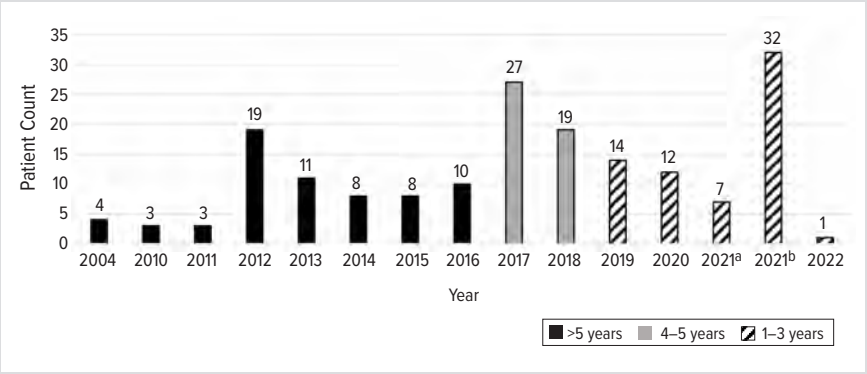
This rigorous quality improvement project was deemed Institutional Review Board-exempt and expanded on our previous work, adding a chart audit, post-intervention survey (January 2022), and a standardized front desk check-in process handing blue sheets to eligible patients. Blue sheets were collected by the hall staff after every visit—even when blank; this patient list was used for the post-intervention EMR audit. Patients with multiple visits during the 12 weeks (n=13) were condensed to a single row entry before final analysis as their blue sheet responses were identical. The survey was analyzed for frequencies and themes.

Table 1. Blue Sheet Patient and Clinician/Hall Staff Responses and Chart Audit

Patient Responses (n = 398)	**Yes**	**No**	**Blank**
Do you know who you would like to make medical decisions for you if you become unable to do so?	115	3	280
Have you told that person that you have chosen them?	85	30	283
Have you talked with that person about what is most important to you?	82	33	283
I am interested in completing the health care agent form today or discussing with my clinician.	130	84	184
I already completed my health care agent or advanced care plan.	137	158	103
I am not interested at this time.	37	0	360
Hall Staff and Clinician Responses (n = 398)	**Yes**	**No**	**Blank**
Patient has HCA/ACP in story board.	104	294	0
Patient has completed ACP/HCA that is not on file, advised to send a copy to clinic.	59	126	213
Patient counseled about value of HCA completion.	130	84	184
Referred to clinical staff (nurse/social work) for follow-up.	9	130	259
Not discussed today, deferred to next visit (due to active symptoms, other health care needs, discussions with loved ones, uncertainty in choices)	66	72	260
HCA form was completed today.	16	unknown	
Took forms home to complete, planning to return.	16	unknown	
Chart Audit Findings	**Yes**	**No**	
Patient Reports they have an ACP/HCA	137	–	
Confirmed present on storyboard	104	33	
Confirmed present in EMR and on storyboard	82	55	
Patient reports that they do not have an ACP/HCA	–	158	
Confirmed present on storyboard	14	144	
Confirmed present in EMR and on storyboard	6	–	

Abbreviations: HCA, health care agent; ACP, advance care planning; EMR, electronic medical record.

Figure. Advance Care Planning/Health Care Agent Document Age, N = 178



[a]Pre-intervention, [b]post-intervention.

RESULTS

Over the 4th quarter of 2021, the HCA bundle was used for 44% (428 visits with 398 unique patients) of all 968 clinic visits for patients aged 50 and older (Table 1). Of the patients who received the blue sheet, 137 reported already having ACP/HCA documents. Since ACP/HCAs are only useful when accessible, we completed EMR chart audits to verify that copies of the ACP/HCA documents were accessible. Only 93 EMR records included the documents and were noted in the storyboard (synopsis of patient information consistently present on EMR screens) where a clinician would look for it; 44 patients who reported ACP/HCA did not have it on record, and 6 patients forgot that they had one on file. An additional 16 patients (4%) completed ACP/HCP documentation during the intervention, with many more encouraged to start these conversations or to complete already begun paperwork.

An unanticipated finding from the chart audit was the number of potentially outdated ACP/HCA documents and the number of patients who did not recall existing EMR documents. Of the 178 patient records in which EMR ACP/HCA documentation was found, 69% were older than 5 years (Figure).

Post-intervention clinician and staff surveys confirmed the HCA bundle process is important to patients, helped complete HCA documentation, and is sustainable (Table 2). Mixed results based on job role were seen in the workflow impact.

DISCUSSION

The intervention and HCA documentation rate demonstrate that using patient wait times to educate about ACP/HCA documentation is effective, sustainable, and a productive way to engage patients in these conversations. Since most patients will need time or multiple interactions to define a full ACP, creating an annual focused patient outreach period in addition to making this process part of all wellness and physical appointments can help to maintain this effort. The intervention increased patient, staff, and clinician discussions and documentation of ACP and HCA by 4%. The involvement of other staff, such as social workers and nurses, in the process to support these conversations allowed patients time and support while maintaining the pace of clinician workflows.

Table 2. Clinician and Staff Post-intervention Survey Responses

Average Likert Scale[a] Responses by Role	Faculty n=5	Frontline n=2	Resident n=8	Rooming Staff n=2
Completion of HCA documentation is important to my patients.	Strongly agree (4.8)	Neutral to agree (3.5)	Strongly agree (4.8)	Strongly agree (5)
The HCA project significantly changed my daily workflow.	Disagree (2.3)	Neutral (3)	Neutral (3)	Disagree (2.5)
The HCA project assisted me in aiding patients to successfully complete HCA documentation.	Neutral to agree (3.8)	Neutral to agree (3.5)	Neutral to agree (3.8)	Agree (4)
The HCA intervention is a sustainable intervention that could be implemented for one month every quarter.	Neutral to agree (3.8)	Neutral to agree (3)	Agree (4.3)	Neutral to agree (3.5)

[a]5-point Likert Scale: 1=strongly disagree to 5=strongly agree.
Abbreviation: HCA, health care agent.

Future implementations include determining how to add the blue sheet to the EMR patient portal for pre-visit preparation and setting reminders in the EMR for review and renewal timeframes, including storyboard audits for accuracy given found discrepancies. Limitations of this work are missing data or missed fields for the chart audits items.

The blue sheet intervention was inexpensive. When paired with the clinician/staff education, EMR shortcuts, and clear workflows, the HCA bundle ensured that the process was easy to implement, sustain, and add as an interval quality improvement effort. While there is no standard published for renewal cycle periods of ACP/HCA documentation, our clinic recommends these documents be reviewed at least every 3 to 5 years to ensure that they still reflect the patient's wishes. The process also ensured that residents were supported while learning to have these essential conversations with the goal of them becoming more habitual.

Funding/Support: This project was conducted in-kind. Financial support for Dr Mullen comes from a University of Minnesota Medical School grant to the residency program to assist with resident and faculty research.

Financial Disclosures: Dr Mullen, a former employee, is now a contracted research advisor and has been compensated for her work on the study design analysis, implementation support, and writing.

Previous Presentations: This material was presented virtually as poster at the Minnesota Academy of Family Practice (MAFP) Research Forum on March 5, 2022, and was accepted as a poster presentation at the American Academy of Family Physicians National Conference July 28-30, 2022, in Kansas City, Missouri.

Acknowledgments: The authors wish to thank Alison Schmitz, RN, for her assistance with this project, especially data entry.

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Evaluation of an Innovative Medical Student Course Integrating Medicine and Public Health

Isha Jain, MD, MPH; Parvathy Pillai, MD, MPH; Patrick L. Remington, MD, MPH

ABSTRACT

Introduction: Educating medical students about the importance of integrating public health into their careers is challenging.

Methods: Medical student demographics, weekly written reflections, and course evaluations for a storytelling-based, public health-oriented elective were reviewed.

Results: Compared to students who did not enroll in the course, enrolled students were more likely to be female (71% vs 48%, $P = 0.001$). Student reflections revealed 2 major themes: (1) public health can be integrated into any specialty career; (2) career paths are often nonlinear. Students were highly satisfied with the course (mean 6.5, scale 1–7).

Discussion: Courses aiming to inspire medical students to integrate public health into their career should consider a similar storytelling approach.

INTRODUCTION

Public health was once commonly a part of medical practice; John Snow famously developed epidemiological methods while treating a cholera outbreak in 19th century London.[1] The 2 disciplines parted ways during the 20th century, however, due to the growing separation of prevention (public health) and treatment (clinical care).[2] The aging and increasingly diverse US population has revealed emerging health and social inequities – problems that must be addressed by once again combining public health and clinical approaches.[3] Clinicians have the unique ability to bridge the gap between medicine and public health if they are trained in both paradigms.[2,3] However, many medical students feel inundated with other curricular requirements and may not see how adding public health education relates to their future clinical careers.[4]

The University of Wisconsin (UW) Medical School's transformation into a combined "School of Medicine and Public Health" in 2005 included expanding the public health curriculum for medical students.[5] An elective preclinical course entitled Integrating Medicine and Public Health was developed in 2012 to offer students interested in public health opportunities to learn how they can combine their interest with clinical medicine. The purpose of this report is to describe the course, the characteristics of students enrolled in the course, assess student perceptions of the main themes presented by the lecturers, and evaluate student satisfaction.

The Course: Integrating Medicine and Public Health

Integrating Medicine and Public Health is a 1-credit elective course that meets weekly in the fall semester for a total of 13 sessions, each lasting 75 minutes. In brief, course objectives are:

- Explore the scope of public health activities practiced by physicians.
- Identify common themes in the career paths of physicians who blend medicine and public health.
- Identify opportunities for public health work with physicians of diverse backgrounds and create your own plan for a path in public health.

The course is offered to first-year (M1) and second-year (M2) students who are otherwise primarily engaged in preclinical work. Most students are M1s interested in later applying for public health-oriented programs that require the course. The course uses

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storytelling by physicians of diverse personal and clinical specialty backgrounds to demonstrate different paths to combine clinical medicine and public health. Guest speakers are identified by the course director's knowledge of their public health work. The course structure has remained stable over time, but speakers have varied.

The 12 primary speakers for the fall 2022 course represented 10 different specialties, including primary care, infectious disease, and emergency medicine. Seven out of 12 speakers had a Master of Public Health (MPH) degree. Speakers' clinical time varied from zero to full-time, and public health involvement included roles such as hospital administrator, public health nonprofit founder, and health department official.

Most sessions center on a physician talking about their career path and their involvement in public health. Speakers are encouraged to discuss aspects of their story, such as why they entered medicine, the role of mentors in their journey, and how their core values influenced their career choices. The remainder of class time is reserved for student questions.

Two class sessions are used for discussion of research; one focuses on summer research opportunities and the other has senior students presenting their public health-related projects. At the end of the semester, students submit a final paper outlining their plans for integrating public health into their education and careers. Students are graded pass/fail for the course based on completion of weekly reflections after each physician talk and the final paper.

METHODS

The present evaluation includes medical students enrolled in the course from 2018 through 2022 (n = 372), with a focus on fall 2022 students for demographic and qualitative data. Qualitative data (student reflections, collected from submission to the online learning portal) were not analyzed for earlier cohorts due to volume of material (>600 for only 1 cohort). The demographics data, obtained in aggregate from the school's academic affairs office, was restricted to the same cohort for which we analyzed qualitative data. Student satisfaction was assessed more broadly through compiling anonymous course evaluations for 2018–2022.

Descriptive statistics were used to assess student characteristics, which were limited to the M1s in fall 2022 as M2 data (n = 2) could not be obtained without risk of disclosure. Characteristics included were gender and race/ethnicity. The definition of "underrepresented minorities in medicine" used includes the following racial/ethnic groups as delineated by the school: African American, Hispanic/Latino, Southeast Asian (Cambodian, Laotian, Hmong, Vietnamese, Filipino), Native American/Alaskan Native, and Native Hawaiian/Pacific Islander.[6] Differences in student characteristics between those enrolled versus those not enrolled in the course were tested for significance (P value <0.05) using the chi-square test.

Table 1. Demographics of First-Year Medical Students (M1s) Enrolled in Integrating Medicine and Public Health Compared With M1s Not Enrolled in the Course, Fall Semester, 2022

	Enrolled M1s (n = 65)	Not Enrolled M1s (n = 112)	Total M1s (n = 177)
Gender (P < 0.001)			
Female	46/65 (71%)	54/112 (48%)	100/177 (56%)
Male	17/65 (26%)	58/112 (52%)	75/177 (42%)
All other genders[a]	2/65 (3%)	0 (0%)	2/177 (1%)
Race/ethnicity (P = 0.311)			
Underrepresented minorities	27/65 (42%)	38/112 (34%)	65/177 (37%)
All other racial/ethnic groups	38/65 (58%)	74/112 (66%)	112/177 (63%)

[a]Chi-square statistic could not be calculated due to small sample size.

Note: Percentages may not add up to 100% due to rounding.

During fall 2022, one of the authors (IJ) conducted a modified thematic analysis by reading all of the reflections each week and noting common themes and quotes. Fall 2022 students were asked to respond to 1 or more of the following prompts after each physician talk:

- What were the take home messages you heard?
- Did any part of the session resonate with you and, if so, why?
- How might this information affect your plans for your time in medical school and beyond?

At the end of the semester, these notes were reviewed by 1 author (IJ) to determine overarching themes in the student reflections; themes were categorized as "major" if they aligned with course objectives and "minor" if they were secondary. The course evaluation reports from each year included the mean of all student responses on a Likert scale (1-7, 7 is highest) for each of 15 questions in the school's standard course evaluation. The mean of the annual means was used to determine how the course was received over the 5-year study period. The 2 free-response questions in the course evaluations were not included in the analysis.

Per an institutional self-certification tool, Institutional Review Board approval was not required for this study as it constitutes educational quality improvement and program evaluation rather than research.

RESULTS

The 2022 course cohort had 67 students, 65 of whom (97%) were M1s. These 65 M1s represented 37% (65/177) of the M1 class. Compared to M1 students who did not enroll in the course, enrolled students were statistically more likely to be female (71% vs 48%, P = 0.001), but no statistical difference was seen for underrepresented minorities (42% vs 34%, P = 0.311). All results are noted in Table 1.

Thematic analysis of the fall 2022 student reflections revealed 2 major themes and 3 minor themes. The major themes include (1) any specialty can integrate public health into their career, and (2) taking a nonlinear career path is okay. See Table 2 for

quotes that exemplify these themes. Minor themes included the importance of mentorship, feeling inspired by the speakers, and acknowledgement that family plays a critical role in career planning.

From 2018 through 2022, 208 out of 372 total enrolled students (56%) completed course evaluations. Students rated the course highly across all 15 questions, with all mean of means >6.3 on a scale from 1 to 7 (see Table 3). The course emphasis on allowing ample time for student questions (6.9) and selection of diverse speakers (6.8) was noted by students, as these were among the highest rated domains.

Table 2. Major Themes From Students' Weekly Reflections on the Lectures From Faculty, During the Elective Course, Integrating Medicine and Public Health, Fall 2022

Major Themes	Quotes
Any specialty can integrate public health into their career	"Dr [A] said not to let your interest in a particular specialty deter you from pursuing public health as a physician. Even if there isn't an established area for public health in your desired specialty [...] You can create a space for public health."
	"It was inspiring to hear how just being there consistently and showing up makes a difference and that you can practice public health in any specialty."
	"Hearing about Dr [B]'s work and career path helped solidify the idea that we can integrate public health into any specialty we choose. For a long time, I thought that if I wanted to stay rooted in public health, I would have to steer clear of any surgical specialties."
Taking a nonlinear career path is okay	"Dr [C]'s journey [...] gives me hope about my own future in medicine. I know that as long as I follow my passions, I'll end up right where I'm supposed to be."
	"[Dr D's] unconventional pathway throughout his medical journey [...] gave me confidence that I have the ability to forge my own path in medicine and achieve my goals, even if they are not neatly laid out before me."
	"I also found it inspiring and reassuring that her career path was not linear in that she was not sure of what specialty she wanted to pursue until her final year of medical school and that her career is still evolving [...] now I feel more at ease and excited about exploring."

Note: All "Dr [letter]" examples above represent different speakers from the course and the letters chosen do not relate to the speakers' name.

Table 3. Integrating Medicine and Public Health Course Evaluations, 2018-2022

Question	Mean of Means[a] (range)
1. This course excited me about the subject matter.	6.3 (6.1 – 6.6)
2. This course was well organized.	6.3 (5.9 – 6.6)
3. Objectives of the course were identified for students.	6.5 (6.1 – 6.7)
4. From course materials (including lectures), I knew what was expected of me to succeed in this course.	6.7 (6.6 – 6.8)
5. Difficult concepts were explained in helpful ways.	6.4 (6.0 – 6.5)
6. Time was used effectively in scheduled course activities.	6.4 (6.0 – 6.6)
7. Student questions were welcomed by instructors.	6.9 (6.9 – 7.0)
8. Help was available if I had difficulty with course material.	6.7 (6.6 – 6.8)
9. The relevance of the course material was made clear.	6.8 (6.5 – 6.8)
10. The course environment was respectful of individual differences (eg, gender, ethnicity).	6.8 (6.6 – 6.9)
11. The objectives of the course were met.	6.7 (6.6 – 6.8)
12. I would recommend this course to other students in the field.	6.7 (6.4 – 6.9)
13. I learned a lot in this course.	6.3 (5.9 – 6.6)
14. Overall satisfaction with the course (ie, organization, learning material).	6.5 (6.3 – 6.7)
15. Overall satisfaction with the teaching activities of the instructor.	6.9 (6.8 – 6.9)

[a]The mean of all student responses for each question or each year was averaged across years to get the mean of means. The range represents the range of the means for the same time period.

DISCUSSION

Integrating Medicine and Public Health is a promising introduction for preclinical medical students to how physician careers can intertwine public health into their clinical practices. The course was popular – taken by 37% of the M1 class in 2022. The primarily female gender makeup of the course reflects the US public health workforce, which is 79% women.[7] Major themes in student reflections aligned with course goals; they noted the vast opportunities for physicians in public health and identified commonalities in career paths among the speakers. Students connected with personal details, such as speakers discussing difficult decisions at career crossroads and the uncertainty they faced when changing careers, going back to school, or shifting to less clinical work.

This study includes both course evaluations and student reflections – tools identified in evaluation framework based on the Kirkpatrick model as effective methods to measure acceptability of public health curricula and impact on students' attitudes toward the subject.[8] Limitations of the study include low evaluation response rates, thematic analysis by a single individual rather than a more formal qualitative research approach, and data analysis restricted to the lower levels of training evaluation (reflection, learning). The elective nature of the course affects the potential utility of future studies looking at higher-level longitudinal outcomes for enrolled students due to selection bias.

CONCLUSIONS

The course *Integrating Medicine and Public Health* supports the UW School of Medicine and Public Health's commitment to eradicate institutional barriers between medicine and public health. In sharp contrast to the basic sciences the preclinical students are learning, the course gives them a taste of how they can apply that knowledge to the betterment of communities. In addition, the course challenges preconceived notions about linear career tra-

jectories and which specialties can engage in public health activities—entirely through storytelling from physicians practicing public health. Opportunities to revisit key themes from this course across the medical student curriculum should be explored—at the UW School of Medicine and Public Health and beyond.

Acknowledgements: The authors would like to acknowledge the Wisconsin Partnership Program, which provides support for the Preventive Medicine Residency Program, and Sarah Zander of the UW School of Medicine and Public Health Academic Affairs office, who helped obtain student characteristic data.

Financial Disclosures: None declared.

Funding/Support: None declared.

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A Case of Allopurinol-Induced Drug Reaction with Eosinophilia and Systemic Symptoms in a Patient With Polycystic Kidney Disease and Chronic Kidney Disease

Emily Koller, MD; Neil Dixit, MD; Remy Lee, MD; Pinky Jha, MD, MPH

ABSTRACT

Introduction: Drug reaction with eosinophilia and systemic symptoms (DRESS) syndrome is a severe drug hypersensitivity reaction.

Case Presentation: A 59-year-old male with a history of stage IV chronic kidney disease, polycystic kidney disease, hypertension, and hyperuricemia on allopurinol presented to the emergency department directly from an outpatient nephrology appointment with concern for severe DRESS syndrome with acute-on-chronic kidney failure, liver failure, and pancreatic involvement.

Discussion: The existing literature on the course of DRESS syndrome in patients with preexisting kidney dysfunction is limited.

Conclusions: We report a case of DRESS syndrome in a patient with chronic kidney disease who presented after initiating allopurinol for hyperuricemia. Care should be taken to quickly identify DRESS, stop the offending agent, and initiate systemic corticosteroids to prevent long-term morbidity and mortality. Furthermore, patient counseling should emphasize follow-up to identify and treat potential long-term sequelae, including thyroiditis and cardiac disease.

INTRODUCTION

Drug reaction with eosinophilia and systemic symptoms (DRESS) syndrome is a rare, drug-induced hypersensitivity reaction, with a mortality of approximately 10%.[1] DRESS typically manifests 2 to 8 weeks after initiating treatment with an offending drug, often an aromatic anticonvulsant, sulfonamide, or allopurinol. The existing literature on the course of DRESS syndrome in patients with preexisting kidney dysfunction is limited.

DRESS was first named in 1996.[2] However, the constellation of symptoms seen in DRESS initially was described as a "drug-induced pseudolymphoma" as early as 1959. The illness presents with a range of cutaneous, visceral organ, and immunological manifestations that were believed to constitute a drug-induced reaction.[1] Further investigations suggest that the aberrant immune response may be triggered by the presence of drug metabolites in the context of a genetic predisposition to altered drug metabolism, such as presence of the HLA-B58:01 allele. Patients with DRESS can present with an extensive and pruritic rash, fevers, lymphadenopathy, peripheral eosinophilia, and multiple organ involvement with onset of symptoms occurring 2 to 8 weeks after initiation of the offending drug. Acute visceral organ involvement can correlate with mortality. The 2 commonly involved organs include the liver and kidney, although isolated hepatic or renal involvement is possible as well. While preexisting kidney disease is not associated with increased mortality, patients with chronic kidney disease (CKD) who develop DRESS are at increased risk of progression into end stage renal disease.[3]

DRESS syndrome is one of several adverse drug reactions known as severe cutaneous adverse reactions. Of all cases of severe cutaneous adverse reactions, 5% are attributable to allopurinol.[4] We present a case of severe allopurinol-induced DRESS syndrome with widespread cutaneous, hepatic, pancreatic, and renal involvement. Given the rarity of DRESS syndrome, this case report aims to encourage the consideration of DRESS syndrome as the potential cause of cutaneous eruption with associated organ failure in patients taking associated pharmacologic agents. We also hope to contribute to the scant literature on DRESS syndrome outcomes in patients with CKD.

CASE PRESENTATION

A 59-year-old male with history of CKD IV due to polycystic

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kidney disease, hypertension, and hyperuricemia presented to a routine nephrology follow-up appointment where he was noted to have an extensive pruritic, erythematous papular rash on the trunk and extremities 2 months after starting allopurinol for hyperuricemia. The rash started on the left axilla and over 2 to 3 days spread to greater than 80% of the body surface area, sparing his palms, soles, face, and oral mucosa. This coincided with low-grade fevers and chills. He also took acetaminophen up to 4 grams daily for fevers. He was referred urgently to the dermatology clinic, where a punch biopsy of the rash was obtained, and he was started empirically on oral prednisone 100 mg daily for suspicion of DRESS syndrome versus acute generalized exanthematous pustulosis. He then was admitted directly to the hospital for close monitoring and treatment.

Upon admission, the patient was well-appearing and comfortable. He was tachycardic to 115, however was otherwise hemodynamically stable and afebrile. Lab results were notable for creatinine of 4.5 mg/dL elevated from his baseline of 2.5 mg/dL, absolute eosinophil 1850/uL, uric acid 7.7 mg/dL, aspartate transaminase (AST) 400 U/L, alanine transaminase (ALT) 1011 U/L, amylase 206 U/L, lipase 121 U/L, c-reactive protein 18.05 mg/dL, erythrocyte sedimentation rate 56 mm/hr, high-sensitivity troponin of 16 ng/L, HLA-B58:01 genotype negative. Additional labs are shown in Table 1. Punch biopsy of the rash showed spongiotic dermatitis with intraepidermal pustule and eosinophils. Chest x-ray, electrocardiogram, and transthoracic echocardiogram were unremarkable. He scored 7 on the RegiSCAR score,[5] a validated scoring system for evaluation of DRESS, indicating a definite diagnosis of DRESS (Table 2).

Dermatology was consulted for management of DRESS, and nephrology was consulted for management of acute kidney injury on CKD. Urine microscopy showed 5 to 10 white blood cells per high power field and occasional dark granular casts, suggestive of acute interstitial nephritis secondary to drug reaction. Per dermatology recommendations, the patient was continued on prednisone 100 mg daily with a gradual taper over 9 weeks and topical clobetasol as needed for pruritus. He also was started on pantoprazole for gastrointestinal prophylaxis and calcium supplement and vitamin D for prophylaxis against osteoporosis due to glucocorticoids.

On day 2 of admission, the patient exhibited decreased pruritus and improvement of the labs and remained hemodynamically stable. Repeat labs showed downtrending creatinine, AST, ALT, and amylase. On day 3, labs showed continued improvement in labs: creatinine 2.94 mg/dL (near the patient's baseline), AST 135 U/L, ALT 675 U/L, lipase 370 U/L, and absolute eosinophil 170/uL. Blood cultures obtained on admission were negative. He was discharged home with a plan for close outpatient follow-up with dermatology and nephrology with frequent trending of labs. He was counseled on strict adherence to the prednisone taper and return precautions to the emergency department.

Table 1. Patient's Laboratory Results Upon Admission and Rechecked at Time of Discharge

Lab Test	Day of Admission	Day 3 (Day of Discharge)	Reference Range
Blood			
White blood cell (10^3/µL)	10.5	11.9	3.9–11.2
Hemoglobin (g/dL)	12.9	10.9	13.7–17.5
Platelet (10^3/µL)	257	262	165–366
Absolute eosinophil (10^3/µL)	1.85	0.17	0.03–0.52
Eosinophil %	18	1	0–6
Peripheral smear, hematopathology review	Reactive lymphocytes	—	none
Blood urea nitrogen (mg/dL)	52	53	6–23
Sodium (mmol/L)	135	137	136–145
Potassium (mmol/L)	5.2	4.8	3.4–5.1
Chloride (mmol/L)	100	107	98–107
Bicarbonate (mmol/L)	21	18	22–29
Creatinine (mg/dL)	4.50	2.94	0.70–1.30
eGFR (mL/min/1.73 m^2)	16	26	≥60
Albumin (g/dL)	3.8	3.7	3.8–5.0
Alkaline phosphatase (units/L)	142	126	40–129
Aspartate transaminase (units /L)	400	135	<50
Alanine transaminase (units /L)	1,011	675	<42
Total bilirubin (mg/dL)	0.7	0.4	0.2–1.2
Lactic acid (mmol/L)	1.3	—	0.5–2.0
Phosphorous (mg/dL)	3.8	—	2.5–4.5
Magnesium (mg/dL)	2.2	—	1.6–2.6
Uric acid (mg/dL)	7.7	—	3.4–7.0
Lipase (units /L)	121	377	13–60
C-reactive protein (mg/dL)	18.05	—	<0.50
ESR (mm/hr)	56	—	0–25
Anti-nuclear antibody	Not detected	—	Not detected
Venous pH	7.34	—	7.32–7.42
Epstein-Barr virus	Not detected	—	Not detected
Cytomegalovirus	Not detected	—	Not detected
Hepatitis A antibody, IgM	Nonreactive	—	Nonreactive
Hepatitis B core antibody, IgM	Nonreactive	—	Nonreactive
Hepatitis B surface antigen	Nonreactive	—	Nonreactive
Hepatitis C Antibody	Nonreactive	—	Nonreactive
HLA-B58:01	Negative	—	Negative
Urine		-	
Urine bilirubin	Negative	Negative	Negative
Urine protein	Negative	Negative	Negative
Urine nitrite	Negative	Negative	Negative
Urine leukocyte esterase	Negative	Negative	Negative

Abbreviations: eGFR, estimated glomerular filtration rate; ESR: erythrocyte sedimentation rate.

DISCUSSION

DRESS syndrome is a rare but serious adverse drug reaction. The epidemiology of DRESS is not fully understood, though estimates place the incidence at 1 in 1000 to 1 in 10000 drug exposures.[3] While the classic manifestation of the disease is cutaneous – most commonly presenting as a maculopapular rash that progresses to coalescing erythema – injury to visceral organs is common and may even present without cutaneous findings. The liver and kidneys are the most commonly involved visceral organs; other organs such as the lungs, heart, and thyroid also may be affected. Different HLA alleles confer a genetic predisposition to devel-

oping DRESS. For example, the HLA-B58:01 allele, which has the highest prevalence in the East Asian population,[6] has been shown to increase the risk of DRESS in patients who are started on allopurinol. A study of the Korean population found that among patients with CKD, significantly more patients with the HLA-B58:01 allele developed drug reactions compared to those who did not carry the HLA-B58:01 allele.[7] Furthermore, a study of the Han Chinese population reported a gene dosage effect of HLA-B58:01; ie, patients with homozygous HLA-B58:01 are at higher risk of DRESS than those with heterozygous HLA-B58:01.[8]

Kidney injury in DRESS warrants particular attention, not only because of the prevalence of kidney involvement, but also because preexisting renal impairment increases the risk for developing DRESS and its complications, including death. The aforementioned study of the Han Chinese population reported an additive effect of HLA-B58:01 positivity and preexisting CKD in the incidence of allopurinol-induced DRESS. Furthermore, the study found that the majority of deaths due to DRESS occurred in patients with preexisting severe renal impairment. While the reason for the increased risk for development and mortality from DRESS in patients with CKD is not fully understood, impaired clearance of the culprit medication, such as allopurinol, appears to play a role.[8]

Table 2. RegiSCAR Scoring System for Diagnosing DRESS

Items	Score			Comments	Patient Score
	-1	0	1		
Fever ≥ 38.5 °C	**N**/U	Yes			0
Enlarged lymph nodes		**N**/U	Y	>1 cm and ≥ 2 different areas	0
Eosinophilia ≥ 0.7 x 10^9/L or ≥ 0% if WBC < 4.0 x 10^9/L		N/U	**Y**	Score 2, when **≥ 1.5 x 10^9/L** or ≥ 20% if WBC < 4.0 x 10^9/L	2
Atypical lymphocytosis		N/U	**Y**		1
Skin rash, extent > 50% of BSA		N/U	**Y**		1
Rash suggesting DRESS	No	Unknown	**Y**	Rash suggesting DRESS: ≥ 2 symptoms: purpuric lesions (other than legs), infiltration, facial edema, psoriasiform desquamation	1
Skin biopsy suggesting DRESS	No	**Y**/U			0
Organ involvement		No	**Y**	Score 1 for each organ involvement, maximal score: 2	2
Rash resolution ≥ 15 days	N/**U**	Yes			-1
Excluding other causes		N/U	**Y**	Score 1 if 3 of the following tests were performed and all were negative: HAV, HBV, HCV, mycoplasma, chlamydia, ANA, blood culture	1
					Total: 7

Abbreviations: ANA, anti-nuclear antibody; BSA, body surface area; DRESS, drug reaction with eosinophilia and systemic symptoms; HAV, hepatitis A virus; HBV, hepatitis B virus; HCV, hepatitis C virus; N/U, no or unknown; WBC, white blood cells.

A score of < 2 indicates no case, 2–3 indicates possible case, 4–5 indicates probable case, > 5 indicates a definite case. The patient's RegiScar score at time of DRESS diagnosis is reflected in the far-right column (7; definite case of DRESS). The patient's score corresponding to each criterion is indicated in bold.

To date, there has been only 1 published case report of DRESS syndrome in a patient with polycystic kidney disease. In this report, a 51-year-old woman with a recent history of travel to rural Hunan and Szechuan, China, presented with DRESS that progressed to sepsis 3 weeks after starting allopurinol.

This case report highlights the importance of a broad differential that considers both infectious and noninfectious etiology, as well as knowledge of the medication history of a patient. Finally, this patient had the HLA-B58:01 haplotype, which has a known association with DRESS syndrome and may help guide clinical decision-making regarding allopurinol induction in patients with impaired kidney function.[9] There already exists American College of Rheumatology guidelines recommending HLA-B58:01 testing for patients of high-risk ethnicities prior to starting allopurinol.[10] However, these cases suggest that further research should investigate whether CKD also should be taken into consideration when deciding to test for HLA-B58:01 before starting allopurinol.

The increased risk of DRESS in patients with CKD poses challenges in the management of CKD and its complications. Allopurinol is one of the most prescribed medications for urate-lowering therapy and commonly is used to reduce the risk of urate-induced nephropathy. However, the benefits of initiating allopurinol must be weighed against the risk of drug hypersensitivity syndromes such as DRESS, which can lead to severe multiorgan damage, including to the kidneys. In a systematic review of 71 patients with DRESS syndrome with renal involvement, a majority had acute kidney injury.[3] This can be all the more serious in patients with baseline CKD, who are at higher risk of acute kidney injury requiring temporary or lifelong renal replacement therapy.[11]

Patients who have experienced DRESS are at risk of recurrence and, therefore, should be monitored with regular outpatient follow-up. Recurrence of DRESS can happen at any time following the initial event and can manifest in serious organ injury such as thyroiditis and myocarditis, as well as injuries to the liver and kidneys. The most common cause of recurrence is re-exposure to the offending drug. This can pose a serious challenge, as patients may continue to require treatment for the condition for which the culprit medication was intended to treat. Although the reasonable choice would be to switch to an alternative medication, even an alternative medication may trigger a recurrence of DRESS due to cross-reactivity with the initial medication. A number of such

cases have been reported involving allopurinol-induced DRESS, where recurrence of DRESS followed the initiation of febuxostat, another xanthine oxidase inhibitor that also is used to treat hyperuricemia.[12-16] Further research is needed to elucidate the cross reactivity of medications commonly associated with DRESS and reduce the risk of DRESS recurrence.

CONCLUSIONS

We report a case of DRESS syndrome in a patient with a history of chronic kidney disease resulting from polycystic kidney disease. The patient presented 6 weeks after initiating allopurinol for the treatment of hyperuricemia. Following the initiation of systemic corticosteroid treatment, his clinical picture improved rapidly and creatinine returned to baseline with no immediate concern for worsening of his CKD or progression to end-stage renal disease. While the incidence of DRESS is low, the mortality rate is approximately 10%. The utmost care should be taken to quickly identify DRESS, stop the precipitating agent, and initiate treatment with systemic corticosteroids to prevent long-term morbidity and mortality. Furthermore, patient counseling should emphasize the importance of long-term follow-up to identify and treat potential long-term sequelae, including thyroiditis and cardiac disease.

Financial Disclosures: None declared.

Funding/Support: None declared.

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Case Report of Delayed Encephalopathy From Pembrolizumab

Christopher Kotsis, MD; Brandon H. Hidaka, MD, PhD

Introduction: Pembrolizumab is an immune checkpoint inhibitor (ICI) used to treat many types of advanced cancer. ICIs can cause encephalopathy, a severe immune-related adverse event, which is a diagnosis of exclusion. Pembrolizumab immune-related adverse events typically develop early (within a few months) in treatment; presentation after a year is extremely rare.

Case Presentation: A 70-year-old White female with metastatic endometrial cancer treated with pembrolizumab for 19 months presented with generalized weakness that rapidly progressed to confusion, delusions, and hallucinations.

Discussion: After ruling out other causes of encephalopathy via broad-based testing of blood and cerebrospinal fluid and imaging, her neurologic status improved after treatment with high-dose glucocorticoids and intravenous immunoglobulin.

Conclusions: Pembrolizumab is an ICI that can cause encephalopathy, which is challenging to diagnose. While immune-related adverse events typically emerge soon after starting treatment, pembrolizumab-induced encephalopathy can be delayed significantly.

INTRODUCTION

Immune checkpoint inhibitors (ICIs) have been used to treat advanced malignancies since 2011.[1] ICIs target cell-surface molecules that enable cancer cells to avoid immune cell-mediated destruction.[2] Pembrolizumab, an ICI that binds programmed cell death-1 (PD-1), improves survival of patients with metastatic endometrial cancer.[3] ICIs carry the risk of side effects known as immune-related adverse events (irAEs) that can affect essentially any organ.[4] Severe, grade 3 or 4, irAEs affect less than 1% of patients.[5] Neurological irAEs account for about 1% to 3% of all irAEs while being treated with ICI monotherapy.[5] Anti PD-1 therapies, specifically, have been implicated in severe neurotoxic irAEs, such as encephalitis, noninfective meningitis, peripheral neuropathy, myasthenia gravis, vague neurological weakness syndrome, and other types of neurologic deterioration.[6,7] Pembrolizumab-induced encephalopathy previously has been shown to occur weeks or months after treatment,[5,8-11] but cases of this severe irAE presenting after more than a year of treatment have not been reported previously.

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CASE PRESENTATION

A 70-year-old White female with stage IV endometrial cancer and a past medical history of hypertension, chronic kidney disease stage III, hypothyroidism, unprovoked deep venous thrombosis, and pulmonary embolism on chronic anticoagulation was brought to the emergency department (ED) by her husband for acute sharp pain in her right fifth toe and confusion. She also had had 2 weeks of worsening generalized weakness. Her metastatic disease was stable (ie, not progressive) since starting pembrolizumab and lenvatinib 17 months earlier; her last pembrolizumab monthly infusion was 2 weeks prior. At that oncology clinic visit, her lenvatinib was stopped due to concerns it was causing excessive uterine bleeding and worsening anemia; her hemoglobin had dropped from 10.2 to 7.7 g/dL over 2 weeks. Her ED evaluation revealed hemoglobin 7.4 g/dL, normal urinalysis, computed tomography (CT) abdomen/pelvis with intravenous (IV) contrast showing a stable uterine mass and widespread lymph node enlargement, a CT chest angiogram without pulmonary embolism, and strong pulses from her fourth and fifth right toes by doppler. Cultures from her portacath were obtained and she was transfused 1 unit of packed red blood cells (pRBCs), which significantly improved her weakness. She and her husband felt comfortable discharging home; however, she returned the following day after her portacath cultures returned positive for *Streptococcus salivarius* after 14 hours. Other than improved anemia (hemoglobin 9.3 g/dL), her testing

was unremarkable. She was admitted for IV antibiotics (ceftriaxone) for bacteremia and anemia.

Shortly into her hospital stay, she became more confused and agitated with clear signs of pain and discomfort, which were treated with oxycodone and acetaminophen; her husband was activated as her designated power of attorney. Her portacath was removed to control the source of the infection; however, antibiotics were stopped on day 5 because none of her blood cultures ever showed bacterial growth. A head CT and brain magnetic resonance imaging (MRI) found no cause for her encephalopathy. An electroencephalogram (EEG) revealed a nonspecific, moderate global disturbance in cerebral function. Her neurologic condition continued to decline while waiting 3 days after stopping her anticoagulation – apixaban – to perform a lumbar puncture. Her cerebrospinal fluid (CSF) showed 9 total nucleated cells per microliter (reference range: 0-5 cells/microliter), 13% neutrophils (reference range: 2% +/- 4%), 73% lymphocytes (reference range: 60% +/- 20%), and 14% monocytes (reference range: 30% +/- 15%). Protein in the lumbar puncture was elevated at 114 mg/dL (reference range: 15-45mg/dL). CSF gram and fungal stains were negative. CSF glucose was 48 mg/dL compared to serum glucose of 87 mg/dL.

While waiting for additional CSF studies to return (eg, a wide range of autoantibodies, herpes simplex virus polymerase chain reaction [PCR], varicella zoster virus PCR, bacterial and fungal cultures, Lyme PCR), the patient was maintained on empiric acyclovir and started on methylprednisolone 1 g IV daily for 5 days due to concern for autoimmune encephalopathy secondary to pembrolizumab treatment. On the second day of methylprednisolone treatment, her mentation improved, though not completely. Acyclovir was stopped after herpes simplex virus and varicella-zoster virus studies returned negative.

Unfortunately, 2 days after completing the 5-day methylprednisolone regimen, the patient's mentation declined again; this time, she began to experience delusions and hallucinations. A repeat brain MRI at this point was nonrevelatory. She was initiated on nightly olanzapine and a prednisone taper starting at 60 mg per day, but this was not effective. She was then restarted on IV methylprednisolone 125 mg daily, which helped minimally, so the dose was increased to 1 g daily and 1 g/kg/day intravenous immunoglobulin (IVIG) was added to her immunosuppressive regimen. She experienced brief periods of lucidity with the high-dose methylprednisolone and IVIG but mostly remained significantly encephalopathic. Eventually, she was transitioned back to IV methylprednisolone 125 mg daily and concomitantly began a regimen that involved weekly IVIG 0.5 g/kg alternating with weekly IV methylprednisolone 1000 mg. After about 2 weeks of this regimen, she became significantly more mentally alert and had more linear thoughts without significant hallucinations or delusions.

The patient's hospitalization was further complicated by acute on chronic blood loss anemia requiring transfusion of a total of 11 units of pRBCs (administered 1-2 units at a time), right fifth toe and foot pain requiring opioid analgesics, and a nosocomial, Enterobacter cloacae complex urinary tract infection treated with cefepime. CT angiography of the abdomen and pelvis showed no bleeding source; furthermore, upper and lower endoscopy found no gastrointestinal source of bleeding. Her persistently worsening anemia eventually was determined to be of uterine origin due to her known malignancy. She received palliative external beam radiation therapy in an attempt to stymy the bleeding, which was not successful. Radiologic imaging of her right foot and rheumatological workup were unremarkable. An ankle-brachial index (ABI) prompted CT angiography of the patient's lower extremities that revealed multiple tandem stenoses of the right femoral artery greater than 70%. She was subsequently started on a high-intensity heparin drip, and a repeat ABI of her right and left legs were 0.54 and 1.05, respectively. Ultrasound showed occlusion of the right proximal superficial femoral artery. She underwent a right superficial femoral artery thrombectomy and stent placement for treatment of blue toe syndrome, which significantly improved her pain. For this active issue, rivaroxaban and clopidogrel were recommended but held due to her anemia requiring many transfusions.

Ultimately, after treating her blue toe syndrome, urinary tract infection, and encephalopathy with high-dose methylprednisolone and IVIG, the patient's neurologic function improved significantly; however, her mental status never fully recovered and would fluctuate significantly throughout the day. She and her husband eventually chose to transition to comfort care. She returned home with hospice support and passed peacefully.

DISCUSSION

Pembrolizumab-induced encephalopathy usually develops early in treatment but can have a delayed onset. Accurate and timely diagnosis is difficult because it is a diagnosis of exclusion; patients with severe sepsis, bacterial meningitis, aseptic meningitis, viral encephalitis, autoimmunity, and thrombotic thrombocytopenic purpura can present similarly.[5] Our patient's persistent anemia, intense pain from blue toe syndrome, and urinary tract infection complicated her clinical picture since all can contribute to delirium; however, even after addressing these conditions, her neurologic function remained significantly impaired.

There are similarities and important differences among our case and others reported in the literature. Most reported cases of pembrolizumab-induced encephalitis have been associated with leptomeningeal enhancements or hyperintensities of periventricular white matter; however, these were absent in our case.[5,10,12] In a case presented by Basnet et al, a 55-year-old-man on 9 months of pembrolizumab treatment for metastatic renal cell carcinoma became encephalopathic and also was found to have a CT and MRI of the brain that did not show any acute abnormalities, negative CSF meningitis/encephalitis and autoantibody panel

results, and EEG monitoring with no evidence of seizure.[8] Usually, immune-mediated encephalitis is associated with a pleocytosis and an elevated protein level in the CSF,[5,8,11] as was found in our case.

The pathophysiology behind irAEs is considered to be primarily due to T-cell and IgG-dependent mediated hypersensitivity reactions from cross-reactivity between tumor cell and non-tumor cell antigens.[8,9,13] Another proposed mechanism is that ICIs bind to non-tumor cell antigens and give rise to an antibody or complement-mediated response.[8,9] By definition, irAEs are caused by off-target immunologic activity and treatment is centered on immunosuppression via glucocorticoids and IVIG, although no standard has been established at this time.[14] It is also essential to discontinue the offending ICI.

Neurological irAEs are categorized into 4 levels of severity, with grades 3 and 4 best describing our patient: a limited ability to care for self and progressively worsening.[14] The 2021 American Society of Clinical Oncology guideline suggests starting patients on empiric IV acyclovir until CSF PCR results are available and starting methylprednisolone 1 g IV daily for 3 to 5 days plus IVIG 0.4 g/kg/day over 5 days or plasmapheresis followed by a steroid taper.[14] A case reported by Gao et al describes a 55-year-old man with metastatic small cell carcinoma treated with 4 rounds of pembrolizumab over 4 months and developing a GAD65-antibody-associated autoimmune encephalitis.[15] He received IVIG at 0.4 g/kg/day for 5 days but without glucocorticoids due to concern that this would contribute to tumor recurrence;[15] nevertheless, his neurologic function recovered.[15] Another case of pembrolizumab-induced encephalopathy was treated successfully with IVIG 10 g/100 mL infusion 36 g daily for 4 days with 40 mg IV methylprednisolone every 8 hours for 1 day, which was then increased to 250 mg every 6 hours the following day for 5 subsequent days, then followed by 40 mg every 8 hours again for 4 days.[10] Another case reported effective treatment with 1 g IV methylprednisolone for 3 days.[9]

CONCLUSIONS

This case is unique due to the delayed neurological irAE, which developed after our patient had been treated with pembrolizumab for 19 months. This should prompt hospitalists and oncologists to consider this diagnosis of exclusion outside of its typical pattern of emerging early in ICI treatment. This case also highlights the challenges and importance of identifying and treating other potential causes of encephalopathy and delirium in patients receiving ICI therapy.

The optimal choice and dosing of immunosuppressive medications for treatment of pembrolizumab-induced encephalopathy remains unclear since they carry a risk of worsening tumor recurrence and progression. In the case of a severe neurological irAE, as we saw, the benefits of immunosuppression far outweigh the risks. Given the inherently poor prognosis of advanced malignancy, it is especially important to regularly reassess these patients' neurologic function, capacity, and goals of care throughout their hospital stay. We hope that this case study will help future patients and their care teams obtain an accurate diagnosis and initiate treatment as early as possible.

Funding/Support: None declared.

Financial Disclosures: None declared.

Acknowledgements: Written informed consent to participate in this case report was obtained from patient's husband, who is the patient's surviving spouse. The authors wish to thank their colleagues on the multidisciplinary health care team who provided invaluable expertise.

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Interpretation of HIV Serologies in the Era of PrEP: Two Cases of False Positives

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ABSTRACT

Introduction: More availability of HIV pre-exposure prophylaxis (PrEP) is needed to end the HIV epidemic, but this means more clinicians will encounter false positive HIV test results. These cases highlight such occurrences and the steps a clinician may take to determine the significance of such results.

Case Presentations: We present the case of a 68-year-old male who presented for routine follow-up for HIV PrEP and a 41-year-old transgender male who presented to establish care with a primary care clinician. On labs, both had repeatedly positive HIV antigen/antibody tests with undetectable viral loads.

Discussion: With increasing prescription of HIV PrEP comes a need for accurate interpretation of HIV serologies. HIV PrEP users may have altered stages of seroconversion. Additionally, heterophile antibody interference can lead to false positive or negative results.

Conclusions: The reader should gain an understanding of HIV testing, potential pitfalls, and next steps amidst unclear results.

INTRODUCTION

HIV pre-exposure prophylaxis (PrEP) refers to the use of medication taken with the purpose of preventing the acquisition of HIV.[1] It is highly effective (approximately 99%) at preventing sexual transmission of HIV.[1] The rate of prescription of HIV PrEP in the United States is increasing – the percentage of 16 to 20 year olds who are accessing PrEP increased from 8% in 2017 to 20% in 2021.[2] Though these statistics are encouraging, even more PrEP prescription and better targeting of PrEP is needed–especially given the significant racial disparities associated with PrEP prescription, as Black and Hispanic/Latino people are much less likely to be prescribed PrEP than their White counterparts.[2] Nonetheless, with increasing PrEP prescription and awareness comes the need for increasing familiarity with various HIV testing modalities among primary care clinicians.

The Centers for Disease Control and Prevention (CDC) has published clinical guidelines (as of 2021) for the prescription of oral and injectable PrEP, with the recommendation to check an HIV antigen/antibody (Ag/Ab) test every 3 months in patients taking oral PrEP to ensure seroconversion has not occurred.[3] In the case of long-acting injectable cabotegravir (Apretude) for PrEP, these guidelines call for HIV RNA testing prior to bimonthly administration (and prior to subsequent doses given if scheduled doses have been missed) given the pharmacokinetics of this drug and the risk of development of HIV resistance.[3] On the whole, lab monitoring may be challenged by false positive or negative results or the rare case of true seroconversion in a person appropriately taking PrEP. This is further complicated by the fact that those taking PrEP may have altered stages of seroconversion, lower viral loads, and less symptoms compared to those not taking PrEP.[4,5]

This report details one such occurrence of a false positive result in the context of PrEP utilization, one in a lower risk patient not taking PrEP, and the steps clinicians may consider in handling such clinical scenarios.

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CASE PRESENTATIONS

Case 1

The first patient is a 68-year-old man who presented to clinic in January 2022 for lab work for routine PrEP follow-up. His labs

were notable for an HIV Ag/Ab test, which returned repeatedly reactive, and reflex HIV-1 and HIV-2 antibody differentiation resulted indeterminate. The patient was contacted via phone. At that time, he reported taking his PrEP, emtricitabine/tenofovir-alafenamide (Descovy), every day without missed doses. He reported the last time he engaged in condomless receptive anal sex was several months prior (April 2021) with a male partner of unknown HIV status and that he had engaged only in condomless oral sex with that same partner since then. An HIV RNA polymerase chain reaction (PCR) test (viral load) was checked, which was not detectable; he was deemed to be HIV negative and was continued on PrEP.

Three months later (April 2022), he returned for an in-person visit at which time he reiterated his adherence to PrEP and disclosed no new sexual partners. Labs were checked and his HIV Ag/Ab test again returned reactive with indeterminate antibody differentiation. An HIV viral load was again checked and was undetectable. He was instructed to stop taking PrEP for 1 month and to return for repeat testing at that time.

He ultimately followed up 3 months later (July 2022) for labs. Again, an HIV Ag/Ab test returned repeatedly positive, this time with negative HIV-1 and HIV-2 antibody differentiation, and his HIV viral load was again negative. An HIV DNA PCR also was checked at this time and was negative. He ultimately was deemed HIV negative and was continued on PrEP.

Case 2

The second patient is a 41-year-old transgender man who presented to establish care with a primary care clinician in Colorado in August 2023. As part of this visit, routine screening labs were collected, including an HIV Ag/Ab test, which ultimately resulted positive with a positive HIV-1 antibody differentiation. His viral load was undetectable. This news came as a shock, as the patient reported having a negative HIV test in 2021 and since then had been in a monogamous sexual relationship with a cisgender female partner. He denied any other risk factors for HIV acquisition, including injection drug use. He purchased 2 separate at-home oral HIV testing kits, which both resulted negative. He was referred to an infectious disease specialist, where he was started on bictegravir/emtricitabine/tenofovir-alafenamide (Biktarvy).

Shortly thereafter, the patient relocated to Wisconsin, where his partner lives, and established care with an infectious disease clinician in Madison. Given the lack of risk factors for HIV acquisition and negative viral load result, further studies were collected at this visit, including another HIV Ag/Ab test (run with a heterophile blocking reagent) and HIV viral load, as well as an HIV DNA PCR. The HIV Ag/Ab test returned negative, and both the HIV viral load and DNA PCR returned negative/undetectable. He was deemed to not have HIV and was instructed to stop taking his antiretroviral medication.

DISCUSSION

These cases shed light on unique scenarios in which the clinician must utilize their knowledge of the pathophysiology of HIV and the various modalities of HIV testing in order to accurately interpret the patient's HIV status. With this comes an assessment of risk of HIV acquisition, which can be somewhat arbitrary. The current CDC PrEP guidelines suggest taking into account number of sexual partners, knowledge of partners' HIV status, use of condoms, and history of bacterial sexually transmitted infections as factors that elevate one's risk for HIV acquisition.[3]

The patient in the first case may be deemed "high risk" given his history of anal receptive sex with a male partner of unknown HIV status; however, he endorsed absolute adherence to his PrEP, which, in theory, would make his risk very low. Undoubtedly, the patient in the second case should be considered low risk given his lack of sexual or environmental exposures.

We suggest taking risk of HIV acquisition into account when determining next steps to interpret a positive HIV Ag/Ab test. In any case, the HIV-1 and HIV-2 antibody differentiation test is the best first step in determining the validity of a positive HIV Ag/Ab test, followed by the HIV RNA PCR (viral load) if the antibody differentiation returns negative or indeterminate, which is the current testing algorithm supported by the CDC.[6] Importantly though, there are only 3 Food and Drug Administration (FDA)-approved HIV RNA PCR tests for diagnosis of HIV infection, one being the Cobas HIV-1/HIV-2 Qualitative test. The other two have a dual claim for diagnosis (qualitative nucleic acid testing [NAT]) and management (quantitative NAT) – these are the Aptima HIV-1 Quant Dx Assay and the Alinity m HIV-1 Assay.[7] Other HIV RNA PCR tests may be used more commonly depending on institutional availability, though non-FDA-approved tests may come with a higher risk of false positive results.[8]

Considering this testing strategy of an initial HIV Ag/Ab test with Ab differentiation followed by an FDA-approved HIV RNA PCR test, one also must consider the natural history of an HIV infection. Though the HIV RNA PCR is a highly sensitive and specific test, there exists an "eclipse" period – typically spanning 8 to 10 days following the initial acquisition of HIV – where the level of HIV RNA is too low to be detected.[9] This is again complicated in patients taking PrEP, where exposure to such antiretroviral therapy may result in low level viremia that is below the threshold of detection.[5] It is also important to consider the wide variability in PrEP dosing and adherence when interpreting these results. A patient's adherence to PrEP may be spotty for several reasons, including lack of adequate education regarding the medication, concerns about side effects, social and financial factors, or by choice – in fact, some patients are opting for "on-demand" or "2-1-1" PrEP. This refers to taking PrEP around the timing of sexual encounters as opposed to daily, and while it is technically an off-label use of PrEP, this method has been shown to be effective

in the prevention of HIV in men who have sex with men.[10] For all of these reasons, we recommend taking a thorough patient history regarding risk factors, utilization of PrEP, and timeline of potential exposures in order to accurately interpret the aforementioned tests.

One important consideration that manifested itself in our cases was the matter of heterophile antibody interference. Heterophile antibodies are weak antibodies that are produced in response to exposure to an external antigen (oftentimes animal products[11]) and are usually weakly reactive to many antigens and antibodies. This becomes clinically significant as they have the potential to interfere with immunoassays by nonspecifically binding to the assays' recombinant proteins and capture antibodies.[12] This may be overcome with the utilization of a heterophile blocking reagent during laboratory processing, as demonstrated in the second case.

Another rare but important consideration when interpreting ambiguous HIV tests is that of elite controllers. While exact definitions vary, the term "elite controller" refers to people living with HIV who can maintain a level of control over viral replication without antiretroviral therapy.[13] This becomes clinically significant in that an elite controller may present with a positive HIV Ag/Ab test and a positive HIV-1 or HIV-2 Ab and a negative/undetectable viral load. In contrast to our second case, in the case of an elite controller, these results could indicate a true infection as opposed to a false positive.

With all of these potential confounding factors, a tool the clinician may utilize to determine the validity of a positive HIV test is the HIV DNA PCR test. This test measures the integrated HIV DNA that persists in infected CD4 cells despite elite controller status or the use of antiretroviral medications.[14] Though this test is most often used to investigate perinatal transmission of HIV in infants of mothers living with HIV, it was used in the cases presented as a means to more definitively determine the patients' HIV status in the context of ambiguous results. It is important to note that while in rare circumstances it may be clinically useful, this is not an FDA-approved indication of this test; and albeit a highly sensitive and specific test, there is no perfect test that effectively rules out HIV infection, meaning clinical context and judgment must be utilized. It is also important to note that timing of infection and presentation to care would impact the interpretation of the HIV RNA test, which may eliminate the need to pursue HIV DNA testing. If the patient had presented with a distinct recent exposure (barring potential interference of PrEP therapy as previously discussed) or symptoms of acute HIV infection, an initial high level of viremia is expected—even in the case of elite controllers—as it takes time for the immune system of an elite controller to successfully suppress the virus.

Table 1. False Positive Results

Reason	Type of Test Affected	Explanation	Possible Intervention
Heterophile antibody	HIV antibody/antigen test	Weakly reactive antibodies that may interact with various immunoassays	Repeat test with utilization of heterophile blocking reagent
Lab error	HIV antibody/antigen or HIV RNA test	Mislabeling of samples/breakdown in sample ID	Repeat test

Table 2. False Negative Results

Reason	Type of Test Affected	Explanation	Possible Intervention
PrEP	HIV antibody/antigen or HIV RNA test	Exposure to incomplete antiretroviral regimen may delay antibody formation or lead to low level viremia below limit of detection	If suspecting false negative antigen/antibody test, check FDA-approved HIV RNA test; if suspecting false negative HIV/RNA test, repeat test while off PrEP for approximately 2 months[15]
Poor antibody response	HIV antibody/antigen test	May not mount antibody response due to severely immunocompromised state due to advanced HIV or other condition)	Check FDA-approved HIV RNA test
Elite controller	HIV RNA test	Innate nature of elite controller status allows for viral suppression without use of antiretroviral medication	Consider HIV DNA test
Heterophile antibody	HIV antibody/antigen test	Weakly reactive antibodies that may interact with various immunoassays	Repeat test with utilization of heterophile blocking reagent

CONCLUSIONS

While HIV testing initially may seem formulaic, there are many intricacies to consider when interpreting these studies—especially in the current age of PrEP. Knowledge of potential causes of false positive and negative results, the effects of PrEP on result interpretation, and various tools available to elucidate ambiguous results are essential. Bearing in mind these concepts, in conjunction with a thorough history and physical, allows the clinician to be able to best counsel patients on their HIV status. And while complicated situations may arise, the more clinicians are comfortable prescribing PrEP and diagnosing HIV, the sooner the HIV epidemic will end. We present Tables 1 and 2 and the National Clinician Consultation Center PrEP hotline phone number (855.448.7737) as resources for navigating complex clinical scenarios.

Financial Disclosures: None declared.

Funding/Support: None declared.

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Spontaneous Splenic Hemorrhage Leading to Diagnosis of Metastatic Adenocarcinoma of Unknown Origin

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ABSTRACT

Introduction: Spontaneous splenic hemorrhage is a rare initial presentation of malignancy. The objective of this case report is to elucidate the complexities of early diagnosis of splenic metastases and the complications associated with advanced malignancies of the spleen. It is also a reminder to consider splenic metastases and hemorrhage in the differential diagnosis for nonspecific presentations, such as acute abdomen, in adults.

Case Presentation: A 58-year-old female with 1 month of vague, worsening systemic symptoms and computed tomography findings suspicious for a subcapsular splenic hematoma was found to have splenic rupture. After undergoing emergency laparotomy with splenectomy, pathological samples revealed metastatic poorly differentiated adenocarcinoma of unknown origin. During a subsequent admission, she was found to be hemodynamically unstable, deemed a poor candidate for inpatient chemotherapy, and elected to proceed with comfort measures after which she died from multiorgan failure 3 weeks after initial presentation.

Discussion: Spontaneous (nontraumatic) splenic hemorrhage secondary to metastasis should remain a differential diagnosis for patients with acute abdomen and associated risk factors for primary malignancies.

INTRODUCTION

Malignancy of the spleen can be categorized broadly as having primary involvement or secondary involvement, with the latter being much more common. Despite the spleen being the most vascular organ in the body, it remains a rare site of tumor metastases.[1-3] Previous autopsy record review of secondary nonlymphoid splenic tumors in patients over a 25-year period demonstrated only 5.3% of splenic metastases as solitary lesions and 95% of secondary splenic tumors as carcinomas.[3] The lung was identified as the most common primary tumor site in 21% of cases.[3] Other tumors that commonly metastasize to the spleen include melanoma and tumors of the stomach, pancreas, colon, breast, and ovary.[1]

Metastasis to the spleen often is detected at a more advanced stage frequently stemming from the organ's asymptomatic nature and nonspecific symptoms at presentation, among a few other factors. The most common primary malignant neoplasm of the spleen is lymphoma, accounting for less than 1% of all lymphomas, which is far more rare than secondary splenic neoplasms.[1-2] The most common primary non-hematopoietic malignant splenic tumor is angiosarcoma, which carries a poor prognosis.[1] Benign neoplasms of the spleen include hemangioma (most common), splenic hamartoma, littoral cell angioma, splenic cyst, and other primary mesenchymal tumors, such as angiomyolipoma or fibroma.[1]

Given the frequency of incidental splenic lesion discovery on imaging, little guidance has been published previously on classifying splenic lesions and best approaches for formulation of a differential diagnosis. Kim et al recognized the existing gap in literature and importance of being able to differentiate various splenic pathologic conditions to inform early treatment decisions and thus developed an image-based algorithm for splenic lesion characterization.[4] This algorithm classifies splenic lesions into 2 primary categories—cystic and solid—before further delving into pathological features, such as whether they are solitary versus multiple, vascular versus nonvascular, or whether they contain unique features such as fluorodeoxyglucose avidity in lymphoma.[4] Accurate diagnosis must be achieved in a timely fashion due to the

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risk for hypersplenism or even splenic hemorrhage and rupture in more critical cases involving primary and secondary malignant splenic neoplasms.

CASE PRESENTATION

A 58-year-old female came to the emergency department (ED) with 1 month of generalized worsening weakness, malaise, and diaphoresis. Her medical history included severe Crohn's disease, osteoporosis, former tobacco use (10 pack years), and right kidney atrophy. Her surgical history was negative for any bowel resection surgeries. Her outpatient medications included propranolol, trazodone, zoledronic acid, gabapentin, and infliximab every 8 weeks for Crohn's management. She had presented to her primary care clinician with a cough 1 week prior and was found to have a COVID infection but did not have other visits or labs for her presenting symptoms prior to arriving to the ED. An outpatient computed tomography (CT) scan also had been completed 3 weeks prior to further evaluate results of a colonoscopy done 2 months prior.

Initial exam findings in the ED included decreased breath sounds at the lung bases, abdominal distension, left upper quadrant tenderness, and anasarca. Given the patient's nonspecific presentation and exam findings, a Crohn's flare was a primary concern; however, the differential diagnosis was kept broad. Labs upon arrival to the ED revealed new anemia (hemoglobin 8.6), normal white blood cell count, new thrombocytopenia (platelet count 35000) (Table), and a normal reticulocyte count, with elevated erythrocyte sedimentation rate, C-reactive protein, and lactate dehydrogenase. Imaging revealed bilateral pleural effusions and a pericardial effusion. Computed tomography (CT) scan of the abdomen and pelvis revealed new interval splenic enlargement compared to 3 weeks prior. The patient was admitted for a probable Crohn's flare and started on prednisone but overnight was found unresponsive in respiratory arrest, despite lack of respiratory symptoms on admission. She underwent resuscitation measures including intubation and was transferred to the medical intensive care unit (ICU).

Upon ICU transfer, the patient was hypotensive and hypothermic. Labs revealed worsening anemia and thrombocytopenia (Table) and a low haptoglobin with a negative Coombs test. An urgent repeat CT was ordered 12 hours after the initial scan, which revealed findings suspicious for a subcapsular splenic hematoma with hemorrhage and worsening significant lymphadenopathy throughout, increasing the team's concern for lymphoma (Figures 1 and 2). Given that she had an increasing vasopressor requirement with worsening renal function and acidosis, Surgery elected to complete an emergency laparotomy with splenectomy on day 2 of admission. In the operating room, the patient was found to have splenic rupture with 3 liters of blood evacuated. Diffuse small mesenteric peritoneal studding also was noted throughout the abdomen. Postoperatively, she was extubated on day 3 and no longer required vasopressor support. Repeat postoperative labs revealed improving anemia and thrombocytopenia (Table).

Table. Lab Values for Hospital Course

	Day 1	Day 2 (Pre-Laparotomy)	Day 2 (Post-Laparotomy)	Day 19
Hemoglobin (g/dL)	8.6	5.3	11.9	10
Hematocrit (%)	25.0	15.6	35	30.4
WBC (10e3/uL)	10.7	13.9	15.3	18.5
Platelet (10e3/uL)	35	20	39	372
Neutrophil (%)	86.8%	75%	N/A	83%
Lymphocyte (%)	6.2%	6%	N/A	2%
CA-125				524
CA 19-9				18.2
CEA				707
Chromogranin				218

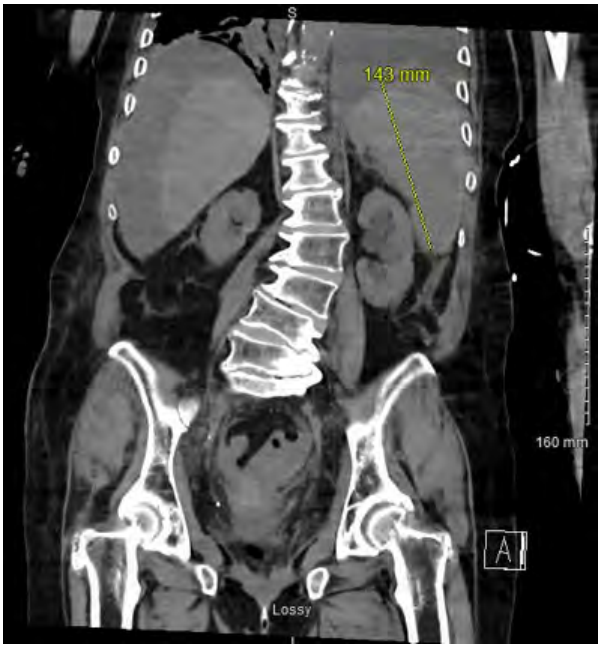
Abbreviations: WBC, white blood cells; CA, cancer antigen; CEA, carcinoembryonic antigen.

Pathology samples of the spleen and omentum were sent and returned on day 9, revealing metastatic poorly differentiated adenocarcinoma of unclear origin with signet ring cell morphology and a nonspecific immunohistochemical profile. The patient's hospital course was further complicated by acute tubular necrosis and worsening bilateral pleural effusions requiring thoracentesis, with lab results confirming malignant pleural effusions. Hematology, oncology, gastroenterology, and gynecologic oncology were consulted during her admission to continue workup of adenocarcinoma of unknown origin (Table). She was discharged after a 16-day hospitalization, with scheduled follow-up with medical oncology for suspected adenocarcinoma of small bowel versus colon.

Of note, the patient was diagnosed with Crohn's disease approximately 22 years prior and had regular screening colonoscopies every 1 to 3 years. Her disease was poorly controlled with initial management (mesalamines, 6-mercaptopurine, methotrexate), and she was receiving infliximab every 8 weeks at time of admission. Her most recent screening colonoscopy was done approximately 2 months prior to admission, with new findings of cecal pseudopolyps and abnormal-appearing mucosa near the ileocecal valve and appendiceal orifice. Biopsies of the mucosa returned negative for malignancy. A CT scan was obtained to further evaluate the colonoscopy findings, which revealed active disease with a new fistulous connection with the appendix and prominent mesenteric lymph nodes, with no splenic enlargement at the time. Given the recent colonoscopy, there was no indication for a repeat colonoscopy during her admission; however, an esophagogastroduodenoscopy was performed and was negative for a primary source.

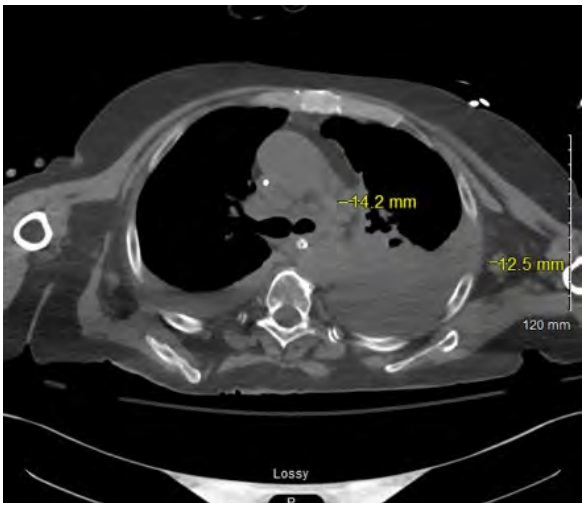
The patient returned to the ED 3 days after discharge with worsening shortness of breath and jaundice. CT imaging revealed a new soft tissue mass at the head of the pancreas with biliary obstruction (Figure 3), which was later noted to be peripancreatic

Figure 1. Computed Tomography Chest/Abdomen/Pelvis



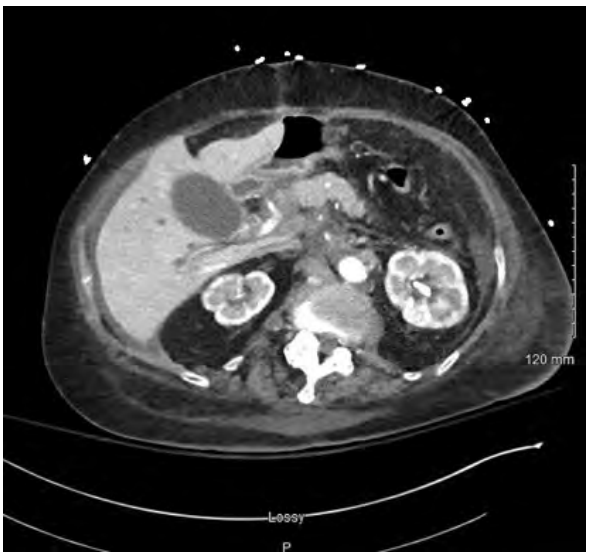
CT demonstrates splenomegaly measuring up to 14.7 cm with new heterogenous attenuation and increased hyperdense perisplenic fluid.

Figure 2. Computed Tomography Chest/Abdomen/Pelvis



CT shows multiple enlarged supraclavicular, axillary, and mediastinal lymph nodes. Representative lesions include 1.3 cm left axillary lymph node and 1.4 cm aortopulmonary window lymph node.

Figure 3. Computed Tomography Abdomen/Pelvis



CT demonstrates an aggressive mass involving the head of the pancreas that extends within the retroperitoneal space and encases the common hepatic artery and superior mesenteric artery.

soft tissue rather than a mass. Due to her hemodynamic instability, significant deconditioning and recovering kidney function, she was considered a poor candidate for inpatient chemotherapy. She ultimately elected to transition to comfort measures 3 days after readmission and died from multi-organ failure 3 weeks after her initial presentation. An autopsy was not performed.

DISCUSSION

Splenic rupture secondary to metastatic cancer is a rare complication that can occur late in the progression of a diagnosed or undiagnosed cancer. Splenic metastases are a result of advanced disease involving multiple other sites. Much of the data on splenic metastases is collected through postmortem studies, many showing the incidence to be 2.3% to 12.9%.[5] The most reported primary sites for splenic metastases include choriocarcinoma (13.3%), melanoma (10%), and gastric carcinoma (6.7%).[6] In clinical presentation, splenic metastasis is often asymptomatic but may present with discomfort in the left upper quadrant and symptoms related to pressure on other organs, such as early satiety, nausea, and dyspnea.[5,7] Symptoms of disseminated systemic disease are not uncommon either, namely cachexia and hematologic abnormalities.[5]

Several theories exist explaining the rarity of metastases to the spleen. These theories can be grouped into 3 main categories: anatomical factors, mechanical factors, and immunological factors. Anatomically, the rare occurrence of metastases to the spleen is attributed to the constant blood supply, the sharp angle of the splenic artery with the celiac axis, and the lack of afferent lymphatic vessels to the spleen.[3] Mechanical contractions of the splenic sinusoids and the presence of a splenic capsule act as a physical barrier to parenchymal metastases.[5] The microenvironment of the spleen is also particularly unfavorable for metastases. High concentrations of angiogenesis inhibition factors associated with the high density of lymphoid cells in the spleen prevent growth of metastatic cancers.[8]

In terms of the mechanism of splenic rupture secondary to malignancy, 2 theories have been proposed. Destruction of the architecture and integrity of the splenic capsule by invading neoplastic cells leading to rupture is the principal theory.[9] The other theory involves necrosis of the malignancy leading to bleeding within the tumor. Eventually, pressure builds up in the spleen leading to capsular rupture.[9]

CONCLUSIONS

Splenic metastases always should be considered part of the differential diagnosis in the context of an acute abdomen in a patient with or without cancer as a primary diagnosis. Consideration of this differential may be lifesaving—especially in the context of spontaneous splenic rupture, with first-line treatment being emergency splenectomy. In the case that a primary malignancy is identifiable and can be treated accordingly, this would not only prolong the patient's life but offer the opportunity for alternative curative therapies to be pursued, which was not consistent with this specific case.

Furthermore, it is important to emphasize the necessity for regular screening and medical management for patients with inflammatory bowel disease, as patients with these diagnoses are at increased risk of developing cancer overall. Even with stringent screening adherence and treatment optimization, it is possible that patients could present similarly to this case with a malignancy of unknown origin. In that situation, discovery of the primary malignancy may prove difficult, and with severe presentations such as this one, metastases may be an indicator of poor prognosis.

Financial Disclosures: None declared.

Funding/Support: None declared.

Institutional Review Board Approval: Not applicable for a single patient case report.

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Worsening Epidural Lipomatosis Leading to Foot Drop Following an Epidural Steroid Injection: A Case Report

Ragav Sharma, DO; Sahitya Hari, DO; Hariharan Shankar, MBBS

ABSTRACT

Introduction: Epidural lipomatosis is a relatively rare condition resulting in the accumulation of unencapsulated fatty tissue within the epidural space. Steroids, either exogenous or endogenous, have been reported as a cause for this accumulation. The diagnosis is confirmed by computed tomography or magnetic resonance imaging. Symptomatic epidural lipomatosis has been reported to present with radiculopathy, myelopathy, claudication, cauda equina syndrome, or paraplegia. It is usually managed conservatively, including weight loss and avoidance of steroids.

Case Presentation: We report the case of a patient with sarcoidosis on oral prednisone who was referred for low back and leg pain of multifactorial origin. After addressing his low back pain, a fluoroscopically guided lumbar epidural steroid injection was performed for his neurogenic claudication. This provided 3 months of complete pain relief. But the patient also developed unilateral foot drop, possibly secondary to worsening epidural lipomatosis.

Conclusions: Epidural lipomatosis may result in complications that include neurological deficits. Although various disease states may cause it, prudence is advised in the use of exogenous steroids.

INTRODUCTION

Epidural lipomatosis (EL) is the excess accumulation of unencapsulated adipose tissue in the epidural space.[1] The first reported documentation of EL was in 1975 by Lee et al in a patient on steroids following renal transplant.[2]

Although it may be an incidental finding with nonspecific symptoms, EL also has been associated either with or resulting in myelopathy, radiculopathy, sensory deficits, spinal stenosis and, rarely, cauda equina syndrome.[3]

We report the case of a patient on oral steroids for sarcoidosis who developed a foot drop with worsening EL incidentally following an epidural steroid injection for spinal stenosis.

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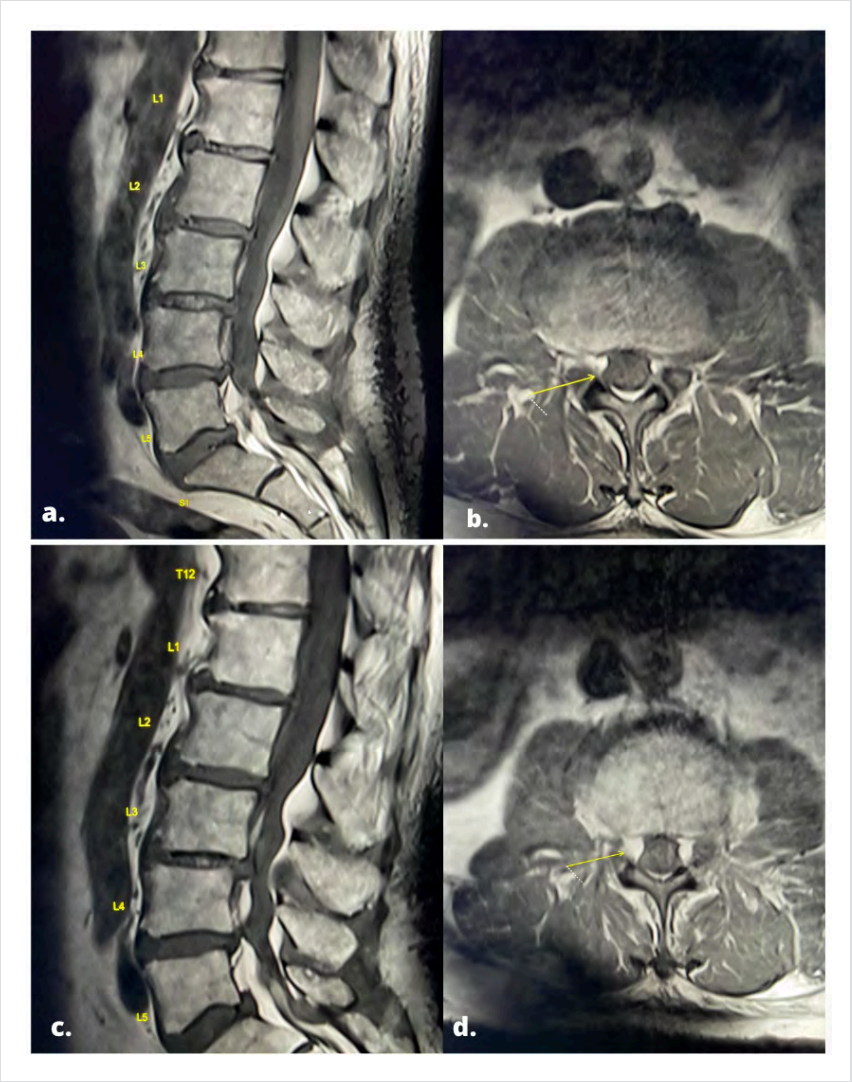
CASE PRESENTATION

A 64-year-old man, with a body mass index of 31, presented with acute-on-chronic low back pain with occasional pain shooting to his knee. He described the left > right pain as constant, dull, and achy. The pain decreased marginally when he leaned forward. He described having worsening pain on standing for a prolonged time, as well as getting up from a seated position. He also was limited in his ability to walk more than a block because of his leg pain. He was managing this pain with exercises and ibuprofen as needed. His past medical history was significant for sarcoidosis, on nightly home oxygen and oral prednisone 20 mg daily, and diabetes on metformin 1000 mg twice a day.

On examination, the patient had tenderness over bilateral sacroiliac joint and over the low lumbar paraspinal area in the possible location of lower lumbar facet joints. His straight leg raise was negative and FABER (flexion, abduction, and external rotation) was positive bilaterally. The rest of his examination was within normal limits. Lumbar spine magnetic resonance imaging (MRI) revealed severe central canal stenosis from L4-S1, multilevel bilateral facet hypertrophy, ligamentum flavum thickening, severe multilevel bilateral foraminal stenosis from L2 to S1, and EL at L5-S1. Given the physical examination findings, along with worse low back pain and based on his preference, we performed therapeutic facet joint intraarticular steroid injection at L5-S1 levels bilaterally and decided to schedule him for diagnostic medial branch blocks at a later date.

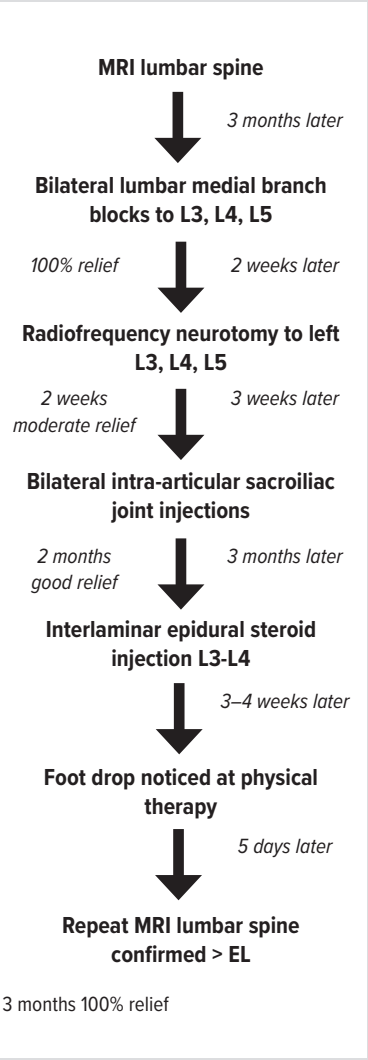
After 2 months, we performed bilateral lumbar medial branch

Figure 1. T1 weighted Sagittal and Axial Images via Magnetic Resonance Imaging Prior to Steroid Injection (A and B) and One Month After Epidural Steroid Injection (C and D)



Arrow pointing to epidural fat deposits

Figure 2. Timeline



Abbreviation: EL, epidural lipomatosis; MRI, magnetic resonance imaging.

blocks at levels 3-5 and, noticing appropriate short-term pain relief, went on to perform a thermal radio frequency ablation of his left lumbar medial branches 3-5 after 2 weeks, as his left side was causing him more pain. On his subsequent visit 3 weeks later, his pain was mostly on rising from sitting to standing with tenderness over the sacroiliac joints bilaterally and no pain over the lumbar area. We performed bilateral ultrasound-guided sacroiliac joint steroid injections with 10 mg of triamcinolone into each joint.

At his 2-month follow-up, the patient's most bothersome pain was the leg pain with features predominantly of neurogenic claudication, including pain behind the thighs and calf worsened with prolonged walking and relieved with rest. Hence, we performed an intralaminar epidural steroid injection (ESI) above the area of severe spinal stenosis at L3-4 using 40 mg of methylprednisolone with 4 ml of preservative-free normal saline. This provided him significant relief from his leg and back pain and facilitated participation in physical therapy.

Several weeks after the ESI, the physical therapist noticed a foot drop. Repeat MRI was ordered and revealed diffuse worsening of his EL from L2-S1 resulting in worsening severe canal stenosis and likely the cause of his foot drop (Figure 1). He was then referred to physiatrists for suitable orthotics (Figure 2). Despite his requests to have the ESI repeated again, which provided him the maximum pain relief, we elected to adopt conservative measures including weight reduction, as he was unable to reduce his prednisone for sarcoidosis. He currently manages his pain with tramadol 3 times daily and has decreased his weight. He continues with his home exercise program but is currently limited by the development of atypical mycobacterial pneumonia.

DISCUSSION

We present a case of foot drop after an epidural steroid injection in a patient with prior documented EL. Besides his body habitus and obesity, the patient's potential for developing EL was that he was

on oral steroids daily for sarcoidosis. He had MRI-documented EL, increasing his chances of worsening of EL.

The prevalence of EL has been reported to be between 1.1% and 6.2%[4,5] and is more common in men. Its cause may be unknown/idiopathic in 17% of patients.[6] Besides obesity, its causes include both exogenous steroid therapy and endogenous overproduction of steroids. Exogenous steroid therapy-related EL (>50% of cases) occurs in patients with organ transplantation, Crohn's disease, ulcerative colitis, and nephritic syndrome; endogenous overproduction of steroids-related EL is seen in Cushing's syndrome, hypothyroidism, carcinoid syndrome, and pituitary prolactinoma.[2,6,7] Other reported possible scenarios include patients on highly active retroviral therapy and Scheuermann's disease.[8] It is possible that etiology may determine the location/level of the EL in the spine. Interestingly, obese patients—in whom EL is more common—have an increase in inflammatory markers such as interleukin-1β and TNF-α that are responsible for enhanced adipose tissue growth.[7]

Computed tomography or MRI imaging is the usual means of identifying EL. Besides volumetric analysis, epidural fat (EF)/antero-posterior diameter of the dural sac also has been proposed as a measure to gauge the severity of EL. Epidural fat in excess of 6 mm also has been proposed as an indicator of EL.[9] In late stages of EL, "Y" sign or polygonal deformations of the dura are noted.[10] EL has been reported to be more frequent in the thoracic than lumbosacral spine with exogenous steroid use, whereas EL related to endogenous steroid affects the thoracic and lumbosacral spine equally.[7]

Previous studies have noted that patients with EL have baseline neurological deficits, with a cohort reporting up to 14.0% of patients having a motor deficit.[1] The only studies thus far demonstrating neurologic weakness in association with EL have reported acute paraplegia following exogenous steroid administration, but there was also documentation of osteoporotic vertebral fractures making it difficult to establish a cause and effect relationship.[6,11] Although a positive correlation between the number of ESI and EL has been demonstrated, no threshold dose of cumulative steroids has been established thus far.[12,13] Interestingly, despite some confounding factors, a few reports have demonstrated resolution of EL-related radicular symptoms with an ESI or by a series of ESIs.[14,15] Symptom severity may be associated with delayed recovery.

Most often, EL is an incidental finding requiring no major interventions. Management of EL associated with neurological injuries is individually tailored with conservative management, including weight loss, decreasing steroid use when possible, and management of the primary condition such as supplementing with thyroid hormones in patients with hypothyroidism. When unsuccessful, some patients have opted for decompression surgery with good results.

CONCLUSIONS

This is a report of foot drop caused by worsening epidural lipomatosis secondary to steroids chronologically following an epidural steroid injection. This report highlights the need for prudence in the use of exogenous steroids, especially when evidence of epidural lipomatosis is present. Although cause and effect cannot be established, cautious use of steroids is recommended to avoid such complications.

Financial Disclosures: None declared.

Funding/Support: None declared.

Acknowledgments: The authors obtained written patient consent and Health Insurance Portability and Accountability Act (HIPAA) authorization to publish this report. This was presented as a poster at the Midwest Anesthesia Residents conference and American society of Regional Anesthesia and Pain Medicine 2022 by Saagar Sheth, DO, resident, Medical College of Wisconsin. The authors would like to thank Veronica Carranza, MD, Clement J, Zablocki Veterans Affairs Medical Center, Milwaukee, Wisconsin, for help in image acquisition.

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A Case of Norwegian Scabies in a Kidney Transplant Patient

Khaing Wei, MD; Sara Shalin, MD; Venkata R. Manchala, MD

ABSTRACT

Introduction: Crusted scabies (Norwegian scabies) is a rare and severe presentation of skin infestation caused by the mite *Sarcoptes scabiei* in patients with compromised cellular immunity. Kidney transplant patients are maintained on immunosuppressive agents, which induce impaired T cell immune response that can lead to increased risk of crusted scabies.

Case Presentation: We report a case of crusted scabies in a kidney transplant patient who presented with a diffuse skin rash. Diagnosis was delayed and misdiagnosed initially, with subsequent skin biopsy leading to an accurate diagnosis and complete recovery with definitive treatment.

Discussion: Unlike classical scabies, crusted scabies can occur in an atypical pattern that can be misdiagnosed as common skin lesions, and a skin biopsy is crucial to obtain an accurate diagnosis to receive definitive treatment.

Conclusions: Transplant recipients are at an increased risk of severe parasitic infections such as crusted scabies due to drug-induced impairment of their cell-mediated immune response, thus maintaining a high index of suspicion for crusted scabies as a differential diagnosis in transplant kidney patients is extremely important. Early histological diagnosis of crusted scabies is essential to prevent delayed or missed diagnosis and avoid unnecessary serious complications. The combination of an oral ivermectin and topical permethrin regimen resulted in excellent clinical outcomes in our case and is recommended as the standard treatment.

INTRODUCTION

Crusted scabies (Norwegian scabies) is a rare and severe presentation of skin infestation caused by the mite *Sarcoptes scabiei* in patients with compromised cellular immunity.[1] Kidney transplant patients are maintained on immunosuppressive agents, which induce impaired T cell immune response that can lead to increased risk of crusted scabies.[2] Unlike classical scabies, crusted scabies can occur in an atypical pattern that can be misdiagnosed as common skin lesions, and a skin biopsy is crucial to obtain an accurate diagnosis to receive definitive treatment.[3]

We report the case of crusted scabies in a kidney transplant patient who presented with a diffuse skin rash whose diagnosis initially was delayed and misdiagnosed. Subsequent skin biopsy led to an accurate diagnosis and complete recovery with definitive treatment.

CASE PRESENTATION

The patient is a 53-year-old female with end stage kidney disease (ESKD) due to uncontrolled hypertension who had a deceased donor kidney transplant (DDKT) in 2007. She received a second DDKT in March 2023 at our hospital. The day before her second kidney transplant, her serum creatinine was 6.4 mg/dL, and her estimated glomerular filtration rate (eGFR) was 8.6 mL/min/1.73 m². One month post-transplant, her serum creatinine was 1.2 mg/dL, and her eGFR was 57 ml/min/1.73 m². Induction immunosuppression included antithymocyte globulin 6 mg/kg, methylprednisolone taper, and mycophenolate 1000 mg twice daily. Her maintenance immunosuppression regimen consisted of extended-release tacrolimus 8 mg daily, prednisone 5 mg daily, and mycophenolate 360 mg twice daily, maintaining a tacrolimus level of 8-10 ng/ml. Approximately 5 months post-transplant, she was admitted to our hospital with fever, vomiting, diarrhea, a 15-pound weight loss, and thrombocytopenia. At the time of admission, her creatinine was 1.6 mg/dL, and her eGFR was 38.4 mL/min/1.73m².

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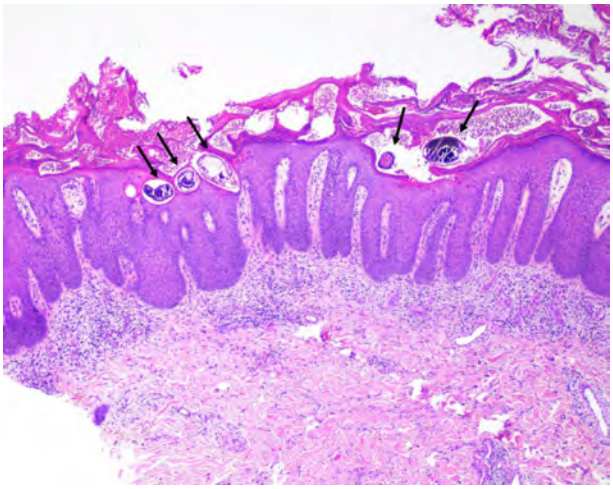
Figure 1. Diffuse Thick Hyperkeratotic Scaling on Trunk and Extremities

One month prior to this admission, the patient developed dryness of skin over the abdomen and thighs and previously had generalized itch, which had improved but had persistent thick, dry skin. She denied similar lesions in the past, and reported there was no history of eczema in her family. On dermatological examination, multiple lichenified hyperkeratotic plaques and diffuse xerosis were noted over the abdomen and upper thigh. The consulting dermatologist started her on triamcinolone ointment 0.1% twice a day and petroleum to the lesions for presumed lichen simplex chronicus. Regarding her fever, nausea, vomiting, and diarrhea, she initially was treated empirically with intravenous (IV) vancomycin and cefepime for sepsis. The infectious workup came back negative except for the respiratory pathogen panel for rhinovirus/enterovirus, and antibiotics were discontinued. She was managed conservatively and all symptoms – except the skin symptoms – resolved, and she was discharged with close outpatient clinic follow-up.

She was readmitted to our hospital about 2 weeks later due to a worsening rash across her body. She said she had been using triamcinolone ointment 0.1% twice a day and petrolatum ointment since discharge. She reported that the above medications helped, but for the past several days prior to this presentation, the lesions on her abdomen and upper thigh had worsened to large, crusted plaques and then spread to her bilateral legs, back, and buttock and were increasingly itchy and painful. She said her husband also had a similar rash on his back.

On dermatological examination, lichenified, cerebriform, verruciform papules and plaques appeared diffusely over the body and were especially hyperkeratotic over the abdomen and upper thighs. There was notable xerosis and lichenification to her hands, including interdigital web spacing, and no appreciable scabietic burrow was noted (Figure 1). Considering chronicity and recurrent lesions, we performed a skin punch biopsy. Histopathology revealed skin with epidermal acanthosis and spongiosis. There were hyperkeratosis and parakeratosis noted in the epidermis and numerous scabietic mite organisms within the corneal layer. The dermis displayed a mixed inflammatory infiltrate (Figure 2).

Figure 2. Skin Biopsy Showing Epidermal Acanthosis with Abundant Hyperkeratosis and Multiple Scabies Mites in the Stratum Corneum (arrows); Mixed Dermal Inflammatory Infiltrate (H&E, 40×)

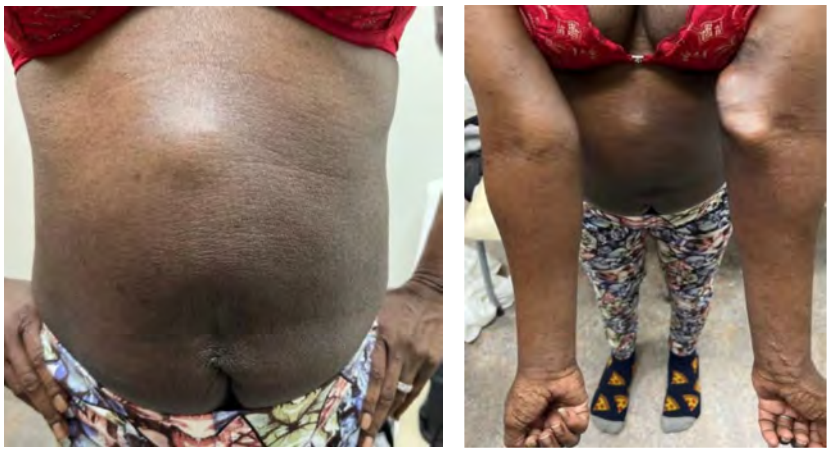


The patient was treated immediately with ivermectin by mouth 200 mcg/kg for 7 days on nonconsecutive days (days 1, 2, 8, 9, 15, 22, 29) and topical permethrin 5% applied to the entire body for 7 days, then twice weekly until symptoms resolved. Her immunosuppressive medications (mycophenolate, tacrolimus extended release, prednisone) continued during hos-

pitalization. She reported a significant improvement in skin scaling, itchiness, and pain with the initiation of ivermectin and permethrin ointment application, and she was discharged after about 5 days with outpatient dermatology clinic follow-up. It was recommended that all household contacts also get treatment with 2 doses of ivermectin 200 mcg/kg 1 week apart and 2 doses of permethrin 5% applied to the full body 14 days apart. Her family members were treated after her hospital discharge, and everyone was reported clearing.

Upon follow-up at the dermatology clinic 2 weeks later, the patient's skin lesions, itchiness, and pain were resolved after 4 doses of 13.5 mg ivermectin. Crusted whitish cerebriform plaques were resolved completely and only a hyperpigmented lesion remained (Figure 3). It was recommended that she complete a 7-day course of ivermectin to prevent a recurrence.

Figure 3. Post-treatment Resolution of Scaly Plaques with Normal Appearing Skin



DISCUSSION

Norwegian or crusted scabies is an uncommon and highly contagious infestation caused by *Sarcoptes scabiei* var. *hominis*.[1] It was first described by Danielssen and Boeck as an atypical skin condition in a population of leprosy patients in Norway in 1848 and is is characterized by hyperkeratosis and crusting of the skin attributed to the immune system's inability to control mite proliferation. Crusted scabies typically develops in patients with compromised T-cell immune response, diminished cutaneous sensation, and a reduced ability to mechanically remove the mites. It occurs with increased frequency among patients on immunosuppressive medications, leukemia, HIV infection, Down syndrome, lepromatous leprosy, malnourishment, and diabetes, and some studies have shown a potential connection between scabies and genetic factors (HLA 11).[1]

Recent studies have shown that crusted scabies patients display a nonprotective T helper 2 (TH2) response. This response is marked by increased production of interleukin (IL)-4, IL-5, and IL-13, along with reduced levels of interferon-c (IFNc) and a diminished T helper 1 (TH1) response. A predominant presence of infiltrating CD8+ T lymphocytes in the dermis has been noted, with minimal helper T lymphocytes (CD4+) and an absence of any B cells. The imbalance in cytotoxic T cells can intensify the dermis of crusted scabies lesional skin by affecting the inflammatory response. When combined with a low B cell count, this condition can result in weakened immune systems incapable of providing effective clearance of parasite.[4,5]

Clinical presentation of crusted scabies varies from patient to patient depending on the level of immunosuppression. Crusted scabies can mimic a variety of conditions and commonly is misdiagnosed as other dermatological conditions, such as psoriasis and lichen simplex chronicus,[3] which can be primary (chronic itching without an identifiable cause) or secondary (due to conditions like chronic eczematous dermatitis). Primary lichen simplex chronicus shows minimal evidence on biopsy, while secondary lichen simplex chronicus causes spongiotic changes in the epidermis and an inflammatory infiltrate with eosinophils. Fungal infections (dermatophytosis) can present with itchy, scaly, ring-like lesions that can sometimes coexist with crusted scabies. This coexistence is due to the overlapping symptoms and the immunocompromised state of affected individuals, making differential diagnosis essential for proper treatment. Patients often are treated initially with topical steroids, which exacerbates their condition further, as was seen in our patient.[3]

This case emphasizes the importance of avoiding pattern recognition bias when addressing skin diseases. An initial oversight in diagnosis extended and complicated the progression of the disease in our patient. Unlike classical scabies, crusted scabies often presents with less pruritic eruptions, and the typical signs of erythematous papules and burrows may be limited, absent, or concealed by the thick crust.

In immunosuppressed individuals, maintaining a high index of suspicion is crucial when dealing with unexplained chronic skin lesions that are itchy and painful as these cases may have atypical presentations.[2] Given the rising use of immunosuppressive medications and the longer life expectancy of immunocompromised patients, an increase in the occurrence of crusted scabies infestations can be anticipated. Therefore, it is important to include scabies in the differential diagnosis of refractory pruritus—even when the presentation is not typical.[6] Early diagnosis of crusted scabies is essential due to its association with heightened morbidity and

mortality. Misdiagnosis can lead to complications such as skin infections, with the fissures associated with crusted scabies being particularly susceptible to bacteremic superinfections, most commonly *S aureus* bacteremia. In cases of crusted scabies, a reported 30-day mortality rate is 16%.[7]

A retrospective review of over 200 cases of crusted scabies in a single hospital showed that 11% developed a superinfection with *S aureus* bacteremia, with a 7% mortality rate within 30 days. In the past 7 years, crusted scabies has had a high mortality rate of 50%, attributed primarily to sepsis or secondary infections.[1,8,9]

The diagnosis of crusted scabies relies on a combination of clinical findings and rapid bedside testing involving the microscopic examination of the scabies mites, eggs, or feces obtained from the skin scrapings of affected individuals. Additional novel methods include video dermatoscopy, epiluminescence microscopy, and polymerase chain reaction testing. When the diagnosis is unexpected, confirmation has been achieved through a skin punch biopsy, revealing mites burrowing in the stratum corneum, which was seen in our patient.[10,11]

Managing crusted scabies can be challenging in certain cases due to factors such as immunocompromised status, diverse skin lesions, numerous hyperkeratotic lesions housing mites, and ineffective penetration of topical agents due to thick crusts. Therapy failure and recurrence are common.[12] Therefore, the recommended approach involves a prolonged treatment with systemic scabicides. The most common treatment for crusted scabies is a single or recurrent dose of ivermectin (oral), adjusted based on the case severity. In our patient, we used both systemic and topical scabicide, which provided a complete response and prevented secondary infections.[1,3,13,14]

Certain literature reviews have highlighted cases in which treating with crusted scabies solely with topical scabies lead to fissures and an inability to tolerate the treatment. Additionally, some cases treated with 2 doses of ivermectin reported recurrence of crusted scabies.[9,12,15] The treatment goal involves eliminating mites, managing symptoms, and preventing secondary infection. The topical scabicides used for classical scabies (sulfur compounds, benzyl benzoate, crotamiton, lindane, malathion, permethrin) also are effective in treating crusted scabies. Typically, repeated applications are necessary, and the clearance process is slower compared to ordinary scabies. Topical permethrin, a synthetic pyrethroid formulation in a 5% cream, is currently the preferred topical scabicide agent used in combination with oral ivermectin. The therapy may be effective with a single dose of a 200 µg/kg, but multiple doses typically are needed for a complete cure. Permethrin is considered safe for pregnant and lactating women and can be used in infants 2 months of age or older.

Anticipating the risk of bacterial colonization and septicemia in all patients is crucial, and any secondary infections should be aggressively treated with broad-spectrum antibiotics. Given the risk of contagion – especially via bedding and clothing – it is advisable for staff to refrain from skin-to-skin contact, use gloves and gowns, and thoroughly launder the patient's clothes and towels. Prophylactic treatment for contacts may extend to the entire institution or include visitors and family members.[9,12,15]

Ivermectin, a semisynthetic anti-helminthic agent derived from Streptomyces avirmitilis, acts as an effective oral scabicide by inhibiting the gamma amino benzoic acid (GABA). However, it should be avoided in pregnant women and children weighing less than 15 kg. The use of keratolytic agents such as 5% to 10% salicylic acid and 40% urea are essential for crust removal, reducing mites' numbers, and enhancing the efficacy of a topical scabicide.[6,14,15]Environmental decontamination also is necessary in the treatment of crusted scabies to prevent recurrence.[1,12]

CONCLUSIONS

Transplant recipients are at an increased risk of severe parasitic infections such as crusted scabies due to drug-induced impairment of their cell-mediated immune response. Our patient, who received high-dose antithymocyte globulin, mycophenolate, and methylprednisolone as induction immunosuppression, was particularly vulnerable. Maintaining a high index of suspicion for crusted scabies as a differential diagnosis in transplant kidney patients is extremely important. Early histological diagnosis of crusted scabies is essential to prevent delayed or missed diagnosis and avoid unnecessary serious complications. The combination of an oral ivermectin and topical permethrin regimen resulted in excellent clinical outcomes in our patient and is recommended as the standard treatment.

Financial Disclosures: None declared.

Funding/Support: None declared.

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Statistical Thinking in Medicine, Part 5: Descriptive Statistics and Quantifying 'Unusual'

Robert A. Calder, MD, MS; Jayshil J. Patel, MD

In part 4 of the "Statistical Thinking in Medicine" series, we discussed that statistics allows us to learn about a population from a random sample. Now, we need a succinct way to summarize both our sample and the corresponding population. The two most important characteristics of both a population and a sample are the "average" and the "spread" of the values. These are among the most important functions of statistics and normally they are among the first concepts taught in most statistics courses. We have chosen to delay this discussion, hoping to first inspire our readers with an understanding of the main uses of statistics in medicine before presenting detailed methods. Our principal focus here will be conceptual rather than mathematical since the mathematics sometimes obscures the overall ideas. Therefore, in this installment, our aims are to describe (1) how to best measure the "average," (2) how to quantify the spread of the data, (3) how the spread of the data in a population differs from the spread of the mean in a random sample, and (4) how these measures help us to determine what is "unusual."

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What is an "Average" Value?

The Mean

Imagine you measure the height of some sample of Wisconsin high school students. What one number would best represent the heights of the students in this sample? The word "average" may come to mind. There are multiple ways to calculate an average, but the three most frequent ways to pick the average are the mean, median, and mode.

The mean is the arithmetic average of some group of numbers. For example, for the numbers 1, 2, and 3, the mean is the sum of the numbers – 6 – divided by the total number of values 3. In this example, the mean is 2. The mean often is used as the average. However, when the data are not evenly spaced, ie, heavily skewed, the mean can be heavily weighted toward the higher values. For example, the average of 1, 4, 5, and 30 is 40 divided by 4, which is 10, a number that would not be most people's first choice of the average of these numbers. A practical example of skewed data is when the mean is cited as the "average" salary in the United States. The mean is not very representative of all salaries since it is heavily weighted by the small number of very high salaries. A humorous example of a right-skewed dataset would be the mean salary today of students in Bill Gates' fifth grade class!

Mathematically, the population mean is computed as:

$$\mu = \Sigma\, x_i / N$$

where the Greek letter mu (μ) represents the population mean, the Greek letter sigma (Σ) means to add up each of the individual "x_i" values, and the capital N represents the number of units in the whole population.

From our example above, suppose instead of merely taking a sample, we measure the height of every Wisconsin high school student. If we then added up all of those measurements and divided by the total number of students, we would derive the ***population*** mean. Suppose that population mean was 5 feet 6 inches. It is the "population" mean because we measured the height of every Wisconsin high school student.

A random sample is a subset that is representative of the population. A sample mean is calculated as:

$$\bar{x} = \Sigma\, x_i / n$$

where the Latin letter "x" with a bar over it represents the sample mean and small case "n" is the number in the sample. In general, Greek letters are used to represent the key features ("parameters") of the population, such as the mean (μ) and standard deviation (σ), and Latin letters are used to represent estimates of these parameters in a sample.

The Median

Recall that values may not be evenly distributed (they are skewed). When the distribution

of values is skewed, the mean is less representative of the distribution, and the median is often a better measure of average. The median is the "middle value" in some group of numbers. For example, the median of 1, 2, 3, 4, and 10 is 3, the middle value. (The mean of these numbers is 4, which is skewed right, or toward the highest value.) If there are an even number of values, the median is the mean of the middle two values, when listed from lowest to highest. For example, in the distribution 1, 2, 3, 4, 5, 10, the median is 3.5. The median is obviously less affected by extreme values. Therefore, when reporting the "average" US salary, which is skewed, it is often presented as the median: half are above that value and half are below.

The Mode

Sometimes the mode, or the most common value, is the best measure of average. In our first-year medical school classes for example, the average number of years of education after high school would be best represented by the mode, since almost everyone would have the same value (eg, 4 years of undergraduate studies). The mode is used as the average when a substantial number of values are the same; however, there is no generally accepted rule for what constitutes "substantial number of values." In the US, the modal salary would most likely be the minimum wage.

What is the Spread of the Values?

The Range

There are several ways to describe the spread of the values in a dataset. The simplest is the range: listing the lowest to the highest value in a data set. For example, when measuring heights for each student in our Wisconsin high school example, suppose the range of heights (shortest to tallest) is from 4 feet 4 inches to 6 feet 8 inches.

The interquartile range is the range from the 25th to the 75th percentile. Suppose interquartile range is heights between 5 feet 2 inches to 5 feet 10 inches. In that case, 25% of the students would be shorter than 5 feet 2 inches and 25% would be taller than 5 feet 10 inches. So, the interquartile range represents the "middle half" of the data with one quarter below that range and one quarter above it.

The Variance

The variance is another way to express the spread of the values. It is the average squared difference from the mean and measures how much the data points are spread out from the mean. To compute the variance for the population, each individual value is subtracted from the mean, that quantity is then squared, and all of these squared values are added up and divided by the total number of values in the population, giving the average (mean) of all the squared values. Squaring these values is done to avoid having to work with absolute values, which are much more difficult to work with. Mathematically, the population variance (σ^2) is computed as:

$$\sigma^2 = \Sigma (x_i - \mu)^2 / N$$

In our high school example, the population mean (μ) was 5 feet 6 inches. To calculate the population variance, the population mean height (5 feet 6 inches) would be subtracted from each individual value; that result would then be squared, and each squared result would be added up. That sum would be divided by the total number of students in the population to derive the population variance. Suppose the population variance is 36 (inches squared). That is the average squared difference from the mean.

As with calculating the population mean, the calculation for the sample variance (S^2) is similar but uses a different denominator. Mathematically it is:

$$S^2 = \Sigma (x_i - \bar{x})^2 / (n - 1)$$

Once again, note that Latin letters are used in sample calculations. This equation means that the sample variance is equal to the sum of the squares of the difference between each sample value and the sample mean, divided by "n – 1". The complete explanation for dividing by n – 1 is beyond the scope of this discussion. However, the key idea is that the mean minimizes the sum of squared differences in the numerator (easily proven with elementary calculus). Since the sample mean is almost never exactly the same as the population mean, the sum of squared differences in the numerator of the sample variance calculation is **smaller** than it would be if the true population mean (μ) were used in the calculation. Dividing by n – 1, rather than just "n," helps to correct this issue, making the quotient larger and therefore making it an "unbiased" estimate of the population variance.

The Standard Deviation

The most frequent measure of spread is the standard deviation (σ), which is merely the **square root of the variance**. Mathematically, the population standard deviation is:

$$\sigma = \sqrt{(\sigma^2)}$$

and the sample standard deviation is:

$$S = \sqrt{(S^2)}$$

One of the virtues of standard deviation is that it is expressed in the same units as the individual measurements. Recall in our high school example, the population variance was 36 inches squared. The square root of that variance is 6 inches, and that is the standard deviation. In a normal distribution, about 68% of the values of the population are within 1 standard deviation of the mean. So, in our high school example, about 68% of the students would be between 5 feet and 6 feet tall (the mean – 6 inches and the mean + 6"). Moreover, about 95% of the population in a normal distribution will be within 2 standard deviations of the mean: 5 feet 6 inches +/- 12 inches.

Standard Error of the Mean (SEM)

When a sample mean is calculated, how much variation would there be in that calculated mean if it were calculated many times with the same random sample size? The answer is: the "standard error of the mean." This is really just the standard deviation of the means computed from many samples. But it gets this new name, "standard error," because the sample mean is an "estimator" of the population mean. ***The standard deviation of any "estimator" (eg, relative risk, odds ratio, hazard ratio, etc) is called the "standard error."*** This serves to differentiate the standard deviation of an ***estimator*** from the standard deviation of ***individual values in the population***. The standard deviation of individual values quantifies the overall spread of the data. The standard error of the mean quantifies the standard deviation of the sample mean. Another important difference between standard deviation and standard error is that the standard error of any estima-

tor depends on the ***size of the sample used to calculate it***. The larger the sample, the smaller the standard error. The difference between the standard error of the mean and population or sample standard deviation is confusing and one of the most frequently asked questions by students.

Mathematically, the standard error of the mean, if we know the population standard deviation is:

$$SEM = \sigma/\sqrt{n}$$

If the population standard deviation is not known – which is usually the case in practice – mathematically, the estimated standard error of the mean is:

$$\text{Estimated SEM} = S/\sqrt{n}$$

Returning to our high school example, recall that the standard deviation of the population was 6 inches. Again, that means that in the ***overall population***, about 68% of the heights of the students were within 6 inches of the population mean. If we were to take a random sample of 16 students, for example, the standard deviation of that sample mean would no longer be 6 inches; it would be much less, because in sampling 16 students and then computing a mean, if that were done many times, ***the range for the computed means*** would be much less than the range for random picks of individual students. Every group of 16 probably would consist of a few very short people, a few very tall people, and the rest of average height. In fact, the variance of the mean in a sample of 16 students would be cut 16-fold from the population variance ($\sigma^2/16$). So, in this example, the variance of the mean for a random sample of 16 students would be the population variance divided by 16, which is 36/16. The square root of this (6/4 or 1.5) would be the standard error of the mean for a sample of 16. So, about 68% of the means calculated from groups of 16 would be within 1.5 inches of the sample mean – that is, ***there would be much less variation for means calculated from groups of size 16 than for individual values***. If the sample size were larger, the standard error would be even less.

How Do We Determine What Is "Unusual"?

The point of calculating and understanding the average and spread of values is to determine whether some individual value is "unusual," whether the mean of some random sample is "unusual," and whether the difference between two means is "unusual" (analogous to the difference between two treatments).

Is This Individual Value "Unusual"?

Suppose in our high school example, we randomly chose a student who was 6 feet 6 inches tall. Would that be unusual (in the sense of being statistically significantly tall)? Given that the population mean is 5 feet 6 inches and the standard deviation is 6 inches, someone 6 feet 6 inches tall would be 2 standard deviations above the mean. In a normal distribution, which we assume our high school population has, about 95% of students will be within 2 standard deviations of the mean, 2.5% would be taller than 6 feet 6 inches, and 2.5% would be shorter than 4 feet 6 inches since a normal distribution is symmetric and "bell shaped." Since only about 2.5% of students would be taller than 6 feet 6 inches, therefore, the "1-tail" *P* value of that student's height would be 0.025, meeting the traditional definition of statistical significance ($P < 0.05$). Typically, a 2-tailed test is done where deviations that are equally extreme in the other direction (ie, shorter than the mean by the same amount) also are counted. However, a 1-tail test is justifiable here because we were only interested in how unusual that height was (ie, that height or taller). An example below will use a 2-tailed test.

Is This Sample Mean "Unusual"?

Suppose we randomly choose 16 people from one of the best basketball teams in Wisconsin and we start by assuming (null hypothesis) that they have the same height as all other students in Wisconsin. If we then calculate the mean height of these 16 basketball players to be 5 feet 10 inches, would that imply that the players on this basketball team are significantly different in height than the overall school population in the state? To determine this, we need to know how many standard deviations this sample mean is from the population mean. Above, we calculated the standard error of the mean height for a group of 16 to be 1.5 inches. Since 5 feet 10 inches is 4 inches above the population mean of 5 feet 6 inches and that represents 2.67 "standard errors" for the sample mean (4/1.5), the question becomes: how unusual would it be for a value in a normal distribution to be more than 2.67 standard deviations away from the mean (in either direction, above or below)? A table for the normal distribution shows that the probability of being ***less than*** 2.67 standard deviations is 0.9962. That means that 1 – 0.9962 or 0.0038 is the probability of being ***more than*** 2.67 standard deviations above the mean, and 0.0038 is also the probability of being 2.67 or more standard deviations below the mean. Therefore, 0.0038 x 2 or 0.0076 of the normal distribution is more than 2.67 standard deviations away from the mean. Therefore, that is the *P* value for a "2-tailed" test of whether the sample height of 5 feet 10 inches is different from the mean for the population. In other words, if we assume (the null hypothesis) that the basketball players have the same height as everyone else in the school population, there is less than a 1% chance ($P = 0.0076$) that we would get these or more extreme results. Therefore, we can reject the null hypothesis and accept the alternative hypothesis that the heights of the basketball players on this team are different from the school population overall.

Are These Sample Means "Unusual"?

Another question we can now answer with this general method is whether the difference between two means is unusual. This is a very common question in medicine. For example, is the mean systolic blood pressure reduction for drug A different than for drug B? To answer this question, subjects could be randomly chosen to receive either drug A or drug B. The mean systolic blood pressure reductions for each group could be calculated, then we could test whether the difference between those mean reductions is statistically significant (at whatever level we decide before doing the study). Our null hypothesis would be that there is no difference in the mean systolic reductions between the drugs. After calculating the difference in the mean blood pressure reductions between the drugs, we would then divide this difference (if any) by the ***standard error of the difference***

between the two means. Assuming the groups are independent (ie, the results in one group do not affect the other group) the standard error of the difference between the means is the square root of the sum of the variances for each mean. The mathematical formulas for this can be found in any standard statistics text. The key concept here is that some difference, such as the mean systolic pressure reductions with drugs A and B, is calculated and that difference ***is then divided by the appropriate standard error*** (in this case for the difference between two means), ***then the probability of that number of standard error units is determined*** and this determines whether the difference is statistically significant. This answers the question: if there is no difference between these drugs, how likely would we see these – or more extreme results – by chance alone?

Conclusion

In summary, the best measure of "average" depends on the skewness of the data. Variance is the average squared difference from the mean. The calculated sum of squares in the sample variance tends to be smaller than that for the population variance; therefore, the sample sum of squares is divided by n – 1 to create an "unbiased" estimate of the population variance. Standard deviation is the square root of the variance, and it measures variation using the same units as the original data. Standard error of the mean (SEM) is the standard deviation of sample means – the larger the sample, the smaller the standard error of these samples. "Unusual" is quantified by how far some quantity is from what would be expected under the null hypothesis. If our data follow a normal distribution, which they often do because of the central limit theorem, we can then determine where our data fall in a normal distribution and read off in a table the probability of seeing such differences or greater if the null hypothesis is true.

In our next (and final) article in this series, we will discuss what constitutes evidence and how to know when the evidence is sufficient to conclude that something causes something else. Finally, you may wish to test your comprehension of the concepts presented in this article (answers will be provided in part 6).

Funding/Support: None declared.

Financial Disclosures: None declared.

Practice Questions/Problems

1. What is the mean of the following numbers: 1, 2, 3, 4, 7, 8?
2. What is the median of the following numbers: 2, 5, 9, 16, 22, 25?
3. If the mean systolic blood pressure of all patients in your practice is 130 mmHg and the standard deviation is 6 mmHg, what percent of your practice would you expect to have systolic pressures above 142 mmHg assuming the systolic pressures follow a normal distribution?
4. Suppose you record the blood pressures of the next 9 patients in your office and calculate the mean systolic pressure of that sample to be 134 mmHg. Would that mean surprise you? What is the standard error of the mean for this random sample of 9?
5. What would the standard error of the mean be for a random sample of 36 of your patients?

Part 4: Probability Practice Questions and Answers

1. When rolling a die, what is the probability of rolling a 1 or a 2?

   Since rolls of the die are mutually exclusive and the probability of each is 1/6, the probability of rolling a 1 or a 2 is 1/6 + 1/6 = 2/6 or 1/3 by the addition rule.

2. If the probability that a laboratory test is positive is 40%, assuming test results on different days are independent, what is the probability of at least one positive test when testing is done on two separate days?

   0.4 + 0.4 – 0.16 = 0.64 or 1 – the probability that both are negative: $1–0.6^2=0.64$

3. As with the conditions in question 2, what is the probability that at least one test is positive if tests are done 5 days in a row?

   1–the probability that all 5 tests are negative = probability that at least 1 test is positive: $1–0.6^5=0.92224$

4. To make a diagnosis, suppose you order 20 independent laboratory tests, each of which is "normal" in 95% of people. What is the probability that at least one test is abnormal?

   1–the probability that all of the tests are normal = the probability that at least 1 is abnormal: $1–0.95^{20}= \sim 0.64$

5. How many ways are there to shuffle a standard deck of 52 cards?

   $52!=8.06\times10^{67}$—a number greater than all of the atoms in the Milky Way Galaxy!

Proceedings from the 2024 Medical College of Wisconsin Innovations in Healthcare Education Research Annual Conference

The following award-winning abstracts were presented during the 11th Annual Medical College of Wisconsin (MCW) Innovations in Healthcare Education Research (IHER) Annual Conference on September 17-19, 2024. Health care educators and researchers from MCW and other national institutions meet annually at IHER to present their research and innovative ideas and to learn from one another about the new and creative approaches to educating students and residents. The 3-day conference includes nationally recognized keynote speakers, panel sessions, workshops, roundtables, oral presentations, and posters that can be viewed at https://www.mcw.edu/IHER2024. Three hundred nineteen participants hailed from 30 states and 9 countries. The winning oral presentations and posters in the research and innovations categories are published below.

BEST ORAL PRESENTATION – INNOVATIONS

Surgical Innovation Discovery Course: Utilizing Surgical Trainee Agile Innovation and Empowerment (STAIR) Framework to Promote Innovation Amongst Surgical Residents

Candice Stegink, MA

Problem Statement: Providing quality innovation programming that is conducive to a surgeon's busy schedule is an ongoing challenge, but even more so for a surgical trainee's schedule. Numerous works have explored the design and development of learning experiences to support physician innovators. However, there is a lack of evidence supporting frameworks that contribute to innovation empowerment for surgical trainees as a complement to the demands of clinical practice. The following catalogs the systematic design and development of a novel innovation and discovery agile framework tailored to surgical residents with original innovation ideas.

Approach: Through qualitative interviews with trainees, findings supported a strong interest to participate in a structured, team-based innovation program designed to increase efficiency and maximize resources (eg, access to engineers, funding, and tangible prototypes). We crafted the Surgical Trainee Agile Innovation and empoweRment (STAIR) framework to support trainee-led innovations, applied in an 8-week team-based course. Trainees submitted applications and served as project investigator. Applications were assessed based on an unmet clinical need, including scope and frequency of problem, potential solution, prototyping feasibility, and recruitment of team members. The STAIR framework created a format to empower surgical trainees to form and lead innovation teams to explore solutions to clinical problems utilizing a team-based fast-fail approach.

Lessons Learned: Our team learned that the STAIR framework provided structure and flexibility for trainees to explore their innovations. This framework allowed participants to innovate around clinical responsibilities and demonstrate leadership and creative thinking and be empowered to ideate solutions to clinical problems. Surgical trainees can continue to utilize this lean-innovation framework throughout their training and careers to lead teams to explore early-stage innovative solutions to clinical problems. Four teams participated in the first cohort. All completed the 8-week course successfully. Three teams are continuing to work on their innovations 1 year after course completion. One team has filed a provisional patent, another is starting a clinical trial, and the other is performing animal testing. All innovations started utilizing the STAIR framework.

Significance: This course and framework provide a novel opportunity to empower trainees to explore their innovative ideas. Trainees are motivated to tackle tough clinical problems early in their career in hopes they do not have to continue facing them for 30-plus years and to better patient outcomes.

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BEST ORAL PRESENTATION – RESEARCH

Benefits and Challenges of Online and Blended Learning Perceived by Students in a Health Care Degree

Feifei Han, PhD

Background: During the COVID-19 pandemic, universities worldwide quickly shifted most courses to online delivery to minimize the impact of the lockdown. Some students were concerned about the quality of their clinical training through online learning, whereas others preferred online learning due to its flexibility. In the post-COVID-19 era, redesigning health professions education programs requires a thorough understanding of students' perceptions of online and blended learning to integrate their opinions into transformative course delivery.

Methods: The present study investigated perceptions of the benefits and bottlenecks of online and blended learning by students enrolled in a health care degree program. The study was conducted in a research-intensive metropolitan university in Australia. A total of 199 students enrolled in a health care degree program participated. They answered an anonymous open-ended questionnaire that asked students' perceptions of the benefits and bottlenecks of both online and blended deliveries. Thematic analyses were used to code the data.

Results: Benefits of online learning: (1) flexible, (2) effective, (3) improving inclusive education. Challenges of online learning: (1) problems with lecture recordings, (2) problems with online course design, and (3) technical issues. Benefits of blended learning: (1) makes learning engaging, (2) easy to handle, (3) diverse learning spaces. Challenges of blended learning: (1) limited time-tabling options for face-to-face learning; (2) large size of face-to-face lectures.

Conclusions: I*mproving students' satisfaction with online learning can be achieved by (1) providing students with quality services to solve their technical issues, which are likely to affect students' acceptance of online learning; (2) adding elements of interaction in course design (eg, embedding collaborative learning tasks and providing timely feedback).

Significance: The study provides useful information for health professions educators in the areas of online and blended course designs.

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BEST POSTER PRESENTATION – INNOVATIONS

Skin Savvy: Student-Led Community Service Learning and Public Education on Skin Cancer in Freeport, Bahamas

Colby Jackson Hunt, BS; Tobiloba Adoun, BS; Mara Dimmick, BS; Michael McClain, BS; Kimberly Taylor, PhD; Elisabeth Schlegel, PhD; James Galpin, BS

Problem Statement: Community service learning enables medical students to develop professional skills while synthesizing content learned. However, such opportunities are rare in the pre-clerkship years, causing a lack of knowledge transfer to community health settings. Moreover, public health concerns, such as skin cancer, are not sufficiently taught to the Bahamian public. Given the predominantly African descent of the Bahamian population, there is a recognized need to raise skin cancer awareness. Therefore, a team-taught skin cancer awareness session at a local community center was initiated and presented. The session empowered students to apply and enhance their classroom knowledge by teaching the public, thus easing rising anxieties about skin cancers and related conditions.

Approach: Skin cancer is the most common cancer in the United States, and 1 in 5 people will develop skin cancer in their lifetime. We explored the need for skin cancer awareness in the Bahamas and expanded on a basic science session to serve the Bahamian community in the vicinity of the medical school. To provide comprehensive public education, an interactive and team-taught presentation titled "Skin Savvy: Sun Safety Against Skin Cancer" was implemented. The public learning session covered the etiology, pathophysiology, diagnostics, treatments, and prevention of skin cancer in accessible language while being ready to address participants' concerns. Taken together, this demonstrated the students' proficiency in the foundational, clinical, and diagnostic knowledge they have accrued, while also building the skills necessary for patient interaction in the future.

Lessons Learned: Medical education community service provides a formative experience and transfer of preclinical knowledge. Several benefits for both students and the audience emerged, including the following. (1) Creating a teaching opportunity enabled students to educate the public and themselves, while also identifying learning gaps. In particular, the effective time of sunscreen or prevalence of acral lentiginous melanoma in people of color were addressed, thus highlighting the importance of this educational session for the Bahamas community. (2) The experience enabled the development of presentational skills and translated clinical terminology into patient-centered language. (3) Classroom concepts and information were synthesized and transferred to practical public health contexts providing the first skin cancer awareness session as a collaborative educational experience.

Significance: Medical education community service enables students to apply knowledge to real-life settings to integrate basic and clinical sciences. This is the first report of a student-led skin cancer awareness session for the Bahamian public, accomplished by the application of a foundational science session.

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BEST POSTER PRESENTATION – RESEARCH

ChatGPT Validation of an Anti-Racism in Medical Education Questionnaire

Simran Shamith, BS; Carolyn Giordano, PhD; Elizabeth Krajic Kachur, PhD; Beverley Ann Crawford, DDS

Background: Surveys are vital in clinical education to evaluate learner knowledge and prompt self-reflection, but creating valid, unbiased surveys is a complex process. Validation involves literature review, interviews, and expert opinions, focusing on item-specific clarity. The rise of artificial intelligence (AI) offers new avenues for medical education survey development, provoking debate on its benefits and limitations in education. This study aims to address questions about the usefulness of ChatGPT in the creation of surveys. Can it help examine content validity and optimize the wording of individual survey items? How does ChatGPT compare with target group opinions? In other words, what is the "value added" of ChatGPT?

Methods: As part of a Josiah Macy Jr grant, a committee of experts developed an 11-item survey to evaluate bias and allyship in the learning environment. After undergoing several committee reviews and revisions, the survey underwent a ChatGPT validation and item review. Both the free (3.5) and paid (4.0) versions of the software were used. The survey was entered in its entirety, and then one prompt after the other was asked of ChatGPT. Each prompt served either to validate and/or optimize the instrument as a whole or the individual items. The authors then convened a 1-hour focus group of 9 medical students (years 2-4) who were given the same prompts that were used for the ChatGPT analysis.

Results: ChatGPT provided quick and extensive output, with both versions correctly identifying the survey's goals and suggesting clarity improvements. Differences in the quality of the versions of ChatGPT were noted, with the paid version offering better formatting. ChatGPT identified ambiguous phrasing in the survey, as well as ways to improve each survey item. As a final output, the AI model integrated its suggestions into new survey questions. However, ChatGPT lacked contextual information, making some unnecessary suggestions given the target group population. This emphasized the value of focus groups in addition to AI models in survey development.

Conclusions: While this is an exploratory study of a new tool, we can conclude that although ChatGPT can offer extensive explanations and valuable suggestions in optimizing a survey, it does lack some contextual understanding. It can provide specific suggestions for a developing survey that focus groups cannot always provide. However, also inviting target audiences to review survey drafts (eg, committee inclusion, focus groups) will result in valuable feedback because they can supply contextual information. By utilizing both together, one has the best chance to optimize survey creation. Using templates and experimenting with prompts and future software iterations will help move the field forward.

Significance: As there are pros and cons to using AI, we don't advocate for ChatGPT as a replacement of human input, but rather as a helpful tool that should be part of every survey developer's toolbox.

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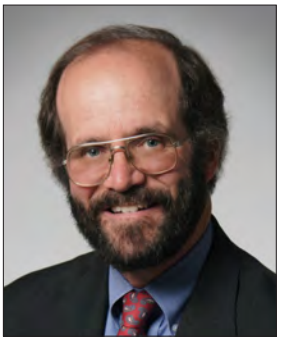

Reflections on the Past Two Decades: Lessons Learned, Opportunities for the Future

Robert N. Golden, MD

In 2006, I became dean of the school of medicine and public health and vice chancellor for medical affairs at University of Wisconsin–Madison. Even before my arrival, I was profoundly impressed with UW–Madison and very excited to play a role in defining what it meant to become a school of medicine and public health. Thus, my family literally packed our bags and headed west with a sense of anticipation and excitement.

What I found here dramatically exceeded my great expectations. The incredibly talented and dedicated faculty and staff were driven by the Wisconsin Idea. There was a strong culture of collaboration and a fierce tradition of shared governance, characteristics that would foster the creation of a shared vision of the integration of medicine and public health. The students and trainees were extremely bright and hard-working. And Madison was a dynamic, exciting amalgam of a college town and capital city.

What I did not expect was the onslaught of unexpected developments. Some were particularly challenging. All were opportunities for our institution to learn and grow. Several are summarized below, in chronological order, followed by reflections on the lessons learned that can help guide us into the future.

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Looking Back

Integrating Medicine and Public Health

In 2006, we began an inclusive process for defining our vision of what it means to meld medicine and public health in our school. Following a series of town hall meetings, focus groups, and a retreat, we created a "white paper" that served as our initial blueprint for constructing our integrative approach across our missions.[1]

While the vast majority of the SMPH community was excited and prepared for our transformation, some groups were not. We quickly learned that the major national public health organization would not consider an application for accreditation as a school of public health because it did not accept our integrated leadership and governance structure. The Centers for Disease Control and Prevention (CDC) accepted applications only from accredited schools of public health or institutions with an accredited preventive medicine residency. Also, within our school, some basic science faculty members were concerned that their key roles would be diminished by our transformation.

The faculty and staff met these challenges head on. We successfully competed for accreditation of our new Master of Public Health (MPH) Program, side-stepping the barriers for accreditation as a school of public health. We created an accredited Preventive Medicine Residency Program and then competed successfully for a CDC Injury Prevention Center. A task force developed a strategic plan for strengthening the role of basic science in an integrated school of medicine and public health; that plan continues to evolve as our roadmap for investing in vitally important basic science research and training.

Challenges to Biomedical Research, Academic Freedom, and Women's Health

Legislation was drafted in 2015 that would criminalize the use of fetal tissue in biomedical research. Over the next several years, intense public debates on this issue sparked frightening threats aimed at scientists who utilized this important research approach.[2] The same legislators who had pushed to criminalize fetal tissue research then developed proposals that would prevent us from offering obstetrics/gynecology residents the optional training in abortion services, and this situation would lead to the loss of accreditation of that residency program. Then, in 2022, the *Dobbs v Jackson Women's Health Organization* decision by the US Supreme Court effectively ended the constitutional right to abortion and shut down the availability of these clinical services in Wisconsin.

Each of these factors posed serious threats to bedrock principles and traditions, including academic freedom, the doctor-patient relationship, and the pursuit of potential life-saving

research and patient care. In each case, strong coalitions and partnerships came together in advocating on behalf of patients for a rational, patient-focused approach based on data, rather than political considerations.

COVID-19 Pandemic

At the onset of the COVID-19 pandemic, there were no readily available diagnostic tests; safe, effective therapies; nor vaccines. More than a million people have died from the novel coronavirus in our nation, and more than 7 million have perished around the globe.[3]

This unprecedented crisis sparked heroic action by countless individuals and organizations. Brave nurses, doctors, and health care staff members put their safety and that of their families at risk by serving the public. Public, private, and academic organizations in our state immediately came together, sharing resources and expertise in an effort to develop and make available diagnostic testing as quickly as possible. Unselfish individuals — ranging from cashiers in grocery stores to public health administrators — provided essential services. Effective vaccines and antiviral treatments were developed and made available with record-breaking speed.

At the same time, social and political forces created schisms that undid the initial "we're all in this together" milieu. Evidence-based public health measures were attacked based on conspiracy theories and fueled by the frustrations and anger associated with the devastating economic and social impacts of the pandemic. Wearing a mask in public was seen as a political statement rather than a protective public health action.

Strong investments in basic and clinical research over the past 50 years enabled the rapid development of life-saving medical tools. Under-development of the public health infrastructure and limited effectiveness of public messaging constricted the availability and acceptance of those tools.[4]

Current Attacks on Research, Academic Institutions, and Access to Health Care

In 2025, the executive branch of our federal government has slashed research funding, severely damaging our nation's medical and public health research infrastructures. Key national institutions — including the National Institutes of Health, the CDC, and the National Science Foundation — have been devastated. Layoffs and forced retirements have decimated the organizations' infrastructures and demoralized the remaining staff. Research grants and contracts to universities have been cancelled, putting at risk the lives of patients in clinical trials and the development of promising new treatments. Several of the nation's most respected universities have been targeted for draconian cuts and restrictions on international students and scholars. As I write this column, the current federal budget proposal could lead to the loss of health insurance for millions of Americans.

Despite our present challenges, I believe the future of medicine and public health will be very bright if we apply the lessons of the past two decades as illumination for effective ways forward.

Looking Forward

Despite our present challenges, I believe the future of medicine and public health will be very bright if we apply the lessons of the past two decades as illumination for effective ways forward.

Partnerships were critical components in navigating past challenges. Our school's success in integrating medicine and public health relied on strong relationships with health systems and clinicians throughout the state. The innovative approaches that are creating an expanded, diverse clinical work force – including our rural and urban training tracks (the Wisconsin Academy for Rural Medicine and the Training in Urban Medicine and Public Health program, respectively) and our pipeline program (Rural and Urban Scholars in Community Health) – have relied on statewide partners for planning and implementation.[5,6] The successful defense of academic freedom, biomedical research, and comprehensive women's health training and services reflects our school's strong partnerships with UW Health, the Medical College of Wisconsin, and our parent university.

Communication is another key for unlocking a bright future for health care and the research that drives innovation. We must explain to our patients and our neighbors the need for increased support for the full continuum of research and access to affordable health insurance for everyone. We must insist that health care policies be based on data, rather than political agendas. If we consistently focus on our patients and the populations we serve, our credibility and effectiveness will be powerful.

Despite the current, unprecedented challenges, I believe there has never been a more exciting time for health care practitioners and research scientists. As I reflect on the past, I look forward to the future with enormous enthusiasm and confidence. And I know that our UW School of Medicine and Public Health (and the future authorship of this column) is in great hands with the arrival of Nita Ahuja, MD, MBA, our 10th dean of the SMPH and vice chancellor for medical affairs at UW–Madison.

On, Wisconsin!

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DEATHS FROM PRESCRIPTION PAINKILLERS HAVE INCREASED BY 38% IN WISCONSIN.

It's a myth that prescription painkillers are completely safe because a doctor prescribes them. The Dose of Reality is that in Wisconsin, prescription painkillers are involved in more overdose deaths than heroin and cocaine combined. In fact, 63% of opioid-related deaths in 2015 involved prescription drugs. And everyone is at risk, especially young people ages 12-25.

Working together, we can prevent prescription painkiller abuse in Wisconsin. Since 4 out of 5 heroin addicts start with prescription painkillers, we can also help to curb the statewide heroin epidemic. Go to DoseOfRealityWI.gov to learn what you can do to help.

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PREVENT PRESCRIPTION PAINKILLER ABUSE IN WISCONSIN.

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A message from Wisconsin Department of Justice, and the Wisconsin Department of Health Services

Wisconsin Department of Health Services

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