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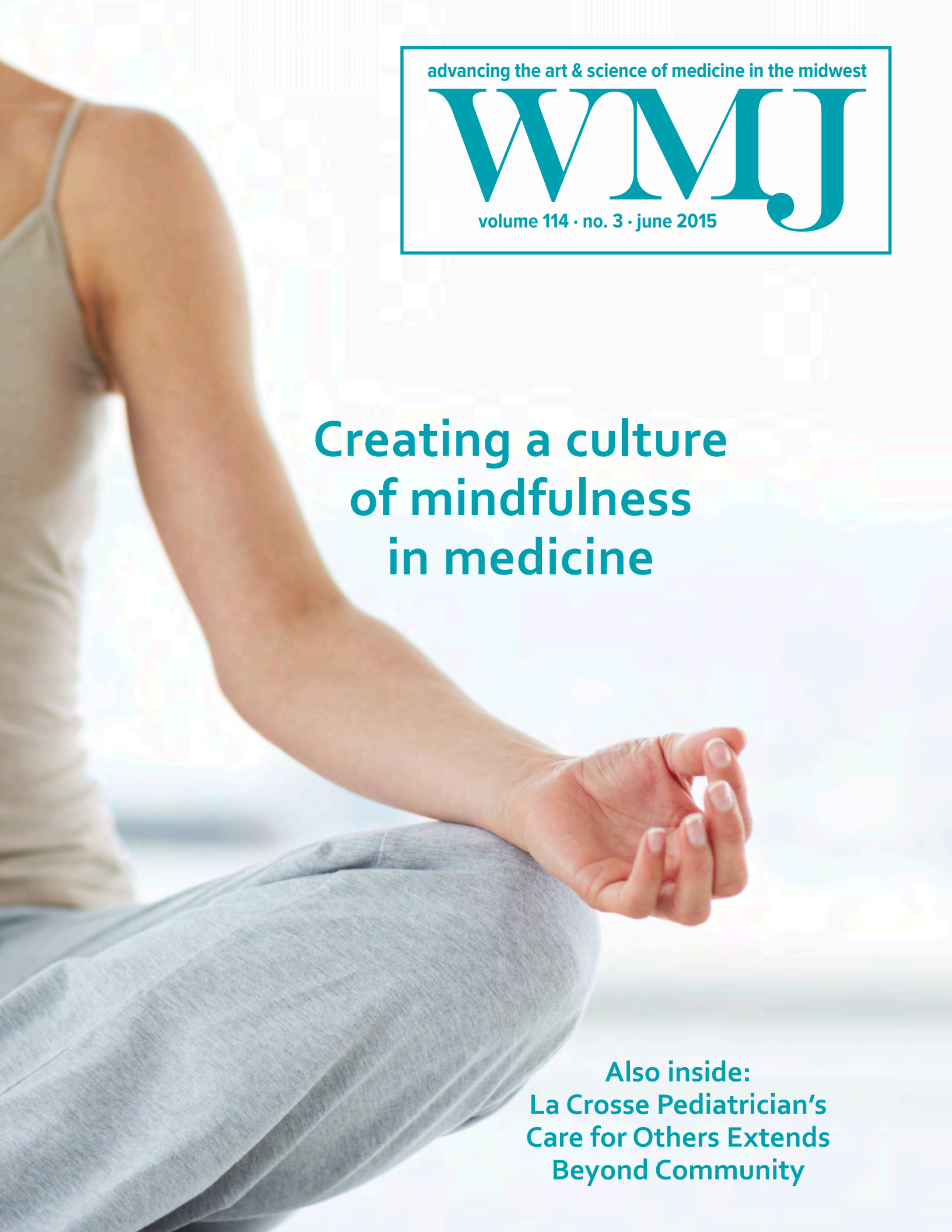

Creating a culture of mindfulness in medicine

Also inside:
La Crosse Pediatrician's Care for Others Extends Beyond Community

Photo: Grant Delin

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WMJ

COVER THEME
Creating a culture of mindfulness in medicine

Many factors contribute to professional burnout, and well-documented evidence indicates that clinician burnout can negatively affect patient care. Meanwhile, a growing body of research supports the benefits of mindfulness in medicine for clinicians and patients alike, including a report in this issue of *WMJ*.

Cover design by
Mary Kay Adams-Edgette

EDITORIAL

In This Issue

Mind and Body for Patients and Health Professionals **93**

John J. Frey III, MD, Medical Editor

ORIGINAL RESEARCH

A Retrospective Review of Contrast Nephropathy in a General Population **95**

Asma Arayan, MD; Mark A. Nigogosyan, MD; Marvin J. Van Every, MD

Self-Reported Mental Health Predicts Acute Respiratory Infection **100**

Lizzie Maxwell, BA; Bruce Barrett, MD, PhD; Joseph Chase, BS; Roger Brown, PhD; Tola Ewers, MS, PhD

HEALTH INNOVATIONS

Creating a Culture of Mindfulness in Medicine **105**

Charlene Luchterhand, MSSW; David Rakel, MD; Cynthia Haq, MD; Lisa Grant, DO, MSW; Angela Byars-Winston, PhD; Steve Tyska, MD; Kathleen Engles, PA-C, MPH

REVIEW ARTICLE

Twelve Tips for Improving the General Surgery Resident Night Float Experience **110**

Rebecca M. Rentea, MD; Jared A. Forrester, MD; Nathan W. Kugler, MD; Anahita Dua, MD, MS, MBA; Travis P. Webb, MD, MHPE

CASE REPORT

A Case of Celiac Disease, Epilepsy, and Cerebral Calcifications With Temporal Lobe Epilepsy **116**

Aaron F. Struck, MD; Brad R. Beinlich, MD; Paul A. Rutecki, MD

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YOUR PROFESSION

Looking Back...to 1965
Regulation Needed 88
D.N. Goldstein, MD

Focus on Community Health
La Crosse Pediatrician's Care for Others Extends Beyond Community 90
Jennifer Wieman

CME Quiz
A Case of Celiac Disease, Epilepsy, and Cerebral Calcifications With Temporal Lobe Epilepsy 118

MetaStar Matters
Quality Improvement, Health Information Technology, and the Shift to Pay for Value 121
Jay A. Gold, MD, JD, MPH

Ad Index 124

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Regulation Needed

D.N. Goldstein, MD

*Editor's note: As evidenced is this "Looking Back" feature, the issue of gun control remains as timely today as it was 50 years ago. The editorial below was first published in April 1965 (*WMJ, *Volume 64, p. 169); the rebuttal—a letter to the editor—was published the following August (*WMJ, *Volume 64, p. 302).*

It's been a year and a half since a lone gunman with a mail-order rifle ended the life of a president of the United States. In all that time, despite the public clamor for effective controls over the sale and use of firearms, Congress has done nothing to prevent a recurrence of the tragedy.

While President Kennedy is probably the best known and, for the nation, the most tragic victim of the present unbridled availability of firearms, medical personnel and police departments are painfully familiar with the day-to-day tragedies resulting from the misuse and malicious use of guns. In an article in *HARPER'S*, December 1964, Carl Bakal reports that more than 17,000 persons are shot to death each year in the United States. This figure includes more than half of the 8,500 reported murders, half of the estimated 22,000 suicides and about 2,000 accident victims.

Shortly after the Kennedy assassination, no less than 18 bills aimed at controlling the sale of firearms were introduced in Congress. By August of last year all of them were buried in committee, and the Congress adjourned without taking any action on the matter.

Most citizens favor some kind of firearms control. J. Edgar Hoover, who should know, favored control legislation; in Congress, support came from both Democrats and Republicans; a January 1964 Gallup poll showed nearly 8 out of 10 persons in favor of a law requiring a police permit to buy a gun. More recently, a survey by a television station in Chicago indicated that over 70 percent of the respondents favored such a law, and more than half of those who owned guns were in favor. Yet the will of what appears to be a majority of citizens of this country, as well as a clear requirement for public safety, has been frustrated by the effective lobbying action of a small group of sportsmen, gun clubs, firearms manufacturers, and "patriotic" organizations.

Those who oppose firearm control legislation base their objection on the second amendment of the Constitution which guarantees "the right of the people to keep and bear arms." Although the amendment referred to the right to bear arms as members of a militia, as a reading of the *entire* amendment makes clear, the gun-lovers and their friends interpret it to authorize some kind of knight-like posture of individual resistance to tyranny. Nevertheless, using their misconception of the second amendment as gospel, the firearms lobby has struck down any kind of systematic federal control of firearms.

The second amendment should not be used to prevent the establishment of controls that are undeniably necessary for the public welfare. Anyone, nowadays, can buy a shotgun or rifle, either in his own hometown or by mail order. In only 9 states is a permit required to purchase a pistol or a revolver. Although the federal government licenses dealers in firearms who sell interstate, such licenses can be obtained virtually for the asking. In the absence of federal action in this important area, the state of Wisconsin has an obligation to protect its citizens by passage of firearms control legislation. To prevent lethal weapons from falling into the hands of irresponsible, demented, or vicious persons, laws must be passed to license their use and control their sale. Just as the state requires an operator's license of all who drive automobiles, the state must insist that those who use firearms be likewise identified, tested, and qualified. Arms and ammunition should be sold only to those properly licensed and therefore qualified to handle them.

While the establishment of statewide firearms control may not entirely eliminate accidental injury and death from firearms, it would put a brake on the rising rate of such hazard in an increasingly congested society. And while it might mean nothing in statistical terms to the homicide rate in Wisconsin, licensing legislation could deter the one single tragedy that might senselessly turn the whole course of history again.

Firearms control legislation is desirable and necessary, and Wisconsin should take the lead in passing it.

—D.N.G

Guns and Their Control

To the Editor:

While a medical journal is an anomalous place to find an editorial about firearms, presumably the editor of any publication has the privilege of saying what he pleases on any subject. But when he does, he owes his readers the duty of being reasonably well informed about his topic. This Editor Goldstein has failed to do so in his editorial in the April issue of the *JOURNAL* and I request equal space to refute his erroneous statements and specious arguments.

Like thousands of other citizens he has fallen victim to the vicious and vociferous propaganda of the anti-gun crowd whose thesis is, "Guns cause crime and therefore should be prohibited (or controlled, regulated, registered, or whatever)." Even a moment's thought will convince any reasonable person that no gun ever caused any crime by itself. True, guns are used by criminals, but they do not cause crime. Guns are also used by law-abiding citizens to protect themselves and their property from *armed* criminals. Guns, both large *and* small, are used by our government to protect the nation as a whole from international criminals who are armed. Would Dr. Goldstein have the United States throw away its arms just because other nations are misusing theirs?

Dr. Goldstein urges reading the *entire* Second Amendment to the Bill of Rights in order to understand its meaning. Obviously he did not follow his own advice. He says, "Although the Amendment referred to the right to bear arms *as members of a militia*, as a reading of the entire Amendment makes clear,- - - -etc." It says no such thing! Here *is* the entire Amendment. "A well regulated militia, being necessary to the security of a free state, the right *of the people* to keep and bear arms shall not be infringed." (Underscoring mine.) I submit that *we,* you and I, are "the people" and unless *we* can keep and bear arms there can be no militia and hence no freedom or security in our state. What Dr. Goldstein proposes would change all this—and not to our advantage—but to that of criminals who would never register *their* arms or voluntarily surrender them. I firmly believe that anything which restricts or prevents access to, or ownership of, firearms by law-abiding citizens is not in the public interest and is a threat to our national security. A disarmed general public would be easy prey for a determined and well armed group of men. While the murder of a president by a demented assassin is a great tragedy, this is a hazard inherent in the office of Chief of State and should not be an excuse for disarming our citizens. We can, and do, replace a president easily, but we can never replace our constitutional government easily. That I am not alone in this idea, I offer the following quotation:

> "By calling attention to 'a well regulated militia' the 'security' of the nation, and the right of each citizen 'to keep and bear arms,' our founding fathers recognized the essentially civilian nature of our economy. Although it is extremely unlikely that the fears of governmental tyranny which gave rise to the Second Amendment will ever be a major danger to our nation, the Amendment still remains an important declaration of our basic civilian-military relationships, in which every citizen must be ready to participate in the defense of his country. For that reason I believe the Second Amendment will always be important."

Who said that? John Fitzgerald Kennedy!

Finally, there is no proof that the regulation, restriction, or registration of firearms will have any material influence on the reduction of the crime rate in this country. Certainly the Sullivan Law in New York has not reduced New York's crime rate, which is nearly as high as any other state in the Union. Furthermore, there is considerable evidence to show that the accessibility of firearms has very little to with the murder rate in this country. A recent FBI report shows that since 1930 the murder rate in the United States has declined 40%. In the same period the number of civilian owned firearms in the United States has increased enormously and since the end of the last war the interest in shooting as a healthful recreation has increased tremendously. There can be no doubt that firearms are used by criminals, but corrective measures should be directed against the criminals and not against the firearms. Congressman Bob Casey of Texas has the right idea when he proposes very severe penalties for using a firearm during the commission of a felony. To support this stand, I submit the following quotation from Police Superintendent Robert V. Murray, Washington DC:

> "It may be argued that any legislation that would reduce the number of pistols in circulation would substantially reduce the number of aggravated assaults. The argument rests on two mistaken premises. First, it assumes that restrictive legislation will prevent criminals from obtaining guns. The fact is that experience has shown that legislation such as the New York Sullivan Law does not reduce the number of pistols in the hands of criminals. Second, the argument assumes that guns are used in the most aggravated assaults, whereas the fact is that they used in only a small percentage of such assaults."

If these are the facts then why is the anti-gun crowd so anxious to disarm the civilian population of this land of freedom? I leave the answer to that question to the reader!

—H.M. AITKEN, MD
Eau Claire, Wis.

Let us hear from you

If an article strikes a chord or you have something on your mind related to medicine, we want to hear from you. Submit your letter via e-mail to wmj@wismed.org or send it to *WMJ* Letters, 330 E Lakeside St, Madison, WI 53715.

WMJ

La Crosse Pediatrician's Care for Others Extends Beyond Community

Jennifer Wieman

Steven Manson, MD, has a fondness for quotes. His favorite from Dr. Martin Luther King, Jr. is posted by his desk in his office at Gundersen Health System in La Crosse, Wisconsin. It reads: "Life's most persistent and urgent question is, what are you doing for others?"

"That reminds me routinely about how I should focus my life," Dr Manson said.

That focus extends far beyond his pediatric patients at Gundersen, where's he's practiced the last 23 years and serves as chair of the Pediatrics Department. Doctor Manson dedicates his time in many ways. Whether it's speaking to an audience at city hall about bullying or reading to a group of children at Northwoods Elementary in La Crosse, his caring for others shines through. This also includes treating the more vulnerable residents in his community who come through the doors of the St Clare Health Mission, a nonprofit clinic in La Crosse, as well as Native American youth on the Pine Ridge Indian Reservation in South Dakota. It's for that reason Dr Manson received the Wisconsin Medical Society's 2015 Physician Citizen of the Year award.

Liz Arnold, who nominated him for the award, said Dr Manson is someone who would never seek recognition for his volunteerism—so she did.

"He embodies servant leadership," said Arnold, who is the administrative director of Gundersen Global Partners. "He leads in a posture of humility, and he always has the interests of others before himself.

"And he does everything so well," she added. "He does everything on his plate with excellence."

That includes volunteering every other month at the St Clare Health Mission, where he serves as medical director, and spending one week, twice a year at Pine Ridge, where he also serves as medical lead. The reservation is one of 3 sites that Global Partners serves.

> "It's often very daunting when you first think to consider going off and doing something you've never done before in a different place, but try to be open-minded and flexible and once you get there, then you will fall in love with the work and the people."

A Collaboration of Care

In 1993, Gundersen Lutheran Medical Center (now Gundersen Health System) and Franciscan Skemp Healthcare (now Mayo Health Clinic–Franciscan Healthcare) collaborated to form the St Clare Health Mission, a nonprofit clinic in La Crosse for those who don't have access to public or private health care. That first summer the clinic opened, Dr Manson was one of 2 dozen physicians to volunteer their services. Twenty-two years later, he continues to see patients there, and in 2000, Dr Manson stepped up again when he took on the numerous administrative duties of medical director when the clinic's first director, Ralph Tauke, MD, decided to take on a different role.

Almost 100% of patients who come through the clinic's door are adults, and on any given day, cases can run the gamut of minor ailments to something as serious as a heart attack.

Doctor Manson still remembers one particular case, where a young woman in her twenties came into the clinic with chest pains and shortness of breath. Tests were administered, but the source of her symptoms could not be determined immediately. Concerned that it might be a pulmonary embolism, Dr Manson sent her to the emergency department, where her diagnosis was confirmed and successfully treated.

"A lot of folks who don't have insurance put things off, much to their own detriment obviously, and if she hadn't had access to our facility, might not have gone in and it could have been a lethal event in her case," he said.

A few weeks later that same young woman sent a thank-you card, expressing her gratitude.

Doctor Manson said they get a lot of those messages from patients. Some who may not be able to give back financially will even come back and volunteer to show their appreciation.

Steven Manson, MD, and his wife Peg volunteer their time reading to children at Northwoods Elementary School in La Crosse, Wisconsin. Dr Manson received the Wisconsin Medical Society's 2015 Physician Citizen of the Year Award, which recognizes physicians who have volunteered their time and talents to improve their communities and honors recipients for civic, economic, and charitable services they provide.

Doctor Manson, a Gundersen Health System pediatrician, connects with a young patient during a trip to the Pine Ridge Indian Reservation, South Dakota. As part of the Gundersen Global Partners' Pine Ridge team, Dr Manson has made multiple visits to the reservation to provide pediatric care since his first trip in 2009.

Doctor Manson, who serves as chair of Gundersen's Pediatrics Department, examines one of his infant patients.

Gundersen Global Partners
www.gundersenhealth.org/global-partners
Started in 2008, the mission of Gundersen Global Partners is to improve the health and well-being of the global communities it serves, as well as inspiring volunteerism throughout Gundersen Health System and local communities.

Gundersen Global Partners serves the Matagalpa region of Nicaragua, Yelebon Ethiopia in Africa and the Pine Ridge Indian Reservation in South Dakota.

St Clare Health Mission
www.stclarehealthmission.org/
The St Clare Health Mission in La Crosse, Wisconsin, began in 1993 as a joint partnership between Gundersen Lutheran Medical Center (now Gundersen Health System) and Franciscan Skemp Healthcare (now Mayo Clinic Health System-Franciscan Healthcare). The volunteer-run, nonprofit clinic is open 2 evenings during the week, providing free medical care for people living in the La Crosse area whose income is at or below 200% of the federal poverty line. Since it opened its doors in the summer of 1993, the clinic has cared for more than 16,500 patients in over 75,000 clinic visits.

Children Are Children—Everywhere

The Pine Ridge Indian Reservation—roughly the size of Connecticut—is located in the southwest corner of South Dakota. It is the second largest reservation in the United States; Dr Manson estimated that up to 40,000 Oglala Lakota currently live there.

Seeing the poverty there first-hand—and for the first time—was an eye opener for him.

"That was a tremendously impactful experience for me. I'd never been on the reservation before and to witness the conditions under which these people live—only 9 hours from my home—was stunning," he said.

In 2000, the US Census Bureau ranked Pine Ridge as the third poorest reservation in the United States. The life expectancy, according to Global Partners, is 48 for men and 52 for women. Doctor Manson said it is the second lowest life expectancy rate in the world. There also is a high rate of alcoholism on the reservation, 8 times the rate of diabetes compared to the general population, and high unemployment. The Indian Health Services receives $2700 per resident, per year for health funding, but that only covers about a third of what is spent on the average US citizen, Dr Manson said. Pine Ridge's communities also are very isolated from each other. It's not uncommon for a family of 18 to live together in a 2-bedroom house and some homes may not have electricity, heating, or indoor plumbing.

"One of the things I noticed most is the resilience of these folks living in a very difficult environment with harsh conditions, but using their energy and talents to try to better the life of their fellow Lakota that live on Pine Ridge," he said.

Something else Dr Manson noted is that the needs and desires of children are universal.

"These kids (on the reservation) grow up in tough conditions—where there's alcoholism, family dysfunction, drug usage, etc—but they're all wanting the same things. They want attention, they want love, they want affection. And we see that in our interaction with the schools and the Head Starts with the adults who are their mentors, they just flourish and bloom when that can be provided for them," he said.

Prior to the first team going to Pine Ridge in October 2009, a call went out to all Gundersen employees who might be interested in volunteering—at their own expense. Anyone who signed up would be paying for the trip themselves and using vacation time. That didn't stop Dr Manson, who was one of the first to volunteer, in spite of his other commitments and responsibilities at the Gundersen and St. Clare Health Mission.

"For him to be willing to step up and say 'I will go,' is just even more of a testament of his willingness to give," Arnold said.

But as Dr Manson is quick to point out, he's not alone on these trips. Since 2009, more than 320 different volunteers, including physicians, nurses, medical assistants, social workers, behavioral health therapists, and community members have donated over 50,000 hours to Pine Ridge.

A trip in April of this year was Dr Manson's ninth to South Dakota. During that week, he and the rest of the pediatrics team saw a combined 142 students for physical exams at 2 Head Start centers and 2 schools on the reservation. The exams fulfill a federal mandate for school enrollment and more funding based on that enrollment, but they also allow kids to participate in sport-related activities.

'Pilamaya'

One of the many mementos from Dr Manson's trips to South Dakota is a small homemade poster from the children at the Porcupine Head Start Center with the Lakota word "Pilamaya" on it. Translation: Thank you. Doctor Manson said that poster and other treasures he's received are daily reminders for him why he invests so much of his time doing what he does.

"I would encourage anyone who has ever thought about doing activities such as these to take the opportunity to do so," he said. "It's often very daunting when you first think to consider going off and doing something you've never done before in a different place, but try to be open-minded and flexible and once you get there, then you will fall in love with the work and the people."

Caring for those close to home in La Crosse and as far as South Dakota, Dr. Manson has done exactly that.

Mind and Body for Patients and Health Professionals

John J. Frey III, MD, Medical Editor

Two articles in this issue of the *WMJ* continue to explore the relationship of attitude and behavior on the well-being of patients and clinicians. The world has come a long way from the time when all mothers admonished their children to not get wet or get a chill or the result would be a cold or, my mother at least, would confirm that any illness would be proof that we had been too stressed or worried or working too hard. The article by Maxwell and colleagues[1] seems to reinforce some aspects of this theory. My mother would feel vindicated.

The increasing literature on mind-body relationships has moved from observational studies to a wide array of epidemiologic and prospective studies that are describing and confirming relationships between a variety of mental states and physical illness. I remember hearing a study 30 years ago when a colleague reported on the relationship of stress to the development of genital herpes and possible immunologic mediators and wondering to myself if this was going to change everything about how we approach physical and mental health.[2] It certainly did. HIV and the immunology of the human response to it created an enormous and transformative world of research that continues today. Recent work in biomics and the relationship between internal viral and bacterial populations on human health connects what have always been considered "behavioral" diseases such as obesity and genetic disease (eg diabetes) to environmental factors.[3] The boundary between "good" and "bad" virology and microbiology is getting fuzzier by the year. The environment in which we live and which lives on and within us is more tightly connected to everything else, both mind and body.

Building on previous work that looked at possible interventions to decrease the development of acute respiratory infections, Maxwell and colleagues found that there is a strong and positive relationship between problematic mental health and getting a cold. While this would not be a surprise to my mother, we have good science, good measures, and important results that could be translated into better prevention if we are able to work with patients. It makes a stronger case for including preventive mental health programs in primary care.

Mindfulness and meditation have been proven to be beneficial for individuals, but can that change a work environment for everyone?

The article by Luchterhand and colleagues[4] offers one of those preventive approaches by describing a mindfulness program for primary care clinicians and the diffusion of that program into health teams and clinics, and even patients. A relatively small investment of time and funds produced a motivated group of leaders who went back to their home environments and began changing those environments for everyone. Mindfulness and meditation have been proven to be beneficial for individuals, but can that change a work environment for everyone?

This study shows that such changes are possible and positive. If such training can bring results to clinical environments, one would hope one day to see the benefits brought to other high-stress, high-risk professions. Just as we see lots of busy young professionals walking or biking with their yoga mats, it would be good to see groups of construction workers or police officers sitting in meditation before beginning their risky and busy days. While that is not likely to be seen soon, the program that Luchterhand and colleagues describe should be offered to a wide variety of workers and work environments. If we believe in something for which there is a proven health benefit, then we should feel obliged to bring it to everyone who would benefit. Health professionals work hard in a stressful environment, but so do many others in society.

Handoffs and Testing Prevailing Beliefs

Rentea and her colleagues[5] give recommendations that, if followed, have enormous potential to improve patient safety and patient comfort during hospital admissions for surgery. Resident work rules have made hospital care seem more like relay races and—for all involved—the baton must not be dropped. Their tips can be summarized in 3 categories: communication, documentation, and supervision. No patient or family in crisis wants to see unfamiliar faces and people who seem not to know about important

issues coming into their room in the middle of the night. Following Rentea's checklist minimizes the likelihood that that will happen.

Finally, in an attempt to describe the incidence of IV contrast-related nephropathy, Arayan and colleagues[6] use data on patients who underwent procedures prior to the general use of prophylactic measures. They found a small number of patients (9/193 [4.7%]) who developed a rise in creatinine after the procedures, each of whom had other reasons for that rise. The discussion in the article is very helpful, both in understanding the relevance for their study and to highlight the continuing controversy about the true incidence of contrast-induced nephropathy—that controversy will continue, short of well-done randomized control trials that are unlikely to happen. Without them, given that US medicine believes in general that doing more is better than doing less, prophylactic measures will continue.

References

1. Maxwell L, Barrett B, Chase J, Brown R, Ewers T. Self-reported mental health predicts acute respiratory infection. *WMJ.* 2015; 114(3):100-104.

2. Schmidt DD, Zyzanski S, Ellner J, Kumar ML, Arno J. Stress as a precipitating factor in subjects with recurrent herpes labialis. *J Fam Pract.* 1985 Apr;20(4):359-366.

3. Specter M. Germs are us: bacteria make us sick, do they also keep us alive? The New Yorker. October 22, 2012. http://www.newyorker.com/magazine/2012/10/22/germs-are-us. Accessed June 3, 2015.

4. Luchterhand C, Rakel D, Haq C, et al. Creating a culture of mindfulness in medicine. *WMJ.* 2015; 114(3):105-109.

5. Rentea R, Forrester J, Kugler N, Dua A, Webb T. Twelve tips for improving the general surgery resident night float experience. *WMJ.* 2015;114(3):110-115.

6. Aryan A, Nigogosyan M, Van Every M. A retrospective review of contrast nephropathy in a general population. *WMJ.* 2015;114(3):95-99.

A Retrospective Review of Contrast Nephropathy in a General Population

Asma Arayan, MD; Mark A. Nigogosyan, MD; Marvin J. Van Every, MD

ABSTRACT

Background: One of the adverse events associated with administration of intravenous (IV) contrast media is contrast-induced nephropathy, yet its incidence is poorly characterized. We investigated the incidence of contrast-induced nephropathy in patients with elevated baseline serum creatinine concentrations who underwent computed tomography (CT) using IV contrast media.

Materials and Methods: Using the electronic medical records at a community hospital, we retrospectively identified patients with elevated baseline serum creatinine concentrations who had undergone CT utilizing IV contrast media between January and July 2000, a period prior to the routine use of pretreatment as prophylaxis against contrast-induced nephropathy, and who subsequently developed elevated serum creatinine. We identified concomitant risk factors for the rise in serum creatinine in these patients aside from IV contrast media exposure.

Results: One hundred ninety-three patients with a baseline serum creatinine concentration greater than 1.2 mg/dL underwent 236 CT studies utilizing IV low-osmolar contrast media. Nine of the 193 patients had a rise in serum creatinine $\geq$ 0.5 mg/dL up to 1 month later. None of these 9 patients had contrast exposure as the only risk factor for their rise in serum creatinine.

Conclusion: The role of IV contrast media in causing contrast-induced nephropathy and, thus, acute kidney injury, may be overestimated. Further study needs to be done into whether contrast-induced nephropathy is truly a common or even a real entity in patients receiving IV contrast media for routine studies who have no other risk factors for kidney injury warranting the expense, risks, and inconvenience of pretreatment.

INTRODUCTION

Despite being one of the chief adverse events associated with administration of intravenous (IV) contrast media, contrast-induced nephropathy and its incidence and pathophysiology are poorly characterized. The reported incidence of contrast-induced nephropathy ranges from as low as 1%[1] to as high as 33%.[2] Many of these studies were done in cardiac patients receiving intra-arterial contrast. Other researchers have shown changes in serum creatinine to be similar in patients undergoing computed tomography (CT) with and without contrast.[3] These researchers also found that although reduced estimated glomerular filtration rate (GFR) is associated with higher risk of acute kidney injury as defined by serum creatinine, this risk is independent of exposure to contrast material.[4] Many risk factors have been suggested, including advanced age, diabetes mellitus, and multiple myeloma. Therefore, we conducted a retrospective review to determine the incidence of contrast-induced nephropathy in patients with elevated baseline serum creatinine concentrations after undergoing CT scans using IV contrast media.

METHODS

Following approval of our application for a Health Insurance Portability and Accountability Act (HIPAA) waiver, we queried the electronic medical record database at a community hospital to retrospectively identify all patients with baseline serum creatinine concentrations between 1.2 mg/dL and 2.5 mg/dL who underwent CT utilizing IV contrast media between January and July 2000 and had a repeat serum creatinine drawn within 1 month of having the CT. These dates were chosen because this was before we used IV hydration or acetylcysteine as a prophylactic measure in patients receiving IV contrast. During the study period, no form of pretreatment was used routinely for renal protection. We used the lower limit of 1.2 mg/dL for serum creatinine because few people with serum creatinine above 1.2 mg/dL have normal renal function. We used the upper limit of 2.5 mg/dL because

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Author Affiliations: Department of Medical Education, Gundersen Medical Foundation, La Crosse, Wis (Arayan); Department of Radiology (Nigogosyan); Department of Urology (Van Every), Gundersen Health System, La Crosse, Wis.

Corresponding Author: Marvin J. Van Every, MD, Mail Stop C04-004, Gundersen Health System, 1900 South Ave, La Crosse, WI 54601; phone 608.775.2212; fax 608.775.6756; e-mail mjvaneve@gundersenhealth.org.

Table. Details of 9 Patients Who Developed Nephropathy After Contrast-Enhanced Computed Tomography (CT) Scan

Age/Sex	IV Contrast	Pre-CT Day of Baseline SCr	Baseline SCr mg/dL	Post-CT Day	Post-CT SCr, mg/dL	Time From CT to Death	Comorbidities/Course
62/Male	Iohexol 140 ml	31	1.4	31 -60	1.9 1.3	<4 mo	DM2, pancreatic cancer, large cell lymphoma, CAD, CHF, HTN, DJD. Upset stomach and weight loss with endoscopy-proven GERD unresponsive to PPI. CT A+P showed progressive liver met and new primary pancreatic lesion. Gemcitabine at 2 wks and 3 wks after CT.
71/Female	Iopamidol 100 ml	0	1.6	10	4.2	<5 mo	Metastatic renal cell cancer (lungs), right ureteral stricture with stenosis, s/p L nephrectomy, breast cancer, carcinoid syndrome. New hepatic mets and a likely right peri-ureteral met; monitoring CT done. Admitted for scheduled stent change; returned 3 days later with ureteral obstruction; stent replaced. Obstructed again; percutaneous nephrostomy 2 days later.
64/Male	Iohexol 140 ml	2	1.4	8 21	1.9 1.4	>6 y	MGUS, HTN, CKD, hernias. CT A+P after several months of abdominal pain (no findings). Concurrent lab results notable for MGUS. Bilateral renal artery stenosis 6 years later.
59/Female	Iohexol 100 ml	0	1.5	13 14 15 17	2.0 1.7 1.4 1.2	1 y	Metastatic breast cancer, HTN. CT confirmed liver mets. Admitted 1 wk later for new back pain from pathologic fracture with dehydration and hypercalcemia, which improved with treatment.
60/Male	Iopamidol 100 ml	9	1.3	3 26 55 84	1.5 2.2 1.9 1.4	>12 y	CHF, pericarditis, GERD, pulm HTN, CAD, Linguinal hernia, small cell lung cancer, COPD, OSA. Bronchogenic small-cell lung cancer; first CT done for planning. Treated with cisplatin daily for 3 days with etoposide, then radiation planning with second CT (1 mo after first CT). Cisplatin/etoposide daily for 3 days, 3 wks later, and again after 3 more wks. Trouble swallowing related to chemotherapy. CT scans each with 100 ml iopamidol (SCr values are for days after second CT).
64/Male	Iohexol 140 ml	0	1.4	1 2 3 7	1.5 1.8 2.9 3.7	1 wk	Crohn's disease, Barrett esophagus. Elective lap Nissen and hiatal hernia repair. Admitted 5 days later with perforated stomach, surgically repaired. Discharged after 10 days, but readmitted next day with repeat perforation; repaired surgically. Septic shock and progressive multisystem organ failure with candida and *Pseudomonas peritonitis* with a fistula between the stomach and the chest. CVVH started. On amphotericin, piperacillin/ tazobactam and on pressors continually. Autopsy found chemical pneumonitis.
62/Female	Iohexol 140 ml	7	1.7	19 41 45 47 54 73	2.2 3.0 3.4 2.5 2.1 1.7	5 mo	DM2, metastatic breast cancer to retroperitoneal nodes, ascites, ureteral obstruction with ureteral stents in place, DVT. Radical mastectomy, chemotherapy in the past, adjuvant tamoxifen with recurrent disease treated with more repeated chemotherapy seen with increased ascites and decreased PO intake. Furosemide increased in addition to continued spironolactone and megestrol restarted. CT A+P 1 wk later to evaluate ascites- stents seem to be working appropriately. Admitted for ascites with paracentesis on post-CT day 45; discharged day 47.
92/Male	Iohexol 140 ml 140 ml	0	1.7	1 8 14	1.9 2.8 2.1	>6 mo	Alzheimer dementia, lung mass, cecal cancer, ascites, liver mass, lymph nodes. Admitted with hip pain after fall; discharged, then re-admitted 2 days later with confusion; KUB showed dilated loops of small bowel. CT A+P 3 days later, discharged next day. 1 wk later hospitalized for 6 days for agitation and rash; decreased PO (by mouth) intake thought to be cause of elevated creatinine.

Table *(continued).* Details of 9 Patients Who Developed Nephropathy After Contrast-Enhanced Computed Tomography (CT) Scan

Age/Sex	IV Contrast	Pre-CT Day of Baseline SCr	Baseline SCr mg/dL	Post-CT Day	Post-CT SCr, mg/dL	Time From CT to Death	Comorbidities/Course
63/Male	Iohexol 140 ml	0	1.3	2	1.3	>9 mo	Anaplastic large cell lymphoma, RUE DVT, zoster; ACE use.
				3	1.9		Admitted and discharged 2 wks later with cellulitis and
				4	1.4		RUE DVT that progressed to SVC thrombosis with resultant PE.
				5	1.5		Chemotherapy for anaplastic large cell lymphoma
				6	1.7		(CHOP then ICE- ifosfamide, carboplatin, etoposide). CT
				7	1.9		chest with contrast done twice: 6 days and 8 days after
				8	2.0		admission. ACE- cytarabine, etoposide, cisplatin admission.
				22	1.7		ACE- cytarabine, etoposide, cisplatin chemotherapy 4 days after
				29	1.3		first CT. (SCr values are for days after first CT)

Abbreviations = DM2, diabetes mellitus type 2; CAD, coronary artery disease; PPI, proton-pump inhibitor; met, metastases; CHF, congestive heart failure; OSA, obstructive sleep apnea syndrome; HTN, hypertension; DJD, degenerative joint disease; GERD, gastroesophageal reflux disease; CT A+P, computed tomography of the abdomen and pelvis; MGUS, monoclonal gammopathy of undetermined significance; COPD, chronic obstructive pulmonary disease; CKD, chronic kidney disease; DVT, deep vein thrombosis; SVC, superior vena cava; PE, pulmonary embolism; CVVH, continuous veno-venous hemofiltration; ACE, angiotensin-converting enzyme; KUB, kidney, ureter, and bladder x-ray; RUE, right upper extremity; CHOP, cyclophosphamide, doxorubicin, vincristine, and prednisone therapy

patients with serum creatinine higher than this were less likely to have contrast CT scans. Only 3 of our 193 patients had serum creatinine >2.0 mg/dL, and another 2 had a serum creatinine of 2.0 mg/dL. All patients received low-osmolar contrast material, either 100 ml iopamidol or 88 to 140 ml iohexol. The dose varied depending upon the regions of the body being evaluated. Evidence suggests that the incidence of contrast-induced nephropathy may be influenced by route of administration,[5] so we excluded patients who received intra-arterial contrast media.

The primary outcome measure was a post-CT serum creatinine rise of ≥0.5 mg/dL from baseline. We chose this degree of change because it is unequivocally categorized as acute kidney injury by the Acute Kidney Injury Network, which defines acute kidney injury as an increase of 0.3 mg/dL or more.[6] We also chose it because smaller fluctuations could be attributed to laboratory error or hydration status. Additionally, contrast-induced nephropathy has been defined as an increase of 25% in baseline serum creatinine, and this represents an increase of 25% or more in our patient population, except for the 3 patients whose serum creatinine was >2.0 mg/dL.

After the patients were identified, their medical records were retrospectively reviewed to determine whether they had any risk factors for acute kidney injury aside from IV contrast media exposure.[6] Based on the other risk factors identified in each patient, we determined whether IV contrast media administration was likely to have been the main cause of the rise in serum creatinine.

RESULTS

One hundred ninety-three patients with a baseline serum creatinine concentration greater than 1.2 mg/dL underwent 236 CT studies utilizing IV low-osmolar contrast media. Nine of the 193 (4.7%) patients had a rise in serum creatinine ≥ 0.5 mg/dL up to 1 month later and all of their baseline serum creatinine levels were 1.3 to 1.7. None of these 9 patients had contrast exposure as the only risk factor for their rise in serum creatinine.

Nineteen of the 193 patients had baseline serum creatinine greater than or equal to 1.8, but none of these patients developed a greater than or equal to 0.5mg/dL rise in creatinine. Forty-two of the 193 patients had diabetes mellitus type 2, and 2 of 193 had diabetes mellitus type 1. Neither of the 2 patients with type 1 diabetes developed a rise in serum creatinine, and 2 of the 42 patients with type 2 diabetes (4.8%) developed a rise in serum creatinine greater than or equal to 0.5mg/dL.

Of the 9 patients with rise in serum creatinine, our youngest patient was aged 59 years, and our oldest patient was aged 92 years. Three of our 9 patients were women. One of 9 patients underwent 2 CT studies 2 days apart, and another had 2 CT studies about a month apart. The remaining 7 patients had only 1 CT study during the study period. Details of patient comorbidities, course of treatment, and serum creatinine values after CT scan with contrast are provided in the Table.

Eight of the 9 patients had an oncologic diagnosis. Of these, 3 received nephrotoxic chemotherapy and a fourth received non-nephrotoxic but dehydration-producing chemotherapy combined with increased furosemide. The only patient who did not have a malignant diagnosis had Crohn's disease and developed renal injury after contrast exposure when he was hospitalized for a perforated bowel. He went on to develop multisystem organ failure due to sepsis and died 1 week after his contrast study, at which time the renal injury was noted. Two of 9 patients had type 2 diabetes mellitus, and 4 of 9 had hypertension, both of which are risk factors for kidney disease. One of the 9 patients had a solitary kidney and had repeated obstruction of that kidney. Seven of our 9 patients died of nontraumatic causes within 2 years after developing nephropathy.

DISCUSSION

The results of this retrospective review show that contrast-induced nephropathy in patients with elevated baseline serum creatinine is an uncommon occurrence. All of the 9 patients who developed what would clinically be considered contrast-induced nephropathy had risk factors in addition to IV contrast media exposure for the measured increase in serum creatinine concentration. Additionally, the incidence of nephropathy after undergoing CT with contrast in our cohort was only 3.8% of 236 contrast CT studies performed (4.7% of 193 individual patients), which is lower than the published incidence in patients with higher risk.[7]

Even though contrast-induced nephropathy has been a named entity for years, the pathophysiology is not well understood. Contrast-induced nephropathy is thought to have multiple possible mechanisms, among them "alterations in renal hemodynamics, rheological properties, endocrine and paracrine factors (adenosine, endothelin, and reactive oxygen species), hyperosmolar and hyperviscous alterations of intratubular fluids," and "direct cytotoxic effects on renal tubular cells."[8] Iso-osmolar and low-osmolar contrast media are less likely than other types of contrast to be associated with contrast-induced nephropathy. Multiple studies have been conducted to determine what interventions minimize the nephrotoxicity of contrast media, but only periprocedural IV hydration has been suggested as a preventive measure. It is thought that patients with certain risk factors, including worse baseline renal function, diabetes mellitus, and advanced age, are more prone to contrast-induced nephropathy than those without risk factors. Therefore, when patients with risk factors undergo contrast media exposure, much care is taken to prevent contrast-induced nephropathy by using periprocedural hydration. It is interesting to note that our patients with diabetes developed a rise in serum creatinine greater than or equal to 0.5mg/dL at a rate similar to that of our entire study population: 4.8% and 4.7%, respectively.

There are few randomized controlled trials differentiating the incidence of contrast-induced nephropathy in cohorts receiving IV contrast media from those receiving intra-arterial injections of contrast media. This is important because not only is the route of administration different, but also the amounts of contrast used are usually higher in intra-arterial exposures for coronary angiography and the patients are often more acutely ill. Additionally, arterial manipulation exposes patients to other forms of nephropathy, such as cholesterol embolization-induced acute kidney injury. This patient population may already be predisposed to acute renal failure/insufficiency because of their underlying vascular pathology and other medical comorbidities. Furthermore, few of these studies employed control groups to compare changes in serum creatinine for similarly ill patients who did not undergo iodinated contrast media exposure.

Similarly, there is question of whether contrast-induced nephropathy due to IV contrast media injection is a true clinical entity. Stratta et al[8] reviewed over 1000 papers on contrast-induced nephropathy and found little concordance regarding results. Newhouse et al[7] examined serum creatinine changes in the absence of iodinated contrast media exposure and found a higher percentage of patients with a significant elevation of their serum creatinine than we found in our patient population.[7] The rate of increase in serum creatinine by at least 0.6 mg/dL in the study for patients with a baseline of 0.6 to 1.2 mg/dL was 7% compared with 26% in patients with baseline of 2 mg/dL or higher. Therefore, one would expect our patient population (baseline 1.2-2.5 mg/dL) to have had at least a 7% to 26% prevalence of increase in serum creatinine even without contrast media injection. In fact, our prevalence should have been even higher because our cut off of 0.5 mg/dL change in serum creatinine is less than 0.6 mg/dL. In this same study,[7] the researchers also found that serum creatinine changes of magnitudes specified in both absolute serum creatinine in mg/dL and in percentage from baseline occurred as often and were of the same magnitude as published reports of contrast-induced nephropathy. None of these patients had received contrast media in the preceding 10 days, which is the usual time frame in which contrast-induced nephropathy occurs and improves. Thomsen and Morcos[9,10] also showed that absolute changes, as opposed to relative changes, in serum creatinine led to significant difference in contrast-induced nephropathy incidence in patients with elevated baseline serum creatinine.

Finally, the reported incidence of contrast-induced nephropathy ranges widely—as low as 1%[1] and as high as 33%,[2] suggesting that either contrast-induced nephropathy is not well defined, with multiple pathologic diseases being called contrast-induced nephropathy, or that IV contrast-induced nephropathy is not a true clinical entity.[8] Contrast-induced nephropathy itself is a clinically nebulous entity, and past published rates of contrast-induced nephropathy need to be evaluated within the context of the study populations, route of contrast administration, baseline renal function, and the amount of change from this baseline in the individual studies. Therefore, it is difficult to generalize the results from these studies. In particular, the *post hoc, ergo propter hoc* (after this, therefore because of this) argument is deceiving: just because measured renal function changes after iodinated contrast media exposure does not necessarily mean the change can be attributed to the exposure. This is true particularly because there are no large randomized control trials measuring renal dysfunction due to IV contrast media use after CT studies. The lack of control groups with patients who are similarly ill in these past studies makes it difficult to attribute kidney injury after IV iodinated contrast use to the contrast media alone.

In a pooled analysis of 2 randomized control trials of patients with glomerular filtration rates (GFR) <60 ml/min undergoing IV contrast media administration with CT imaging, Thomsen and Morcos[10] found that no patients in these studies needed any intervention other than observation after contrast-induced nephropathy was diagnosed. All the patients recovered back to their baseline. Furthermore, just as the reported incidence of contrast-induced nephropathy ranges widely, so does the rate requiring treatment other than observation. Some reports suggest that dialysis is required in 0.4% to >5% of patients.[8]

An interesting point raised by Stratta et al[8] is that contrast-induced nephropathy itself might be a marker for worsening renal and systemic prognosis. Patients prone to contrast-induced nephropathy usually have multiple medical comorbidities, and these comorbidities often are associated with increased risk for acute kidney injury and chronic kidney disease in general. This might be why patients who undergo coronary angiography develop contrast-induced nephropathy more commonly than we have found—the patients are more ill to begin with prior to their intra-arterial contrast media exposures. This suggests that otherwise healthy people with minimal risk factors for renal dysfunction also should be at minimal risk for contrast-induced nephropathy. With our study results, we suggest that this holds true even for people with elevated serum creatinine (1.2-2.5 mg/dL), and that patients who do go on to develop the clinical entity of contrast-induced nephropathy are those who already have a poor prognosis.[10] In fact, 7 of our 9 patients who developed contrast-induced nephropathy died within the following 2 years of nontraumatic causes.

Our study has a number of limitations. Our sample size is small, and the study is subject to the inherent weaknesses of a retrospective study. Furthermore, although we disparage the faulty logic used to support the contention that contrast-induced nephropathy is a true entity, we use the same logic to argue that patients with multiple risk factors for renal dysfunction who develop acute kidney injury do so because of these risk factors, not the IV contrast media. We also did not control for hospitalized or nonhospitalized CT studies performed, which may be important because patients who are hospitalized not only are more ill, but they also are more likely to be volume depleted and to have a host of other complicating conditions, such as fluctuations in blood pressure and exposure to nephrotoxic medications. Therefore, if most of the patients in our study were outpatients, the prevalence of contrast-induced nephropathy found likely would be lower than expected because these patients are less ill. Nonetheless, we believe that this is also a strength of our study because we are suggesting that patients undergoing routine outpatient CT scans utilizing IV contrast media have minimal risk of contrast-induced nephropathy.

CONCLUSION

The role of IV contrast media in causing contrast-induced nephropathy and, thus, acute kidney injury, may be overestimated. Further studies with control groups are needed to determine whether contrast-induced nephropathy due to IV contrast media is first, a true entity and second, whether patients with chronic kidney disease are more at risk of developing contrast-induced nephropathy than people with normal renal function.

Currently, unwarranted concern about contrast-induced nephropathy often prevents us from obtaining contrast studies, thereby limiting our ability to accurately diagnose and treat our patients. Patients with decreased renal function at baseline are treated as being at higher risk for contrast-induced nephropathy, and periprocedural IV hydration often is used for patients prior to contrast media exposure. However, does IV contrast media for routine outpatient studies truly cause nephropathy? And does the risk of nephropathy warrant the expense, inconvenience, and possible complications of periprocedural IV hydration? We believe the importance of these questions warrants further investigation.

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REFERENCES

1. Narang R, Sakhare M, Bahl VK. Contrast-induced nephropathy. *Indian Heart J.* 2004;56(1):13-20.

2. Barrett BJ, Parfrey PS, Vavasour HM, et al. Contrast nephropathy in patients with impaired renal function: high versus low osmolar media. *Kidney Int.* 1992;41(5):1274-1279.

3. McDonald RJ, McDonald JS, Bida JP, et al. Intravenous contrast material–induced nephropathy: causal or coincident phenomenon? *Radiology.* 2013;267(1):106-118.

4. McDonald JS, McDonald RJ, Carter RE, Katzberg RW, Kallmes DF, Williamson EE. Risk of intravenous contrast material-mediated acute kidney injury: a propensity score-matched study stratified by baseline-estimated glomerular filtration rate. *Radiology.* 2014;271(1):65-73.

5. Katzberg RW, Newhouse JH. Intravenous contrast medium-induced nephrotoxicity: Is the medical risk really as great as we have come to believe? *Radiology.* 2010;256(1):21-28.

6. American College of Radiology. Contrast-induced nephrotoxicity. In: *ACR Manual on Contrast Media.* Version 8. Reston, VA: American College of Radiology; 2012:33-41. http://geiselmed.dartmouth.edu/radiology/pdf/ACR_manual.pdf. Accessed May 7, 2015.

7. Newhouse JH, Kho D, Rao QA, Starren J. Frequency of serum creatinine changes in the absence of iodinated contrast material: implications for studies of contrast nephrotoxicity. *AJR Am J Roentgenol.* 2008;191(2):376-382.

8. Stratta P, Bozzola C, Quaglia M. Pitfall in nephrology: contrast nephropathy has to be differentiated from renal damage due to atheroembolic disease. *J Nephrol.* 2012;25(3):282-289.

9. Thomsen HS, Morcos SK, Barrett BJ. Contrast-induced nephropathy: the wheel has turned 360 degrees. *Acta Radiol.* 2008;49(6):646-657.

10. Thomsen HS, Morcos SK. Risk of contrast-medium-induced nephropathy in high-risk patients undergoing MDCT—a pooled analysis of two randomized trials. *Eur Radiol.* 2009;19(4):891-897.

Self-Reported Mental Health Predicts Acute Respiratory Infection

Lizzie Maxwell, BA; Bruce Barrett, MD, PhD; Joseph Chase, BS; Roger Brown, PhD; Tola Ewers, MS, PhD

ABSTRACT

Background: Poor mental health conditions, including stress and depression, have been recognized as a risk factor for the development of acute respiratory infection. Very few studies have considered the role of general mental health in acute respiratory infection occurrence. The aim of this analysis is to determine if overall mental health, as assessed by the mental component of the Short Form 12 Health Survey, predicts incidence, duration, or severity of acute respiratory infection.

Methods: Data utilized for this analysis came from the National Institute of Health-funded Meditation or Exercise for Preventing Acute Respiratory Infection (MEPARI) and MEPARI-2 randomized controlled trials examining the effects of meditation or exercise on acute respiratory infection among adults aged >30 years in Madison, Wisconsin. A Kendall tau rank correlation compared the Short Form 12 mental component, completed by participants at baseline, with acute respiratory infection incidence, duration, and area-under-the-curve (global) severity, as assessed by the Wisconsin Upper Respiratory Symptom Survey.

Results: Participants were recruited from Madison, Wis, using advertisements in local media. Short Form 12 mental health scores significantly predicted incidence ($P=0.037$) of acute respiratory infection, but not duration ($P=0.077$) or severity ($P=0.073$). The Positive and Negative Affect Schedule (PANAS) negative emotion measure significantly predicted global severity ($P=0.036$), but not incidence ($P=0.081$) or duration ($P=0.125$). Mindful Attention Awareness Scale scores significantly predicted incidence of acute respiratory infection ($P=0.040$), but not duration ($P=0.053$) or severity ($P=0.70$). The PHQ-9, PSS-10, and PANAS positive measures did not show significant predictive associations with any of the acute respiratory infection outcomes.

Conclusion: Self-reported overall mental health, as measured by the mental component of Short Form 12, predicts acute respiratory infection incidence.

INTRODUCTION

Acute respiratory infection (ARI), including influenza, is one of the most common categories of illness in the United States and worldwide.[1] Influenza and noninfluenza ARI yield an inordinate economic burden.[2] The United States bears estimated annual costs of $40 billion for noninfluenza ARI.[2] At a time when health care is seeking to rein in excessive spending, public health efforts could profit from identifying and targeting factors that increase susceptibility to ARI.

Poor mental health has been implicated as a risk factor for developing ARI.[3] Cohen and colleagues identified an association between increased stress and respiratory infection vulnerability. This was demonstrated by an increased likelihood of developing ARI upon viral challenge for people with higher mental or social life challenges.[4] A more recent population-based retrospective cross-sectional study revealed that individuals with any diagnosed Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) mental disorder had a 44% greater risk of having developed a cold in the previous 12 months.[3] However, such research is in its infancy, and mental health's impact on ARI susceptibility is still uncertain.[3] Despite evidence implicating specific mental conditions such as stress and DSM-IV disorders in the development of ARI, no prospective cohort research has yet looked at whether general mental health influences ARI occurrence.

The Short Form 12 Health Survey (SF-12), a validated instrument measuring generic health-related quality of life, is a reliable measure of overall physical and mental health status.[5] Like the Short Form 36 Health Survey (SF-36) from which it was derived, the SF-12 can be divided into 2 summary measures: the Physical Component Summary and the Mental Component Summary (MCS-12).[5] The primary aim of this study was to determine if general mental health, as assessed by the mental component of

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Author Affiliations: Department of Family Medicine, University of Wisconsin-Madison School of Medicine and Public Health (Maxwell, Barrett, Chase, Brown, Ewers); University of Wisconsin-Madison School of Nursing (Brown).

Corresponding Author: Bruce Barrett, MD, PhD, Department of Family Medicine, University of Wisconsin-Madison School of Medicine and Public Health, 1100 Delaplaine Ct, Madison, WI 53715; phone 608.263.4550; fax 608.263.5813; e-mail bruce.barrett@fammed.wisc.edu.

the SF-12, is correlated with incidence, duration, or severity of ARI illness. We also looked at the relationships of a variety of other self-report psychosocial measures to ARI illness.

METHODS

Design

Data utilized for this paper came from 2 National Institutes of Health-funded randomized controlled trials: the Meditation or Exercise for Preventing Acute Respiratory Infection (MEPARI) study as well as the first 2 cohorts of the follow-up MEPARI-2 study. The primary aim of the MEPARI and MEPARI-2 trials was to determine if training in mindfulness meditation or exercise might be effective in decreasing ARI illness burden when compared to the control group.[6] The pilot MEPARI trial found positive results, especially for meditation.[6,7] The MEPARI-2 trial is in progress. Detailed methods can be found at www.clinicaltrials.gov (National Library of Medicine Identifier: NCT01654289). The following serves to briefly describe the methods pertinent to this analysis.

The MEPARI and MEPARI-2 trials enrolled adults >50 and 30-69 years of age, respectively. Participants were recruited from Madison, Wisconsin by means of advertising in local media. Prospective participants were screened by telephone using a scripted protocol. Following telephone screening, eligible adults were enrolled in a 2-week run-in trial to assess ability to adhere to the study protocol. Eligibility criteria included healthy adults who reported having either >2 colds in the last 12 months or >1 cold per year on average. Exclusion criteria included moderate exercise >2 times per week, vigorous exercise >1 time per week, regular practice or previous training in meditation, autoimmune, immunodeficiency, or malignant disorder, a score of >14 on the Patient Health Questionnaire (PHQ-9) Depression Screen, current or anticipated use of antibiotic or antiviral medications, pregnancy or plans of becoming pregnant, and previous allergic reaction to eggs or the seasonal influenza vaccine.[6] Upon successful completion of the run-in trial, participants were eligible for consent and enrollment in the main trial. Participants were randomized to 1 of 3 parallel groups: meditation, exercise, or observational control. Those randomized to the meditation and exercise arms underwent 8 weeks of training in their respective behavioral intervention. All participants were monitored for ARI occurrence until study exit, with regular contact with study staff and daily reporting on the Wisconsin Upper Respiratory Symptom Survey (WURSS-24) during ARI illness episodes. Participants in cohort 1 and cohort 2 of the MEPARI trial were enrolled for 9 and 5 months, respectively. MEPARI-2 cohorts were enrolled for 9 months each.

Measures

Psychosocial Measures

The following psychosocial measures were completed at baseline. The mental component of the SF-12 version 2 (MCS-12) includes 5 of the 12 SF-12 items, and is calculated using an item-weighted algorithm.[8] Three items were derived from the 5-item Mental Health Inventory assessing common diagnostic symptoms of depression and anxiety disorders, while the other items in the MCS-12 pertain to the level of functional impairment attributable to poor mental health.[5] The Positive and Negative Affect Schedule (PANAS) is a valid measure of positive and negative emotion consisting of two 10-item scales.[9] PANAS has been used more for research than clinical applications. The PHQ-9 is a self-administered measure used to assess and monitor depression severity.[10] Individuals with scores >14 (moderately severe depression) were excluded from the MEPARI and MEPARI-2 trials. The Perceived Stress Scale (PSS-10) is an instrument assessing psychological stress that has been used widely in clinical and epidemiological research.[11] The Mindful Attention Awareness Scale (MAAS) is a well-developed and validated 15-item measure of trait mindfulness.[12]

Measures of ARI Illness

Incidence

All participants were monitored for ARI from study onset until study exit, using either biweekly telephone check-in (MEPARI) or weekly electronic surveys (MEPARI-2) and at-home daily self-reports during ARI episodes. ARI incidence was determined by study personnel using the Jackson Scale. The Jackson Scale is a sum of symptom scores for the following health outcomes: sneezing, headache, malaise, chilliness, nasal discharge, nasal obstruction, sore throat, and cough.[13] Each symptom is rated as absent (0), mild (1), moderate (2), or severe (3). An ARI illness episode was defined by a score of >2 on the Jackson scale, with at least 1 of the following cold symptoms: nasal discharge, nasal obstruction, sneezing, or sore throat. Participants had to answer "yes" to "Do you think you have a cold?" or "Do you think you are coming down with a cold?"

Duration

Total duration of an ARI illness episode was assessed as time from first reported ARI symptom to the last time the person reported being ill. The end of the episode was confirmed by a person marking themselves as "not sick" for 2 days in a row. Self-report times were recorded in hours and minutes and converted to decimalized days.

Global Severity

The WURSS-24 is a validated illness-specific questionnaire assessing symptom severity and quality of life impact.[14] The WURSS-24 was used to assess daily symptom severity during each ARI illness episode. Items are rated on a 7-point Likert-style severity scale. For each participant, a daily global severity score was calculated by summing WURSS-24 items 2 to 23.[6] Total illness burden was represented by a WURSS-AUC (area-under-curve) global severity score, calculated using trapezoidal approxi-

Table 1. Demographic Information for MEPARI and MEPARI-2 Trials

	MEPARI 1	MEPARI-2[a]	MEPARI 1 and 2
N	149	204	353
Number of ARIs[a]	93	193	286
Percent female	82%	75%	78%
Race, white	94%	90%	92%
Ethnicity, non-Hispanic	99%	93%	96%
Mean age (SD)	59.3 (6.6)	50.5 (11.2)	54.2 (10.4)
Education, college grad or higher	65.8%	75.5%	71.4%
Income > $50,000	56.4%	61.0%	59.1%

[a]Data reflects the first 2 cohorts of the ongoing 4-cohort MEPARI-2 trial.
Abbreviations = MEPARI, Meditation or Exercise for Preventing Acute Respiratory Infection; ARI, acute respiratory infection

mation across all days of each illness episode (with duration on the X-axis and WURSS-24 severity on the Y-axis).[6]

Statistical Analysis

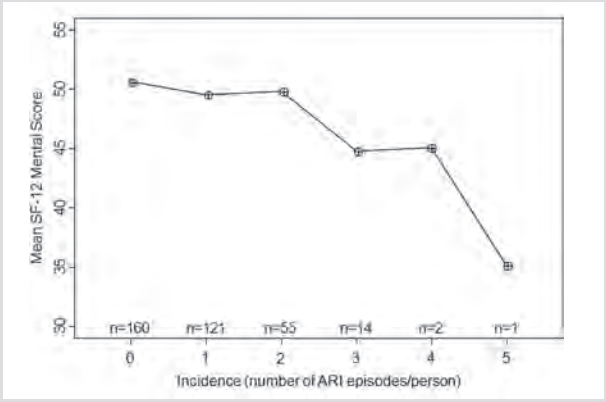
Data were analyzed using the R package Version 3.1.1 (R Foundation for Statistical Computing, Vienna, Austria). Predictive associations between baseline psychosocial measures and subsequent ARI outcomes were assessed using Kendall's tau rank correlation. Kendall tau rank correlations are unconditional assessments examining the number of concordant and discordant pairs after ordering the values based on ranking each of the quantities.[15] Kendall tau rank correlation was chosen because of the skewed distributional nature of the dependent variables, duration and global severity, and the binomial nature of incidence.

RESULTS

Eight hundred eighty-three adults were screened for the MEPARI study; 204 of those screened were entered into the run-in trial, 154 were randomized into the main trial, and 149 were followed through the monitoring period. For the MEPARI-2 studies, 503 adults were screened; of those, 250 were entered into the run-in trial, 204 were randomized into the main trial, and 191 were followed through the monitoring period. MEPARI participants underwent assigned 8-week interventions (meditation or exercise) beginning in September 2009 for cohort 1 and January 2010 for cohort 2. MEPARI-2 interventions began in September 2012 for cohort 1 and September 2013 for cohort 2. Both MEPARI and MEPARI-2 participants were monitored through May of the years in which they participated. A more detailed description of results from the MEPARI trial can be found elsewhere.[6] Furthermore, as the MEPARI-2 trial is ongoing, the described results pertain only to the first 2 cohorts of this 4-cohort study. Demographic information is presented in Table 1.

Baseline SF-12 scores in the MEPARI and MEPARI-2 trials ranged from 18.6 to 66.8 with a mean (SD) of 49.8 (8.89). Possible SF-12 mental scores can be as low as 0 and as high as 100, with greater scores representing better mental health-related quality of life. SF-12 mental scores are calculated by an item-weighted algorithm, normed to a mean of 50.0 and a standard deviation of 10.0.[16] In 2001, mean scores (by age group) in the United States were 48.9 (25-34), 48.8 (35-44), 49.9 (45-54), 50.8 (55-64), 51.6 (65-74) and 48.9 (75+).[16]

Figure. SF-12 Mental Score in Relation to Coincidence.



ARI outcomes from the MEPARI and MEPARI-2 studies were as follows. There were 282 ARI illness episodes, with a minimum incidence of 0 and a maximum incidence of 5. The mean (SD) incidence per person was 0.81 (0.91) illnesses. Duration ranged from 0 to 85+ days of ARI illness, with a mean (SD) duration of 7.8 (11.3) days. WURSS-AUC global severity scores ranged from 0 to 8724 with a mean (SD) of 298 (656).

The Figure depicts the relationship between SF-12 mental scores at baseline and the number of subsequent ARI episodes. While the sample size for those with 3 or more illness episodes is limited (n = 17), the trends are consistent and rather striking.

Table 2 depicts Kendall tau rank correlation coefficients for each psychosocial measure with regards to ARI outcomes (incidence, duration, and severity). SF-12 mental scores significantly predicted incidence ($P = 0.037$) but not duration ($P = 0.077$) or severity ($P = 0.073$) of ARI. Though not statistically significant, the relationships between duration and severity with SF-12 mental scores trended in the predicted (negative) direction. The PANAS negative measure significantly correlated with global severity ($P = 0.036$) but not incidence ($P = 0.081$) or duration ($P = 0.125$) of ARI. MAAS scores were significantly associated with incidence ($P = 0.040$) but not duration ($P = 0.053$) or severity ($P = 0.070$) of ARI. The PANAS positive, PSS-10 and PHQ-9 measures did not show significant predictive relationships with any of the ARI outcomes.

DISCUSSION

This paper provides additional support to the previously reported relationship between poor mental health status and ARI outcomes. Of the 6 psychosocial measures analyzed, baseline scores for the SF-12 mental, PANAS negative, and MAAS significantly predicted ARI outcomes in the expected directions. Aside from

the PHQ-9 and the PANAS positive emotion measure, which showed no discernible trends, the correlation coefficients for the 6 psychosocial measures with all 3 ARI outcome measures were in predicted directions. That is, psychosocial measures reflecting better mental health pointed towards fewer, shorter and less severe ARIs, while psychosocial measures reflecting poor mental health were correlated with or trended towards predicting more frequent, longer and more severe ARIs (Table 2).

The relationship between the SF-12 mental health score and ARI incidence depicted in the Figure is especially provocative. Understanding of these associations could be further strengthened with a larger population that included more individuals with 3 or more colds.

Table 2. Predictive Correlations of Mental Health Scores with Acute Respiratory Infection (ARI) Outcomes Using Kendall Tau Rank Correlations

Instrument	Mean (SD)	Incidence: # of ARI illnesses tau (SE)	Duration: # of ARI illness days tau (SE)	Severity: total WURSS global severity score tau (SE)
SF-12 Mental	49.87 (8.83)	**-0.09 (0.04)[a]** **P=0.037**	**-0.07 (0.04)** **P=0.077**	**-0.07 (0.04)** **P=0.073**
PANAS +	35.60 (6.67)	0.00 (0.04) P=0.942	**-0.01 (0.04)** **P=0.802**	0.00 (0.04) 0.989
PANAS -	16.87 (5.84)	**0.07 (0.04)** **P=0.081**	**0.06 (0.04)** **P=0.125**	**0.08 (0.04)[a]** **P=0.037**
PHQ-9	2.82 (2.55)	-0.05 (0.04) P=0.276	-0.01 (0.04) P=0.716	**0.01 (0.04)** **P=0.803**
PSS-10	12.22 (5.63)	**0.01 (0.04)** **P=0.723**	**0.01 (0.04)** **P=0.778)**	**0.03 (0.04** **P=0.392**
MAAS	4.38 (0.78)	**-0.09 (0.04)[a]** **P=0.036**	**-0.08 (0.04)** **P=0.053**	**-0.07 (0.04)** **P=0.070**

Kendall tau rank scores are analogous to correlation coefficients.
[a]Significant association, *P*-value < 0.05
BOLD = expected direction of relationship (positive or negative)
Abbreviations = SF-12, Short Form 12 Health Survey; PANAS, Positive and Negative Affect Schedule; PHQ-9, Patient Health Questionnaire; PSS-10, Perceived Stress Scale; MAAS, Mindful Attention Awareness Scale

Several potential explanations exist regarding the relationship between poor mental health and increased ARI occurrence and severity. To begin, a common risk factor such as negative emotion may increase an individual's susceptibility to both ARI and poor mental health. Previous studies have demonstrated that in individuals vulnerable to depression, increased negative emotion activates dysfunctional thinking and attitudes,[17] which in turn could negatively influence the experience and functional impact of ARI symptoms. Likewise, negative emotion has been shown to interfere with the release of secretory immunoglobulin-A (s-IgA), a primary antibody in the defense against the common cold.[17] Therefore, negative emotion may be a causative or mediating agent in the development of both poor mental health and ARI illness.

It is also quite possible that poor mental health may influence ARI outcomes through health-related behaviors. It is documented that rates of smoking[18] and excessive alcohol consumption[19] are greater among individuals with mental illness. Prior research has shown that such behaviors increase an individual's susceptibility to respiratory infection by subduing the host immune response.[20] Thus, poor mental health may heighten ARI vulnerability by means of health-related behaviors, such as smoking, excessive alcohol consumption, or other mediators that impact immunity or susceptibility to infection.

A third consideration is that individuals with poor mental health may merely report more symptoms. In a previous study, for example, it was noted that individuals with a greater negative emotional style reported more unfounded cold symptoms.[21] The intensive ARI-monitoring and laboratory verification measures in the MEPARI studies (multiplex polymerase chain reaction viral identification, not shown here) argues against this as a sole explanation for the associations observed, but self-report tendencies and potential biases should not be discounted.

Finally, a complex interplay of the above factors, or as yet unknown causal or mediating pathways, might better explain the observed relations between poor mental health and ARI occurrence.

Our data and analyses have both strengths and limitations. Although past research has investigated the impact of specific mental disorders on ARI outcomes, this paper expands current research by examining nonspecific, overall mental health, using validated measures with a prospective cohort study design. Noteworthy was the use of stringent criteria to define and monitor ARI illness episodes. One of the best previous studies was retrospective and relied on 12-month recall of ARI incidence.[3] Also distinct in our work was the daily assessment of ARI severity; research by Cohen and colleagues assessed cold symptoms for up to 9 consecutive days regardless of cold duration,[22] whereas subjects enrolled in the MEPARI and MEPARI-2 trials assessed symptom severity daily from illness onset until 2 days of no reported symptoms, regardless of the actual duration of illness.

An important limitation is the fact that the MEPARI-2 trial is yet ongoing; consequently, this manuscript lacks data pertaining to the final 2 cohorts of the study, an estimated 200 participants. We expect that incorporation of these final 2 cohorts will strengthen our conclusions, as the increased sample size will provide greater statistical power. Furthermore, due to the current nature of the study with group status blinded to investigators, we were unable to analyze the 3 groups (meditation, exercise, and control) separately and, therefore, our data does not take into account potential confounding effects of meditation and exercise.

Having analyzed only baseline mental health indicators, controlling for interventions should not have altered the self-reported mental health scores included in this manuscript, yet the ARI outcomes reported in this paper may have been alleviated by meditation or exercise. As these interventions were assigned randomly and not in relation to mental health, and as any ARI-prevention efforts would reduce the number of illness episodes that mental health indicators could be related to, we do not believe this would invalidate our results.

In addition, the population in this analysis may not be representative of the general adult population. A larger proportion of our study cohort was white (92%), non-Hispanic (96%) and college educated (71.4%) (Table 1) than the general adult population in the United States.[23,24] Thus, it is unclear how these conclusions would translate to other populations.

Finally, despite the significant *P*-values, the Kendall tau rank correlation coefficients were small; the extent to which ARI variability is explained by self-reported mental health scores appears to be limited.

CONCLUSION

In conclusion, using high quality prospective cohort data, we found evidence to support the hypothesis that mental health may influence the occurrence and impact of acute respiratory infection. This is consistent with previous findings, and may have important implications for clinical practice, population health, and public policy. Future studies will be needed to confirm and extend these findings, and to discover ways to reduce impacts of both mental health and respiratory infection.

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REFERENCES

1. Monto AS. Epidemiology of viral respiratory infections. *Am J Med.* 2002;112(Suppl 6A):4S-12S.

2. Fendrick AM, Monto AS, Nightengale B, Sarnes M. The economic burden of non-influenza-related viral respiratory tract infection in the United States. *Arch Intern Med*. 2003;163(4):487-494.

3. Adam Y, Meinlschmidt G, Lieb R. Associations between mental disorders and the common cold in adults: A population-based cross-sectional study. *J Psychosom Res.* 2013;74(1):69-73.

4. Cohen S, Tyrrell DA, Smith AP. Psychological stress and susceptibility to the common cold. *N Engl J Med.* 1991;325(9):606-612.

5. Vilagut G, Forero C, Pinto-Meza P, et al. The mental component of the short form 12 health survey (SF-12) as a measure of depressive disorders in the general population: results with three alternative scoring methods. *Value Health.* 2013;16(4):564-573.

6. Barrett B, Hayney MS, Muller D, et al. Meditation or exercise for preventing acute respiratory infection: a randomized controlled trial. *Ann Fam Med.* 2012;10(4): 337-346.

7. Obasi CN, Brown R, Ewers T, et al. Advantage of meditation over exercise in reducing cold and flu illness is related to improved function and quality of life. Influenza *Other Respir Viruses.* 2013;7(6)938-944.

8. Ware JE, Kosinski M, Turner-Bowker DM, Gandek B. *User's Manual for the SF-12v2 Health Survey.* Boston: QualityMetric; 2008.

9. Watson D, Clark L. Development and validation of brief measure of positive and negative affect: the PANAS scales. *J Pers Soc Psychol.* 1988;54(6):1063-1070.

10. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606-613.

11. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24(4):385-396.

12. Brown KW, Ryan RM. The benefits of being present: mindfulness and its role in psychological well-being. *J Pers Soc Psychol.* 2003;84(4):822-848.

13. Jackson G, Dowling H, Muldoon R. Acute respiratory diseases of viral etiology. VII. Present concepts of the common cold. *Am J Public Health Nations Health.* 1962;52:940-945.

14. Barrett B, Brown RL, Mundt MP, et al. Validation of a short form Wisconsin Upper Respiratory Symptom Survey (WURSS-21). *Health Qual Life Outcomes.* 2009;7:76.

15. Kendall, M. A new measure of rank correlation. *Biometrika.* 1938;30(1–2):81–89. doi:10.1093/biomet/30.1-2.81. JSTOR 2332226.

16. Utah Department of Health. 2001 Utah Health Status Survey. Interpreting the SF-12. http://health.utah.gov/opha/publications/2001hss/sf12/SF12_Interpreting.pdf. Accessed May 8, 2015.

17. Miranda J, Gross J, Persons J, et al. Mood matters: negative mood induction activates dysfunctional attitudes in women vulnerable to depression. *Cognit Ther Res.* 1998:22(4):363-376.

18. Lasser K, Boyd W, Woolhandler S, et al. Smoking and mental illness: a population-based study. *JAMA.* 2000;284(20):2606-2610.

19. Kuo P, Gardner C, Kendler K, et al. The temporal relationship of the onsets of alcohol dependence and major depression: using a genetically informative study design. *Psychol Med.* 2006;36:1153-1162.

20. Cohen S, Tyrrell D, Russell M, et al. Smoking, alcohol consumption, and susceptibility to the common cold. *Am J Public Health.* 1993;83(9):1277-1283.

21. Cohen S, Doyle W, Turner R, et al. Emotional style and susceptibility to the common cold. *Psychosom Med.* 2003;65(4):652-657.

22. Cohen S, Miller G. Stress, immunity, and susceptibility to upper respiratory infection. Ader R, Felten D, Cohen N (Eds). *Psychoneuroimmunology.* 3rd Ed. New York: Academic Press; 2001. 2:499-509.

23. Stoops N. US Census Bureau Current Population Reports. Educational Attainment in the United States: 2003. June 2004. http://files.eric.ed.gov/fulltext/ED486333.pdf. Accessed May 8, 2015.

24. US Census Bureau. Statistical Abstract of the United States: 2006. Resident Population by Sex, Race, and Hispanic Origin Status: 2000-2004. http://www.census.gov/prod/2005pubs/06statab/pop.pdf. Accessed May 8, 2015.

Creating a Culture of Mindfulness in Medicine

Charlene Luchterhand, MSSW; David Rakel, MD; Cynthia Haq, MD; Lisa Grant, DO, MSW; Angela Byars-Winston, PhD; Steve Tyska, MD; Kathleen Engles, PA-C, MPH

ABSTRACT

Background: Well-documented challenges faced by primary care clinicians have brought growing awareness to the issues of physician wellness and burnout and the potential subsequent impact on patients. Research has identified mindfulness as a tool to increase clinician well-being and enhance clinician characteristics associated with a more patient-centered orientation to clinical care.

Objective: The overall goal of our intervention was to promote the cultivation of mindful awareness throughout our health system, creating a culture of mindfulness in medicine.

Methods: We developed a systems-level strategy to promote health and resilience for clinicians and patients by preparing a group of clinician leaders to serve as catalysts to practice and teach mindfulness. The strategy involved 3 steps: (1) select 5 primary care leaders to help foster mindfulness within both health care delivery and education; (2) provide funds for these leaders to attend advanced mindfulness training designed specifically for clinicians; and (3) foster mindfulness within our health system and beyond via collaborative planning meetings and seed money for implementation of projects.

Results: All 5 leaders endorsed the personal value of the mindfulness training, with some describing it as life-changing. Within 8 months, 4 of the leaders fostered a wide variety of mindfulness activities benefitting colleagues, medical students, and patients across our state and beyond.

Conclusion: We found that the value received from our investment in mindfulness far exceeded our relatively low cost, although further evaluation is needed to prove this.

INTRODUCTION

Providing primary care has become increasingly complex. The need to frequently address multiple medical issues at each patient visit, an insufficient number of primary care clinicians, increased workloads with a high number of hours worked per week, rising costs, inadequate reimbursement for aspects of care management, increased administrative requirements, and suboptimal self-care can contribute to professional burnout.[1-4] Evidence suggests that clinician burnout can negatively affect patient care.[5] The idea to create a culture of mindfulness in medicine within our academic health system germinated when Integrative Medicine Department faculty, in response to these well-documented challenges facing primary care clinicians, sought to promote mindful awareness, a practice that they found to be rewarding both personally and professionally.

Mindfulness has been defined as "moment-to-moment, nonjudgmental awareness. It is cultivated attention in a particular way, namely, on purpose in the present moment."[6] Mindfulness involves removing oneself from autopilot to live in the moment. To provide excellent patient-centered care, clinicians and staff must be fully present, flexible, and recognize their own patterns and beliefs, but this is not always easy. One can further develop this capacity through practice—cultivating mindfulness.

A growing body of research supports the benefits of mindfulness in medicine. Krasner et al demonstrated that an educational program in mindful communication that focused on self-awareness improved clinician well-being (burnout and mood) and increased behaviors and cognitions consistent with a patient-centered approach to care.[7] Beckman et al interviewed a random sample of the primary care clinicians who had completed this earlier study's mindful communication program. One of 3 main themes to emerge from these in-depth interviews was that mindfulness skills improved clinicians' ability to listen more attentively and respond more effectively to their patients.[8] Fortney et al conducted a pilot study that provided abbreviated, tailored mindful-

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Author Affiliations: Department of Family Medicine, University of Wisconsin School of Medicine and Public Health, Madison, Wis (Luchterhand, Rakel, Haq, Tyska); Department of Medicine, Division of General Internal Medicine, University of Wisconsin School of Medicine and Public Health, Madison, Wis (Grant, Byars-Winston); University of Arizona Integrative Health Center, Phoenix, Ariz (Engles).

Corresponding Author: Charlene Luchterhand, MSSW, Department of Family Medicine, University of Wisconsin School of Medicine and Public Health, 1100 Delaplaine Ct, Madison, WI 53715-1896; phone 608.262.0740; fax 608.263.5813; e-mail char.luchterhand@fammed.wisc.edu.

ness training (18 hours) to 30 primary care clinicians.[9] Study participants improved at all 3 subsequent data points compared to baseline, with data at 9 months post-intervention showing statistically significant reductions in measures of job burnout, depression, anxiety, and stress. In an observational study of 45 clinicians and 437 patients, Beach et al found that clinicians who rated themselves higher on a mindfulness scale were more likely to have a more patient-centered pattern of communication. Furthermore, their patients were more likely to rate highly both the clinician's communication, as well as the overall quality of medical care they received during the past 6 months.[10]

The purpose of this paper is to describe a program to promote mindful awareness for clinicians, trainees, staff, and patients.

METHODS

Population

The initial population for our program was primary care clinician leaders within our academic health system, which involves clinical and teaching sites across our state.

Goal of the Intervention

The overall goal of our intervention was to promote the cultivation of mindful awareness throughout our health system. Our strategy involved 3 steps.

Step 1: Select 5 primary care leaders to help foster mindfulness within both health care delivery and education.

Potential leaders were recruited from primary care departments in our health system via electronic and posted announcements and word of mouth; they submitted brief written applications. Project directors selected 5 leaders based on their availability to attend a 4-day continuing medical education (CME) workshop on mindful communication and responses to 3 questions, which asked them to describe (1) their training and experience in mindfulness or other contemplative practices; (2) why they desired further training in mindfulness; and (3) how they would incorporate the concepts gained from the workshop into their areas of leadership.

Step 2: Provide funds for these leaders to attend advanced mindfulness training designed specifically for clinicians.

A grant provided funds for the leaders to attend a 4-day CME workshop entitled *Mindful Communication: Bringing Intention, Attention, and Reflection to Clinical Practice,* which was offered by The Mindful Practice in Medicine Institute at the University of Rochester School of Medicine and Dentistry in May 2012. The training was directed by faculty physicians, whose research with primary care clinicians has demonstrated that training in mindful communication can increase clinician well-being and enhance clinician characteristics that are associated with a more patient-centered orientation to clinical care.[7,8] Participants included about 50 clinicians from a variety of specialties and more than 6 countries.

Course objectives prepared participants to (1) incorporate mindful practice curricula into undergraduate, graduate, and continuing education programs; (2) lead experiential exercises that involve meditation, mindfulness, self-awareness exercises, narrative writing, group discussion, and didactic material; and (3) enhance their own capacity for self-awareness and self-monitoring, including attentive observation, curiosity, informed flexibility, and presence. Topics included "noticing" (ie, learning to be more observant and attentive with patients), managing uncertainty, responding to suffering, dealing with conflict, and approaching death and dying.

Step 3: Foster mindfulness within our health system and beyond via collaborative planning meetings and seed money for implementation of projects.

Leaders met with the project directors following the course to identify ways to foster mindfulness within their respective areas of work. Grant funding provided $500 for each leader to initiate the mindfulness activities of his or her choice appropriate to that leader's unique settings.

Data Collected

We collected the following data: the number of primary care leaders who completed brief written applications for the leader positions and the disciplines, departments, roles, and physical locations of the chosen leaders; the 5 leaders' written and verbal feedback about the *Mindful Communication* CME program and the number of these leaders who continued to promote mindfulness within their respective program areas following the training; and the leaders' written and verbal reports of the ways in which they used their seed money to promote mindfulness and the numbers and qualitative descriptions of mindfulness activities they undertook along with the number and type of attendees for each of these programs.

RESULTS

Effects on Clinician Leaders

Twelve clinicians applied for our 5 available positions. The selected leaders are clinicians (physicians, a physician assistant, and a counseling psychologist) from 2 departments (Family Medicine and Medicine/Division of General Internal Medicine) with diverse roles within our organization: teaching and research faculty, program director, and clinic director. Their work settings are scattered across the state and include medical student education, family medicine resident education, and urgent care.

All 5 leaders provided feedback on the benefits of the mindfulness communication CME course they attended. The leaders strongly endorsed the value of the training with comments such as "This may be the most rewarding CME course I have ever attended. I plan to use the skills I learned in my life and work for years to come," and "Attending this retreat was an incredible gift

Table. Mindfulness Activities

Activity	Audience/Attendees
Medical Students	
Incorporation of mindfulness content into the TRIUMPH curriculum through readings, poetry, and humanism rounds to share clinical narratives, exercises in meditation, compassion and self-care.	24 third- and fourth-year medical students/year.
Humanism rounds to share clinical narratives and emotional responses to challenging patient cases.	175 third-year medical students/year on OB/GYN rotations.
Clinicians and Clinic/Hospital Staff	
Didactic lectures on mindfulness and/or experiential exercises.	28 family medicine residents in 2 cities.
Four-week class (90 minutes once/week) in mindfulness techniques.	11 urgent care clinic practitioners and staff.
Three-hour conference on mindfulness and physician self-care.	20 medical staff in an urban location distant from our academic health center.
Brief mindful training exercise at an integrative medicine retreat.	30 family medicine faculty and staff.
Article on mindfulness for a clinic staff newsletter.	40 clinic staff.
Presentation discussed mindful communication, with an emphasis on the potential personal and professional life-enhancing benefits of cultivating a mindfulness practice in daily life.	150 physician assistants attending a statewide conference.
Two 6-week classes "Mindful Movement for Stress Management" (30 minutes once/week).	30 clinic and hospital staff.
Patients	
Grant funding secured to offer "Mindful Movement for Stress Management" classes.	30 patients.

Abbreviations = TRIUMPH, Training in Urban Medicine and Public Health; OB/GYN, obstetrics and gynecology

personally and professionally." Three of the 5 responded affirmatively to a question posed 7 to 8 months following the course, asking them if they believed their personal and/or professional lives were different because of the training. The benefits they described included a better focus on breathing and being emotionally present; the cultivation of an affectionate, nonjudgmental relationship with their thoughts; continued mindful reflective work; and daily meditation practice. Two did not respond to the follow-up question.

As with any therapeutic approach, the practice of mindfulness does not provide the same meaning and utility for everyone. One leader, while noting that "the conference was refreshing and helped me to recharge my batteries—much needed," reflected that mindfulness is a great practice but is not the "be-all and end-all" for people who find meaning and support through faith-based approaches, such as prayer. This leader chose not to personally lead future mindfulness activities but promoted mindfulness indirectly.

Effects on Systems

Seed Funds

Leaders used their seed money in a variety of ways. One used the funds to further the mindfulness outreach activities (begun independently of this project) of a physician colleague, thus creating a sixth project leader. Another leader hired an experienced mindfulness instructor who helped provide training for staff in a clinical environment. Several leaders purchased either training materials and/or equipment such as yoga mats and meditation cushions for their respective clinics. These continue to be used for mindfulness meditation instruction and practice for medical students, residents, staff, and patients.

Mindfulness Activities

During the 8 months of the project following the CME, our leaders initiated a wide variety of mindfulness activities across our academic health system and the state. This involved 10 different activities with a total of 538 participants. A summary of these activities and the audience/attendees is provided in the Table.

Qualitative data helped show the benefits of the mindfulness activities for our health care system. Following is a description of representative activities with our 3 target populations: (1) medical students, (2) clinicians and clinic/hospital staff, and (3) patients.

Medical Students

Mindfulness practice is now part of the core curriculum for students in the Training in Urban Medicine and Public Health (TRIUMPH) program, a health track that prepares students to care for urban, medically underserved populations. Students apply and are selected for the program during their second year. They then move to an urban setting, where they complete most of their third and fourth years of medical school.[11] The TRIUMPH curriculum includes several full days of exercises devoted to exploring mindful practice, compassion, enhancing self-awareness, and building resilience. Students are introduced to a variety of techniques to enhance these skills including yoga, meditation, walking, noticing, and breathing exercises. They review and develop personal health plans to enhance their own well-being. They learn and practice appreciative inquiry through discussion of challenging patient scenarios in "humanism rounds" on a monthly basis. Students have reported that mindful practices helped them retain their compassion, avoid burnout, and prevent them from becoming jaded as they care for patients from

disadvantaged backgrounds. They have requested more time to cultivate mindful practice and have worked with faculty to incorporate exercises into the weekly curriculum. One of our faculty leaders was selected by medical students to receive a national award for humanism in medicine through the Gold Foundation and the American Association of Medical Colleges.

Clinician and Clinic/Hospital Staff

A 4-week program in mindfulness techniques, including meditation and movement, was offered to clinicians and staff of an urgent care clinic with the assistance of the UW-Health Mindfulness Based Stress Reduction (MBSR) program. The class met for 90-minute sessions weekly for 4 weeks. Eleven participants were given instruction in MBSR and meditated together. Elements of Tai Chi (mindfulness in motion) were demonstrated and practiced by the participants. Discussions were held regarding the application of mindfulness principles in the workplace; ie, how efforts to remain present with patients help clinicians and patients to make a deeper and more meaningful connection, and how to communicate more effectively. A core group of coworkers was established who could actively work to promote mindfulness in the workplace by offering support to coworkers in informal discussions, focusing on the importance of nurturing the clinician-patient connection through mindfulness. The 11 individuals who participated, as well as 8 additional staff who were interested but unable to attend, expressed a willingness to meet in the future for practice and to consider ways to build a culture of mindfulness.

The sixth colleague who joined the project offered a "Mindful Movement for Stress Management" class to 15 clinic and hospital staff. Employee wellness staff assisted in marketing the class in order to reach a broad group of potential participants. Class registration filled to capacity within 24 hours. Participants included both clinicians and staff from nonclinical units. The class was held for 30 minutes once a week for 6 consecutive weeks over the lunch hour.

The class introduced the concept of mindfulness and helped participants cultivate an awareness practice to help manage stress. Participants were taught breathing techniques and physical postures as tools to help anchor their attention to the present moment. They learned that when they more fully inhabit the present moment, a greater sense of ease and well-being are often experienced. Participants identified common stress patterns that are held in the physical body and learned how breath and body movements can facilitate release of those patterns. They were asked to practice a specific technique, such as the 4-7-8 Relaxing Breath exercise,[12] daily at home. Although the techniques take only about 5 minutes once or twice a day, they can provide a sense of continuity throughout the week. The class taught participants what they could do for their own health—helping people to live better with whatever conditions or situations they have. The leader offered a second 6-week session for 15 participants in a different location. An employee wellness staff member attended a session with the intention of learning how to teach a similar class. More sessions are planned for the future.

Our sixth leader also helped spread mindfulness content to a medical center outside our own system. Interactions between our leader and a physician from that center inspired the physician to attend a week-long mindfulness retreat and then form a weekly meditation group for medical colleagues.

Patients

Inspired by the experiences of offering classes for staff, the sixth leader subsequently sought and received grant funding to develop and lead a mindfulness class as a tool to manage stress for internal medicine patients who have been identified as high utilizers of health care visits. A phone message this leader received from one of the patients attests to the helpfulness of this approach for that patient: "I really, really like the mindfulness class. I have the start of Alzheimer's disease and my short-term memory is really poor. This is really stressful for me. I have never, ever liked meditation in my life. I enjoy this class 110%. Mindfulness is such a nice way to meditate. I am so happy I have found a style I enjoy." The clinician is investigating how to transition this type of mindfulness class into group visits.

DISCUSSION

The number of primary care clinicians (12) who applied to be one of our 5 leaders gave us an early indication of the interest in this project. We were encouraged that more leaders were interested in the mindfulness communication training than our project was able to support. Our efforts were strengthened by leaders' reports about the personal and professional value of the mindfulness communication CME and by their preparation to serve as catalysts to launch additional projects. We also experienced and respect that mindfulness does not have the same meaning and utility for all. An avenue for further research may be to identify characteristics of those who report great benefit from mindfulness practice as well as those who find other practices more sustaining.

The Institute for Healthcare Improvement (IHI) has embraced a *triple aim* to improve health care in the United States: (1) improving the individual experience of care, (2) improving the health of populations, and (3) reducing the per capita costs of care for populations.[13] Others have focused attention on a fourth interrelated goal—improving the well-being of clinicians.[14-16] Mindfulness can impact all of these critical dimensions of health care.

In a study of mindfulness meditation and moderate exercise intervention to prevent acute respiratory infection (ARI), researchers noted a reduction in incidence, severity, and duration of ARI with meditation and exercise.[17] They further documented

the added value of mindfulness—health-related cost savings, mainly from a reduction in missed days of work.[18] Likewise, we note the many returns on our investment in a CME course on mindful communication for 5 of our clinical leaders. Our total project budget was under $15K. For $5225 ($1045/per person) plus travel expenses of $2915 (a total of $8140), our leaders received content that some reported as life-changing. For an additional $3144 (initially budgeted as $500/leader for a total of $2500), they added value by initiating and sustaining a variety of mindfulness activities benefitting colleagues, medical students, and patients across our state and beyond.

Within the 1-year span of this project, we provided a means of mindfulness communication training for 5 clinical leaders and initiated a range of mindfulness activities in our state and beyond (one of our leaders has transitioned to a new role out-of-state). Based on existing mindfulness research,[7-10,17,18] we believe that sustaining and building upon these initiatives will help to create health and resilience for clinicians and patients alike. However, more methodologically rigorous projects employing sound recruitment procedures, adequate sample size for statistical analysis, pre and post measures, and ultimately randomized controlled trials would be needed to prove the benefits of our initial system-wide approach to establish a culture of mindfulness in medicine, as well as each of our mindfulness initiatives. In the meantime, colleagues in other health systems may appreciate learning more about mindful clinical practice, for example, as described by Epstein who wrote, "As a link between relationship-centered care and evidence-based medicine, mindfulness should be considered a characteristic of good clinical practice."[19] We hope our model of a system-wide approach to promote mindfulness within healthcare is helpful to others as well.

CONCLUSION

Our project to promote mindfulness within our academic health system using primary care clinician leaders as catalysts resulted in a number of positive outcomes. We feel that our investment in the promotion of mindfulness yielded benefits that far exceeded our relatively low cost, although further evaluation is needed to prove this.

"Mindful practice has enriched my life, my teaching, and my interactions with others," noted one of our leaders. In this time of great challenge for primary care, this is no small accomplishment. We offer this narrative of our experience as an approach that other health systems may want to consider in the quest to improve health care for patients and clinicians alike.

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REFERENCES

1. Baron RJ. What's keeping us so busy in primary care? A snapshot from one practice. *N Engl J Med.* 2010;362:1632-1636.

2. Bodenheimer T, Pham HH. Primary care: current problems and proposed solutions. *Health Aff* (Millwood). 2010;29:799-805.

3. Wallace JE, Lemaire JB, Ghali WA. Physician wellness: a missing quality indicator. *Lancet.* 2009;374:1714-1721.

4. Shanafelt TD, Boone S, Tan L, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med.* 2012;20:1-9.

5. Shanafelt T, Dyrbye L. Oncologist burnout: causes, consequences, and responses. *J Clin Oncol.* 2012;30(11):1235-1241.

6. Gazella KA. Jon Kabat-Zinn, PhD, bringing mindfulness to medicine. *Altern Ther Health Med.* 2005;11(3):56-64.

7. Krasner MS, Epstein RM, Beckman H, et al. Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *JAMA.* 2009;302(12):1284-1293.

8. Beckman HB, Wendland M, Mooney C, et al. The impact of a program in mindful communication on primary care physicians. *Acad Med.* 2012;87(6):815-819.

9. Fortney L, Luchterhand C, Zakletskaia L, et al. Abbreviated mindfulness intervention for job satisfaction, quality of life, and compassion in primary care clinicians: a pilot study. *Ann Fam Med.* 2013;11(5):412-420.

10. Beach MC, Roter D, Korthuis PT et al. A multicenter study of physician mindfulness and health care quality. *Ann Fam Med.* 2013;11(5):421-428.

11. Haq C, Stearns M, Brill J, et al. Training in Urban Medicine and Public Health: TRIUMPH. Acad Med. 2013;88(3):352-363. doi: 10.1097/ACM.0b013e3182811a75.

12. Weil A. Breathing: Three Exercises. http://www.drweil.com/drw/u/ART00521/three-breathing-exercises.html. Accessed May 12, 2015.

13. Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. *Health Aff.* 2008;27(3):759-769.

14. Wallace JE, Lemaire JB, Ghali WA. Physician wellness: a missing quality indicator. *Lancet.* 2009;374:1714-1721.

15. Epstein RM, Krasner MS. Physician resilience: what it means, why it matters, and how to promote it. *Acad Med.* 2013;88:301-303.

16. Spinelli WM. The phantom limb of the triple aim. *Mayo Clin Proc.* 2013;88(12):1356-1357.

17. Barrett B, Hayney MS, Muller D, et al. Meditation or exercise for preventing acute respiratory infection: a randomized controlled trial. *Ann Fam Med.* 2012;10:337-346.

18. Rakel D, Mundt M, Ewers T, et al. Value associated with mindfulness meditation and moderate exercise intervention in acute respiratory infection: The MEPARI Study. Fam Pract. 2013. [Epub ahead of print] doi:10.1093/fampra/cmt008.

19. Epstein, RM. Mindful practice. *JAMA.* 1999;282(9):833-839.

Twelve Tips for Improving the General Surgery Resident Night Float Experience

Rebecca M. Rentea, MD; Jared A. Forrester, MD; Nathan W. Kugler, MD; Anahita Dua, MD, MS, MBA; Travis P. Webb, MD, MHPE

ABSTRACT

Restriction of resident duty hours has resulted in the implementation of night float systems in surgical and medical programs. Many papers have examined the benefits and structure of night float, but few have addressed patient safety issues, quality patient care, and the impact on the residency education system. The objective of this review is to provide practical tips to optimize the night float experience for resident training while continuing to emphasize patient care. The tips provided are based on the experiences and reflections of residents, supervising staff, group discussions, and the available literature in a hospital-based general surgery residency program. Utilizing these resources, we concluded that the night float system addresses resident work hour restrictions; however, it ultimately creates new issues. Adaptations will help achieve a balance between resident education and patient safety.

INTRODUCTION

Many dramatic changes have occurred in graduate medical education over the past 2 decades. Following the Libby Zion case in the 1980s, there has been increased public pressure to restrict duty hours in order to combat perceived house staff fatigue resulting in decreased performance and patient care errors.[1-5] In both Europe and the United States, action was taken to ensure changes in residency education and culture. The policy implementations focused on objective measurements for residency training and duty hour restrictions with a goal to decrease fatigue and, ultimately, medical errors.[6]

Prior to formal hour restrictions, the Accreditation Council for Graduate Medical Education (ACGME) implemented 6 core competencies in 2001. These competencies include patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.[7] Residency programs were expected to focus educational initiatives and assessment strategies on the achievement of the competencies. In 2003, duty hours were officially mandated with an 80-hour work week limitation followed by further updates and stricter limitations on resident presence in the hospital.[4] Likewise, in Europe the European Working Time Directive (EWTD) was fully implemented by 2009 and requires junior staff to work no more than 48 hours per week.[8]

In order to address patient care needs and workforce shortages, many residency programs initiated night float shift coverage. Much of the literature on night float coverage has involved analysis of patient handoffs, resident case volumes, and fatigue.[9,10] Since the introduction of a night float rotation at our institution, several issues have emerged that previously have not been addressed cohesively in the literature.

The tips provided by this article are a compilation of the experiences of residents involved in our night float system, supervising faculty, and group discussions. The scope of recommendations were deemed critical to effective resident education and patient safety, which may be used to inform further refinements to night float rotations. Our 12 tips are organized into those focused on improving communication (practical tips for improvement of transitions of patient care), patient care (areas for enhancing overnight patient management and safety initiatives), and maintaining a resident educational experience (tips for maintaining and increasing an educational environment).

IMPROVING COMMUNICATION

Tip 1: Improve Documentation

The daily progress notes in the electronic medical record (EMR) are increasingly important for the night float team as they cover a large number of unfamiliar patients on multiple surgical services. The EMR has replaced the short handwritten progress notes in many hospital systems. However, EMR notes often contain volumes of imported template information used primarily for billing

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Author Affiliations: Medical College of Wisconsin, Department of Surgery, Milwaukee Wis (Rentea, Kugler, Dua, Webb); Stanford University, Department of Surgery, Palo Alto, Calif (Forrester).

Corresponding Author: Rebecca M. Rentea, MD, Medical College of Wisconsin, 9200 W Wisconsin Ave, Milwaukee, WI 53226; phone 414.805.3000; fax 414.805.5921; e-mail rrentea@mcw.edu.

Table. Tips for Improving the General Surgery Resident Night Float Experience

Tips	Recommendation
Improving Communication	
Improve documentation	Document clearly in templated notes, highlighting plan and findings. Move assessment and plans to the top of a templated note, to increase efficiency of chart review at night.
Standardize handoffs	A standard sign-off form (service dependent). Sign-out rehearsal between junior/senior resident on each team prior to night float sign-outs. A supervised junior resident sign-out or structured group sign-out.
Emphasize sign-in	Designate resident to communicate with night float team each morning. Emphasize importance of short, timely, and accurate EMR documentation by night float residents.
Well-defined end-of-life plans and care plans	Document in sign-out sheet goals of care within 2 days of hospital stay.
Proper management of after-hour patient calls	Develop a "must speak to directly" sheet for attending surgeons and have readily available.
Patient Care	
Night float physician extenders	Considering the cost constraints and implementation of support structure for physician extenders, implement use of nurse practitioners for help at night.
Backup	Document numbers to call for backup directly on sign-out sheet. Foster an environment where calling backup is expected.
Resident role in night float	Encourage early recognition by junior resident of limits and call upon senior resident. Implement early education of interns on proper performance of informed consent.
Night Float Educational Experience	
Faculty support of education	Provide ongoing instruction to faculty to emphasize the difference in clinical and educational responsibilities on night float.
Recognize the impact on operative volume	Implement acute care surgery services with dedicated attending surgeon to allow for increased operative time. Encourage junior residents to second assist overnight to increase educational operative experience.
Focus on the need for resident education	Implement educationally focused morning report involving face-to-face faculty interactions.
Medical students taking call on night float	Encourage educational opportunities through introduction to the new team and establishing direct patient care through seeing consults and attending cases.

Abbreviation = EMR, electronic medical record

purposes, offering little important information regarding patients' daily care. Many notes contain copy-pasted sections with poorly updated problem lists, copied exams with errors, and loss of narrative function.[11] To maximize effective communication for health care providers we advocate using short, focused, untemplated notes in the chart to allow individuals involved in patient care to be alerted of overnight events and ongoing care plans. A basic brief SOAP note (subjective, objective, assessment, and plan) as a classic note works well to capture patient information that occurred. Some of our services also have adopted the practice of moving the critical information such as the assessment and plans to the top of templated notes in order to improve the efficiency of chart review (Table).

Tip 2: Standardize Handoffs

One of the downsides of the night float system is the inherent increase in the number of handoffs. There is growing literature regarding the inherent problems associated with the transfer of care between health care providers.[12] Many non-health care, high-risk industries such as the airline industry, space programs, and the nuclear power industry have described the regulation and standardization of their sign-out systems.[13,14] Unlike these industries and despite many expert recommendations, the medical field lacks a standardized sign-out process.[15,16] Even though standardized handoff forms have been demonstrated to improve residents' perceptions of accuracy and completeness of handoffs, the forms are frequently lengthy in order to capture completeness and do not efficiently glean the critical patient information needed for quick decision making in the middle of the night.[15] Training and level of resident experience with handoffs remains a key factor, with residents able to predict adverse patient events less than half the time following handoffs.[17]

We have adopted a supervised junior resident sign-out or structured group sign-out in an attempt to improve our handoff communication. Additionally, we often reference the paper by Kemp et al who summarized 10 tips for a successful surgical team sign-out.[16] These 10 tips facilitate communication of critical information for each patient/team in written and verbal sign-out and include the following: allot adequate time for sign-out, make it an active process, emphasize sick patients, note the senior on call, provide standardized list per team, place important patient details on the list, outstanding tasks should be emphasized as should laboratory tests/studies, pending admissions need to be communicated, and a morning update should take place. One of the factors leading to successful handoff of patient care is that significantly shorter sign-outs are prone to less error. Finally, at our institution, each team runs their own evening sign-out between

the senior and junior resident to solidify important patient care plans, and then individual residents sign out to the night float team.

Tip 3: Emphasize a Quality Sign-in

While transition of care at sign-out has garnered much attention, the accurate and thorough sign-in of information to the primary team is equally important. The primary team must be made aware of critical overnight events. Timely and accurate EMR documentation of overnight events is crucial, regardless of how brief. The sign-in dilemma has been addressed at some institutions by implementing a detailed morning report, yet this approach is logistically difficult for many programs given the number of services covered and the time constraints during the early morning hours of most surgical environments.[18] At a minimum, a formal plan should assure that each primary team identify a resident designee to communicate with the night float team each morning if a formal morning report is not possible.

Tip 4: Importance of Well-Defined End-of-Life Plans and Care Plans

The primary team assumes the responsibility for making decisions regarding formal plans and management. Unfortunately, many family members visit their loved ones when the primary team is unavailable. The night float team frequently is called to speak with family members to address complex global issues and expectations. We found these discussions frequently lead to family and night float team confusion and frustration.

In addition, changes in patient status may prompt a request for a do-not-resuscitate (DNR) order from either the family or in-house team. While end-of-life and DNR discussions do not legally require an in-depth knowledge of the patient's prognosis and goals of care, ideally these important issues should be known to the health care provider. One way to prevent ill-timed discussions between night float residents, patients, and their families is to proactively address and, most importantly, document in the sign-out sheet goals of care early in the hospital stay. Proactive discussions are not merely a good way to avoid unfortunate discussions, they also are the ideal forum for optimizing patient care by maximizing alignment between the patient's goals and available medical options.

Tip 5: Proper Management of After-Hours Patient Calls

When clinics close, outpatient phone calls are directed to the senior surgery resident on call. Inpatient calls are directed to the junior resident, who then calls either a senior resident or attending physician. Poor communication results in delays of care.[19] One recurrent difficulty in handling telephone encounters relates to the decision to notify staff. A significant problem often encountered is a lack of understanding of call parameter expectations from each faculty. When resident obligations for communication with faculty are unclear, the resident must make a decision regarding what constitutes "routine" patient care versus what issues require attending input.[20] Silverman et al developed a top 10 "must speak to directly" list, which includes a new admission, cardiorespiratory events, death, hemodynamic instability, invasive procedure, need for intubation, new GI bleed, new major wound complication, pulmonary embolism, and a transfer to the intensive care unit.[19] In a study of 80 critical events, a third were not communicated with faculty; and importantly, of the events that led to faculty communication management was altered in a third.[21] One solution is to have a printout for each attending that can be attached to the sign-out sheet consisting of their "must speak to directly" events. In addition, the senior resident on each respective service must understand their attending's patient population and expectations at the beginning of the rotation to address and clarify issues before they arise for the night float team.

PATIENT CARE

Tip 6: Provide Dedicated Night Float Physician Extenders

In-house patient care often becomes occupied with multiple consults and acute patient care issues. A primary concern identified with large censuses is the triage and timely management of highly complex patients and consultations. Offloading noneducational activities such as scheduling patients for follow-up appointments has been thought to lead to improved patient care and resident satisfaction. Surveys have demonstrated that residents spend approximately 20% of their time on noneducational service related activities.[22] Hiring physician extenders is an attractive solution that has been adopted by over 80% of programs in response to the 80-hour work restriction.[23]

The addition of physician extenders has many perceived positives from a resident perspective, but also presents inherent challenges and tradeoffs. First, advanced practice providers generally do not take in-house calls after hours, which would be beneficial from a night float team perspective. A second consideration is the overall financial impact of physician extenders—specifically, the high cost to departments, especially compared to the government-subsidized resident roles in an era of cost containment. Salaries of physician extenders can be double that of the government-subsidized residents.[24] Interestingly though, one institution found that implementation of a physician extender on 2 busy services increased efficiency and quality of discharge planning, leading to fewer emergency department visits and, in turn, an overall decrease in cost.[24] Third, physician extenders require continual professional development and support, which requires organization in addition to resident support and training. This ultimately results in in a time, cost, and resource requirement for the continued development and support of the physician extender group. This support may have synergistic or detrimental effects on resident training and education. While physician

extenders have proven beneficial to surgical residents by distributing the workload and improving continuity of care, it is the responsibility of the surgical program to establish well-defined roles for the physician extenders and use them to their maximum potential.[25,26]

Tip 7: Call on Backup

The night float system relies upon only 1 or 2 residents to provide care for numerous patients from multiple services. It is of paramount importance that the resident can determine the level of assistance required for safe patient care. The hierarchy of residency training is a critical barrier to address. Furthermore, resident self-awareness is frequently flawed and inadequate. Gow et al demonstrated that low-performing residents repeatedly over estimate their capabilities whereas senior residents and top achieving surgical residents are more self-critical.[27] Regardless, all groups appear to lack accurate insight into their abilities.[27] Therefore, designated providers, documented as such on sign-out sheets, need to be readily available and willing to provide backup. Reassurance that calling backup is expected rather than discouraged is likewise critical.

Tip 8: Understanding the Resident Role in Night Float

Though goals may be similar, learning objectives and responsibilities of senior and junior residents are different for any given rotation. The senior resident acts in a supervisory role to the junior resident as well as a liaison to fellows and attending staff. Highlighting the importance of communication and teamwork, surgical nurses and surgical residents often have a limited understanding of the full scope of one another's roles and responsibilities.[28] In addition, the junior resident needs to develop so as to know and understand his or her limits and effectively communicate those limits with nursing staff. In a study of critical events with pre- and postoperative patients, one-third were not reported promptly to attending physicians, who often can change the plan initially implemented by a resident.[21]

Another identified area of concern is the documentation of informed consent. Often interns are tasked with obtaining the written informed consent. However, interns frequently are unable to answer questions or provide patients with the correct description of the risks, benefits, and alternatives. Adult education is an active, not merely passive process for the learner. However, surgical faculty must not only provide appropriate oversight but educate junior and senior residents to perform consents for procedures on a night float rotation.[29] One solution is that the attending surgeon can teach and model responsible appropriate garnering of informed consent. Residents should be responsible for seeking out opportunities to participate in patient or family discussion of complex decision making, informed consent, and request guidance and feedback when doing so themselves.

NIGHT FLOAT EDUCATIONAL EXPERIENCE

Tip 9: Continue Faculty Support of Education Efforts During the Night Float Resident Experience

The increase in faculty workload since the 2003 ACGME resident duty hour regulations has been correlated with a decreased time allocated to resident teaching. Despite consensus that resident supervision and education are essential components of duty hour reform, faculty retention and burnout is a significant concern. Wong et al describe how the tension between reduced resident duty hours and faculty burnout may ultimately undermine the current ACGME duty hour regulations.[30] Opportunities for improving teaching behaviors among faculty and staff need to be highlighted. A recent study demonstrated that when faculty simply know their perioperative teaching is being evaluated, their teaching performance improves.[31] Identifying the accountable faculty for staffing of the night float service during handoffs is vitally important to improve education and oversight of clinical duties.[15] Therefore, an area for improvement in many night float systems is engaging faculty so they understand their clinical and educational responsibilities to the residents on night float. Our institution has identified a faculty member to be in charge of the night float rotation. This faculty also meets with the residents to develop reading plans and potential projects, as well as act as a liaison to other faculty when issues arise on the rotation.

Tip 10: Recognize the Impact on Operative Volume

The night float system impacts the educational opportunities for the resident overnight, but also those not on the night float rotation. For both the senior and junior residents, night float represents an opportunity for increased autonomy, responsibility, and decision making. One drawback of night float rotations is decreased operative volume, which is consistent in both Europe and the United States.[10,32,33] Senior residents lose an average of 50 cases during each year they participate on a night float rotation.[10]

At our institution, the acute care surgery service provides an opportunity to address some of this decreased operative time. The senior night float residents have the opportunity to increase nighttime cases (ie, acute cholecystitis and appendicitis) due to a dedicated acute care surgeon on duty. Secondly, when not attending to consults and patient care issues on the floor, the junior resident seeks out opportunities to second assist on these emergency nighttime cases. Overall, the hope remains that residents who participate in a schedule with a night float will ultimately be able to experience high volume operative periods during the day on their service, thus overall improving surgical education throughout the program.[10]

Tip 11: Focus on the Need for Resident Education

One of the greatest criticisms of the night float system is that residents are not able to interact and learn directly from faculty members.[34] The educational experience may appear diminished

on the night float service due to less faculty interaction and the inability to attend conferences or teaching rounds. One survey of residents after implementation of the night float system found that when compared to intern daytime residents, night float residents experience significantly less conference attendance, operative experience, and faculty teaching interactions.[35] While some studies have demonstrated an improved amount of on-call sleep with the new 80-hour work week, this does not translate to better continuity of care or perception of resident education.[34]

Despite the challenges associated with alterations in the circadian rhythms of night float residents, some institutions have addressed the educational issue through "after hours" independent learning sessions and educationally focused morning report involving face-to-face faculty interactions.[18,36] While the 80-hour work week was thought to translate into improved time for resident self-education with reading during non-hospital time as well as improved educational efforts, this has not been reflected nationally. In addition to establishing off-hours teaching conferences, resident education may benefit from greater oversight and accountability to reading programs and self-directed learning. Finally, our institution has created a basic week-long curriculum for junior residents that meet several times a year to address patient cases, reading, and operative techniques.[37]

Tip 12: Medical Students Taking Call on Night Float Should Have Defined Goals

The night float service has potential to strongly affect student education. The impact may be positive for those who desire greater interaction with residents, more autonomy, and an increase in clinical activities.[38] Whereas resident education depends heavily on faculty interaction, student education has been found to rely greatly on the student-resident interaction.[39,40] When students take night call with the night float team, they are working with new residents and new expectations. Therefore, it is important to introduce the student to the new team and explain expectations, which may include seeing consults, documenting plans for patients, and attending operative cases. Additionally, the exchange of contact information between residents and students allows for students to be contacted for educational opportunities.

CONCLUSION

Duty hour regulations in Europe and the United States have resulted in limiting work hours in exchange of the opportunity for educational experiences in an effort to offer better patient care. The ACGME duty hour restriction has reduced the general surgery residency by 6 months of in-hospital experience, preferentially removing night and weekend experience. Additional duty reforms have mandated that residents have direct supervision. These are the same times are when residents are more likely to see urgent and emergency conditions with greater autonomy.[41] The night float system has been implemented at many institutions as a solution to provide continuous coverage and ultimately allow residents to experience night and weekend call.

While meeting duty hour requirements, the night float system has led to many issues affecting the resident experience. We have provided 12 examples of areas for improvement to the surgical night float system, each with potential solutions in an effort to remain focused on both resident education and quality patient care (Table). Communication and documentation through proper sign-out and sign-in are critical components to insure success and excellent patient care.[9,10,42] The process for managing consults, managing patient's calls, and making end-of-life decisions are 3 areas that have the potential to negatively impact in-house patient care and safety. We propose a standard sign-out sheet that includes the goals of care for each patient, on-call staff and backup, and a reference for the attending's preferences for patient issues always requiring a phone call. In addition, to facilitate efficiency for nighttime chart review, we propose documenting pertinent thresholds for overnight labs, interventions, and images in daily notes and moving assessment and plans to the top of template notes. We encourage use of short, untemplated notes as well as proper documentation in the EMR by night float residents, regardless of how brief. Decreased operative volume and education through lectures or interactions with staff are important issues that night float has yet to address. Potential solutions include employing physician extenders to assist with either emergency department consults or floor issues, improving the process for managing patient calls at night, encouraging increased use of acute care surgery services with a dedicated staff, and implementation of educationally focused morning reports.

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REFERENCES

1. The Libby Zion case. *Ann Intern Med.* 1991;115(12):985-986.

2. Leung L, Becker CE. Sleep deprivation and house staff performance. Update 1984-1991. *J Occup Med.* 1992;34(12):1153-1160.

3. Papp KK, Stoller EP, Sage P, et al. The effects of sleep loss and fatigue on resident-physicians: a multi-institutional, mixed-method study. *Acad Med.* 2004;79(5):394-406.

4. Philibert I, Friedmann P, Williams WT, Education Work Group on Resident Duty Hours. ACGME. New requirements for resident duty hours. *JAMA.* 2002;288(9):1112-1114.

5. Pilcher JJ, Huffcutt AI. Effects of sleep deprivation on performance: a meta-analysis. *Sleep.* 1996;19(4):318-326.

6. Leach DC. A model for GME: shifting from process to outcomes. A progress report from the Accreditation Council for Graduate Medical Education. *Med Educ.* 2004;38(1):12-14.

7. Leach DC. Changing education to improve patient care. *Qual Health Care.* 2001;10 Suppl 2:ii54-58.

8. Pickersgill T. The European working time directive for doctors in training. *BMJ.* 2001;323(7324):1266.

9. Goldstein MJ, Kim E, Widmann WD, Hardy MA. A 360 degrees evaluation of a night-float system for general surgery: a response to mandated work-hours reduction. *Curr Surg.* 2004;61(5):445-451.

10. Kelly RJ, Jr., Senkowski CK. Effect of the night float system on operative case volume for senior surgical residents. *J Surg Educ.* 2009;66(6):314-318.

11. Siegler EL, Adelman R. Copy and paste: a remediable hazard of electronic health records. *Am J Med.* 2009;122(6):495-496.

12. Riesenberg LA, Leitzsch J, Massucci JL, et al. Residents' and attending physicians' handoffs: a systematic review of the literature. *Acad Med.* 2009;84(12):1775-1787.

13. Vidyarthi AR, Arora V, Schnipper JL, Wall SD, Wachter RM. Managing discontinuity in academic medical centers: strategies for a safe and effective resident sign-out. *J Hosp Med.* 2006;1(4):257-266.

14. Stevens DP. Handovers and Debussy. *Qual Saf Health Care.* 2008;17(1):2-3.

15. Wayne JD, Tyagi R, Reinhardt G, et al. Simple standardized patient handoff system that increases accuracy and completeness. *J Surg Educ.* 2008;65(6):476-485.

16. Kemp CD, Bath JM, Berger J, et al. The top 10 list for a safe and effective sign-out. *Arch Surg.* 2008;143(10):1008-1010.

17. Scoglietti VC, Collier KT, Long EL, Bush GP, Chapman JR, Nakayama DK. After-hours complications: evaluation of the predictive accuracy of resident sign-out. *American Surg.* 2010;76(7):682-686.

18. Stiles BM, Reece TB, Hedrick TL, et al. General surgery morning report: a competency-based conference that enhances patient care and resident education. *Curr Surg.* 2006;63(6):385-390.

19. Silverman AT, Goldfarb MA, Baker T. When should a surgical resident call an attending surgeon? *J Surg Educ.* 2008;65(3):206-212.

20. Phitayakorn R, Williams RG, Yudkowsky R, et al. Patient-care-related telephone communication between general surgery residents and attending surgeons. *J Amer Coll Surg.* 2008;206(4):742-750.

21. ElBardissi AW, Regenbogen SE, Greenberg CC, et al. Communication practices on 4 Harvard surgical services: a surgical safety collaborative. *Ann Surg.* 2009;250(6):861-865.

22. Brasel KJ, Pierre AL, Weigelt JA. Resident work hours: what they are really doing. *Arch Surg.* 2004;139(5):490-493; discussion 493-494.

23. Pezzi C, Leibrandt T, Suryadevara S, Heller JK, Hurley-Martonik D, Kukora JS. The present and future use of physician extenders in general surgery training programs: one response to the 80-hour work week. *J Am Coll Surg.* 2009;208(4):587-591.

24. Robles L, Slogoff M, Ladwig-Scott E, et al. The addition of a nurse practitioner to an inpatient surgical team results in improved use of resources. *Surgery.* 2011;150(4):711-717.

25. Buch KE, Genovese MY, Conigliaro JL, et al. Non-physician practitioners' overall enhancement to a surgical resident's experience. *J Surg Educ.* 2008;65(1):50-53.

26. Resnick AS, Todd BA, Mullen JL, Morris JB. How do surgical residents and non-physician practitioners play together in the sandbox? *Curr Surg.* 2006;63(2):155-164.

27. Gow KW. Self-evaluation: how well do surgery residents judge performance on a rotation? *Am J Surg.* 2013;205(5):557-562; discussion 562.

28. Schlitzkus LL, Agle SC, McNally MM, Schenarts KD, Schenarts PJ. What do surgical nurses know about surgical residents? *J Surg Educ.* 2009;66(6):383-391.

29. Angelos P, DaRosa DA, Bentram D, Sherman H. Residents seeking informed consent: are they adequately knowledgeable? *Curr Surg.* 2002;59(1):115-118.

30. Wong BM, Imrie K. Why resident duty hours regulations must address attending physicians' workload. *Acad Med.* 2013;88(9):1209-1211.

31. Anderson CI, Gupta RN, Larson JR, et al. Impact of objectively assessing surgeons' teaching on effective perioperative instructional behaviors. *JAMA Surg.* 2013;148(10):915-922.

32. Antiel RM, Van Arendonk KJ, Reed DA, et al. Surgical training, duty-hour restrictions, and implications for meeting the Accreditation Council for Graduate Medical Education core competencies: views of surgical interns compared with program directors. *Arch Surg.* 2012;147(6):536-541.

33. Breen KJ, Hogan AM, Mealy K. The detrimental impact of the implementation of the European working time directive (EWTD) on surgical senior house officer (SHO) operative experience. *Ir J Med Sci. 2*013;182(3):383-387.

34. Desai SV, Feldman L, Brown L, et al. Effect of the 2011 vs 2003 duty hour regulation-compliant models on sleep duration, trainee education, and continuity of patient care among internal medicine house staff: a randomized trial. *JAMA Intern Med.* 2013;173(8):649-655.

35. Lefrak S, Miller S, Schirmer B, Sanfey H. The night float system: ensuring educational benefit. *Am J Surg.* 2005;189(6):639-642.

36. Fields RC, Bowman MC, Freeman BD, Klingensmith ME. Implementation of an "after hours" resident educational program in a general surgery residency: a paradigm for increasing formal didactic training outside of the hospital setting in the era of the 80-hour workweek. *J Surg Educ.* 2009;66(6):340-343.

37. Webb TP, Weigelt JA, Redlich PN, Anderson RC, Brasel KJ, Simpson D. Protected block curriculum enhances learning during general surgery residency training. *Arch Surg.* 2009;144(2):160-166.

38. Farkas DT, Shah AK, Cosgrove JM. Medical student perception of night call in a night float system. *Am J Surg.* 2013;205(2):147-150.

39. Healy NA, Cantillon P, Malone C, Kerin MJ. Role models and mentors in surgery. *Am J Surg.* 2012;204(2):256-261.

40. Nguyen SQ, Divino CM. Surgical residents as medical student mentors. *Am J Surg.* 2007;193(1):90-93.

41. Lewis FR, Klingensmith ME. Issues in general surgery residency training—2012. *Ann Surg.* 2012;256(4):553-559.

42. Zahrai A, Chahal J, Stojimirovic D, Schemitsch EH, Yee A, Kraemer W. Quality of life and educational benefit among orthopedic surgery residents: a prospective, multicentre comparison of the night float and the standard call systems. *Can J Surg.* 2011;54(1):25-32.

A Case of Celiac Disease, Epilepsy, and Cerebral Calcifications With Temporal Lobe Epilepsy

Aaron F. Struck, MD; Brad R. Beinlich, MD; Paul A. Rutecki, MD

ABSTRACT

This is a case report of a 55-year-old man with medication refractory right temporal lobe epilepsy since adolescence. He was found to have bilateral posterior cerebral calcifications on routine head computed tomography with confirmation on magnetic resonance imaging. He also had elevated antibody markers for celiac disease. He was diagnosed with the rare, but well-described syndrome of celiac disease, epilepsy, and cerebral calcifications (CEC). He failed a brief trial of gluten-free diet and went on to have a right temporal lobectomy with sustained freedom from disabling seizures. This case is an example of the growing recognition of neurologic disorders associated with celiac disease. It also provides an example of the characteristic radiographic sign associated with CEC.

CASE REPORT

A 55-year-old man with a 40-year history of medication-refractory localization-related epilepsy was admitted for epilepsy surgery workup. Review of his imaging found bilateral occipital/parietal/temporal cerebral calcifications on noncontrast head computed tomography (CT) (Figure). Magnetic resonance imaging (MRI) confirmed the presence of calcifications and found right hippocampal atrophy. Video electroencephalogram (EEG) monitoring captured several of his habitual seizures. They were localized to the right mesial temporal lobe by seizure semiology and scalp EEG. The patient denied symptoms of celiac disease, but reported a brother with a history of gluten intolerance. He was found to have a markedly elevated Tissue Transglutaminase IgA blood level at 134 (normal range 0-19). The patient did not improve with a brief attempt at a gluten-free diet. He declined further workup and treatment for celiac disease. Serum folate levels were checked on 3 occasions with all results within laboratory reference standards. The patient underwent right anterior temporal lobectomy with pathology confirming hippocampal sclerosis with severe cell loss and gliosis in CA1/CA3/CA4. He continues to have daily auras, and remains on an antiseizure medication, but has been free of disabling seizures for greater than 2 years.

DISCUSSION

Celiac disease is an autoimmune condition with growing prevalence and an expanding list of associated diseases including several neurologic disorders such as neuropathy, cerebellar degeneration, and epilepsy.[1,2] Celiac disease, epilepsy, and cerebral calcifications (CEC) is a rare, but well described syndrome of celiac disease, epilepsy, and cerebral calcifications.[3] Originally there were reports of several cases of patients with bilateral occipital calcifications. The appearance of the calcifications was similar to "tram-track" radiographic sign of Sturge-Weber syndrome, with the important exemption of bilaterality. In investigating these patients an association of epilepsy and celiac disease was uncovered. These findings were codified by the Italian Working Group on Coeliac Disease and Epilepsy as the syndrome of CEC in 1992.[4] The syndrome was originally thought to have a geographic and ethnic predilection to the Mediterranean region, particularly Italy, but subsequent case reports from Europe, South America, and Australia have been published.[5,6,7] This patient is of North European (Germanic) ancestry with the country of origin being the United States, but he lacked more specific ancestral knowledge.

The underlying cause for the association of CEC has not been fully determined. There was speculation that the calcifications were secondary to folate dysmetabolism because similar imaging findings have been described in patients treated with methotrexate.[8] Others believe that folate is an unlikely mediator,[9] with more recent investigation suggesting that the mineralization is secondary to direct autoimmune affects from a specific antibody to neuronal trans-

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Author Affiliations: University of Wisconsin Department of Neurology, Madison, Wis (Struck, Beinlich, Rutecki); William S. Middleton Memorial Veterans Hospital, Madison, Wis (Rutecki).

Corresponding Author: Aaron F. Struck, MD, 7162 UW MFCB, 1685 Highland Ave, Madison, WI 53705; phone 608.261.1470; e-mail astruck@mgh.harvard.edu.

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glutaminase isoenzyme (TG6).[5,10] The role of the calcifications in the etiology of the seizures is not entirely straightforward, either. It appears in some cases there may be an association of the epileptogenic region and the calcifications, as surgical removal of the calcifications has rendered a patient seizure free.[11] But other cases do not support the epileptiogenicity of the calcifications. Calcifications have been reported to occur after the onset of epilepsy, and in some cases surgical removal of them did not affect the seizure frequency.[10] The use of temporal lobectomy in patients with CEC and temporal lobe epilepsy been undertaken at another center with satisfactory results similar to this case.[12]

This case highlights an important topic for neurologists, gastroenterologists, radiologists, and primary care physicians. Celiac disease has protean manifestations including progressive neurologic diseases like neuropathy, cerebellar atrophy, and epilepsy. These conditions may be the sole symptom of the disease with absence of gastrointestinal complaints. It can be argued that this case did not have pathologic confirmation of celiac disease as the patient declined intestinal biopsy, but, according to the leading researchers on this topic, CEC is felt to be a spectrum of disease. It does not require active intestinal celiac disease to make the diagnosis. At the time of presentation many patients have silent or latent celiac disease.[4] CEC could be looked at as an autoimmune disease that affects different organ systems to varying extents. The compelling radiographic findings and elevated antibody titers and a history of epilepsy are sufficient to qualify our patient for at least an incomplete form of CEC.

There are still a number of unexplained elements of the CEC association. While there is anecdotal evidence that a gluten-free diet is helpful, it remains to be proven.[7] In this case the patient did not respond to the diet. However, he did endorse substantial diet noncompliance. It is also unclear why there is an association between epilepsy and celiac disease if the calcifications themselves are not the mediators.[13]

CONCLUSION

Initially CEC was felt to only be in the Mediterranean population, but after recognition of the disease within the larger European community, cases started to be reported from several regions. Likewise, it is not unexpected that there would be patients with CEC in the United States. The lack of other reports is more likely related to under-recognition than absence of the disease. This case can serve to increase the awareness of neurologic disease associated with celiac disease, as well as provide an example of the near pathognomonic imaging finding of CEC.

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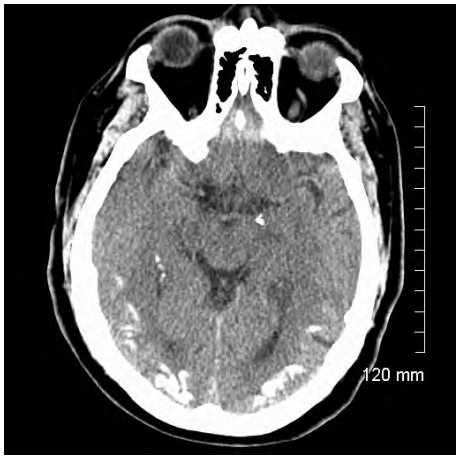
Figure. Head Computed Tomography of 55-year-old Man With Right Temporal Lobe Epilepsy Demonstrates Bilateral Occipital/Temporal Cerebral Calcifications



REFERENCES

1. Fasano A, Catassi C. Clinical practice. Celiac disease. *N Engl J Med.* 2012;367(25):2419-2426.

2. Jackson JR, Eaton WW, Cascella NG, Fasano A, Kelly DL. Neurologic and psychiatric manifestations of celiac disease and gluten sensitivity. *The Psychiatr Q.* 2012;83(1):91-102.

3. Gobbi G. Coeliac disease, epilepsy and cerebral calcifications. *Brain Dev.* 2005;27(3):189-200.

4. Gobbi G, Ambrosetto P, Zaniboni MG, Lambertini A, Ambrosioni G, Tassinari CA. Celiac disease, posterior cerebral calcifications and epilepsy. *Brain Dev.* 1992;14(1):23-29.

5. Johnson AM, Dale RC, Wienholt L, Hadjivassiliou M, Aeschlimann D, Lawson JA. Coeliac disease, epilepsy, and cerebral calcifications: association with TG6 autoantibodies. *Dev Med Child Neurol.* 2013;55(1):90-93.

6. Sunnikutty AP, Harding J, Nelson JC. CEC syndrome—a rare manifestation of coeliac disease. Ulster Med J. 2008;77(3):205-206.

7. Canales P, Mery VP, Larrondo FJ, Bravo FL, Godoy J. Epilepsy and celiac disease: favorable outcome with a gluten-free diet in a patient refractory to antiepileptic drugs. *Neurologist.* 2006;12(6):318-321.

8. Calvani M Jr, Parisi P, Guaitolini C, Parisi G, Paolone G. Latent coeliac disease in a child with epilepsy, cerebral calcifications, drug-induced systemic lupus erythematosus and intestinal folic acid malabsorption associated with impairment of folic acid transport across the blood-brain barrier. *Eur J Pediatr.* 2001;160(5):288-292.

9. Toti P, Balestri P, Cano M, et al. Celiac disease with cerebral calcium and silica deposits: x-ray spectroscopic findings, an autopsy study. *Neurology.* 1996;46(4):1088-1092.

10. Licchetta L, Bisulli F, Di Vito L, et al. Epilepsy in coeliac disease: not just a matter of calcifications. *Neurol Sci.* 2011;32(6):1069-1074.

11. Nakken KO, Roste GK, Hauglie-Hanssen E. Coeliac disease, unilateral occipital calcifications, and drug-resistant epilepsy: successful lesionectomy. *Acta Neurol Scand.* 2005;111(3):202-204.

12. Kinay D, Dubeau F, Andermann F, Olivier A. Palliative temporal resection for the treatment of intractable bioccipital epilepsy. *Epileptic Disord.* 2004;6(2):97-105.

13. Peltola M, Kaukinen K, Dastidar P, et al. Hippocampal sclerosis in refractory temporal lobe epilepsy is associated with gluten sensitivity. *J Neurol Neurosurg* Psychiatry. 2009;80(6):626-630.

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Quiz: A Case of Celiac Disease, Epilepsy, and Cerebral Calcifications With Temporal Lobe Epilepsy

EDUCATIONAL OBJECTIVES

Upon completion of this activity, participants will be able to:

1. Describe the syndrome of celiac disease, epilepsy, and cerebral calcifications (CEC).
2. Describe the known relationship between the cerebral calcifications and epilepsy in CEC.
3. Recognize the diverse neurological manifestations that may be a part of celiac disease even in the absence of gastrointestinal symptoms.

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QUESTIONS

1. The syndrome of celiac disease, epilepsy, and cerebral calcifications (CEC) may be secondary to:
   - ❑ A. folate deficiency
   - ❑ B. hypocalcemia and associated secondary hyperparathyroidism
   - ❑ C. direct autoimmune effects from an antibody to neuronal transglutaminase isoenzyme
   - ❑ D. A and C
   - ❑ E. A, B, and C

2. The role of cerebral calcifications in the etiology of the seizures in CEC not certain.
   - ❑ True
   - ❑ False

3. Various neurological diseases including neuropathy, cerebellar degeneration, and epilepsy may be manifestations of celiac disease.
   - ❑ True
   - ❑ False

4. Active intestinal disease is an essential component of CEC.
   - ❑ True
   - ❑ False

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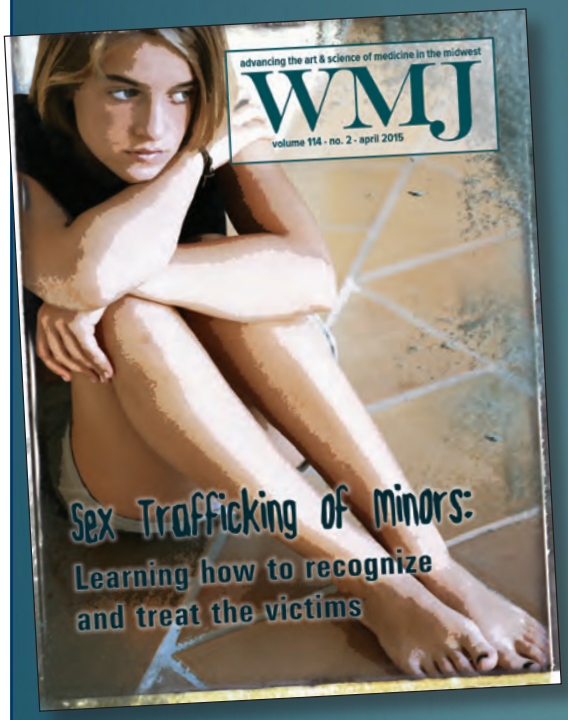

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Quality Improvement, Health Information Technology, and the Shift to Pay for Value

Jay A. Gold, MD, JD, MPH

Health care reform encompasses the need to design quality improvement initiatives that involve health information technology adoption and the overall gradual shift to pay-for-value models. For years, MetaStar has provided support for such initiatives in physician offices. Currently much of this work is performed through MetaStar's partnership in the Lake Superior Quality Innovation Network, which contracts with the Centers for Medicare & Medicaid Services (CMS) to provide quality improvement assistance for those who provide care to Medicare beneficiaries. MetaStar also has supported such initiatives through its work with the Office of the National Coordinator for Health Information Technology, as well as in its privately funded work. A few areas of focus for physicians are the use of data to identify high-risk patients, care coordination, and patient-centered care.

For years, clinics have been working towards adoption of certified electronic health records (EHRs) and the 3 stages of Meaningful Use: data capture and sharing (Stage 1), advanced clinical processes (Stage 2), and improved outcomes (Stage 3), with each stage building upon the previous one. Clinics started the journey by capturing data in the EHR (generating patient lists by specific conditions) and then continued with improvements in health information exchange and care coordination. Recently, CMS published the proposed Stage 3 rule: to improve clinical outcomes, we need to utilize the data captured in EHRs to identify high-risk patients, and hence better to manage and mitigate disease.

Have you ever referred a patient to a specialist, but didn't receive complete information back as to the outcome of that visit? Or have you received a patient referred for specialized treatment, but weren't sure what tests already had been ordered by the primary care physician? Health care information systems frequently do not talk to one another, which can create confusion. Care coordination is essential not only from the patient perspective, but also from the payer and provider side of health care. When professionals can communicate through the patient's health record, they potentially can reduce errors and increase patient-provider satisfaction.

Similarly to the growing use of technology, pay-for-value models have evolved over the past few years. The stage is being set for consumers to "shop online" for their health care. For example, consumers can research which hospital had the most expensive heart transplant procedure, which home health agency had the highest rate of patients who experienced ambulation improvement and, which nursing home had the highest incidence rate of developing pressure ulcers. Access to such information will be an inevitable factor as health care reform and quality improvement initiatives move forward.

CMS initiates this process by defining a set of standardized measures for quality reporting. Physicians and other health care professionals may be familiar with a few of these programs such as the Physician Quality Reporting System (PQRS), Hospital Inpatient Quality Reporting (IQR), or Hospital Consumer Assessment of Healthcare Providers and System (HCAHPS). These are programs where measures have been defined, processes have been rolled out, and reporting has become fluid within clinical workflows.

After measures have been defined, the cycle moves into its next phase: pay for reporting. Penalties are imposed when organizations do not submit those previously defined CMS measures. Conversely, when those measures are submitted, CMS provides full reimbursement.

The next part of the process is pay for performance. The measures that CMS previously collected and providers reported on are compared (hospital vs hospital, nursing home vs nursing home). These data are then translated into public reporting. This feature of public reporting enables patients to compare and contrast different providers where circumstances permit, and to determine where they want to receive services based upon previous clinical outcomes. Providers with the highest performance of those measures can receive bonus payments in addition to their standard reimbursements.

A Summary of Approaches and Programs

PQRS (Physician Quality Reporting System)

- Created in 2006 by CMS as a pay-for-reporting program.
- Uses incentive payments to encourage eligible professionals to report on specific quality measures.
- Eligible professionals in this program are those based on or paid by the Medicare Physician Fee Schedule, including physicians, practitioners, and therapists.
- If providers have not submitted their quality data to CMS, they will see a 1.5% cut this year.

• • •

Doctor Gold is senior vice president and chief medical officer for MetaStar. Caitlin McLeish, Health Information Technology Specialist at MetaStar, also contributed to this article. This material was prepared by the Lake Superior Quality Innovation Network, under contract with the Centers for Medicare & Medicaid Services (CMS), an agency of the U.S. Department of Health and Human Services. The materials do not necessarily reflect CMS policy. 11SOW-MI-A1-15-05 0450615

Meaningful Use of EHRs

- Established in 2009 as part of the American Recovery and Reinvestment Act.
- Part of the Medicare and Medicaid EHR Incentive Programs.
- Eligible professionals and hospitals meaningfully use certified EHRs to improve patient care by meeting thresholds for a number of objectives.
- The Stage 3 proposed rule was released earlier this year.

Value-Based Payment Modifier

- The Affordable Care Act mandated this payment structure in 2015 based on performance in 2013.
- Provides payments to physicians under the Medicare Physician Fee Schedule based upon the quality of care provided compared to the cost of care provided.
- The modifier currently is applied to groups of 100 or more eligible professionals.

Hospital-Acquired Condition (HAC) Reduction Program

- Signed in 2006 as part of the Deficit Reduction Act.
- In 2009, the HAC payment adjustment was rolled out driving improvements in patient safety by using payment adjustments based on DRGs (Diagnostic Related Groups) that use CCs (complicated conditions) when present as secondary diagnoses.

MetaStar will continue to work with physicians and hospitals throughout Wisconsin to improve their ability to participate in these approaches, with the ultimate goal of improved patient care.

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