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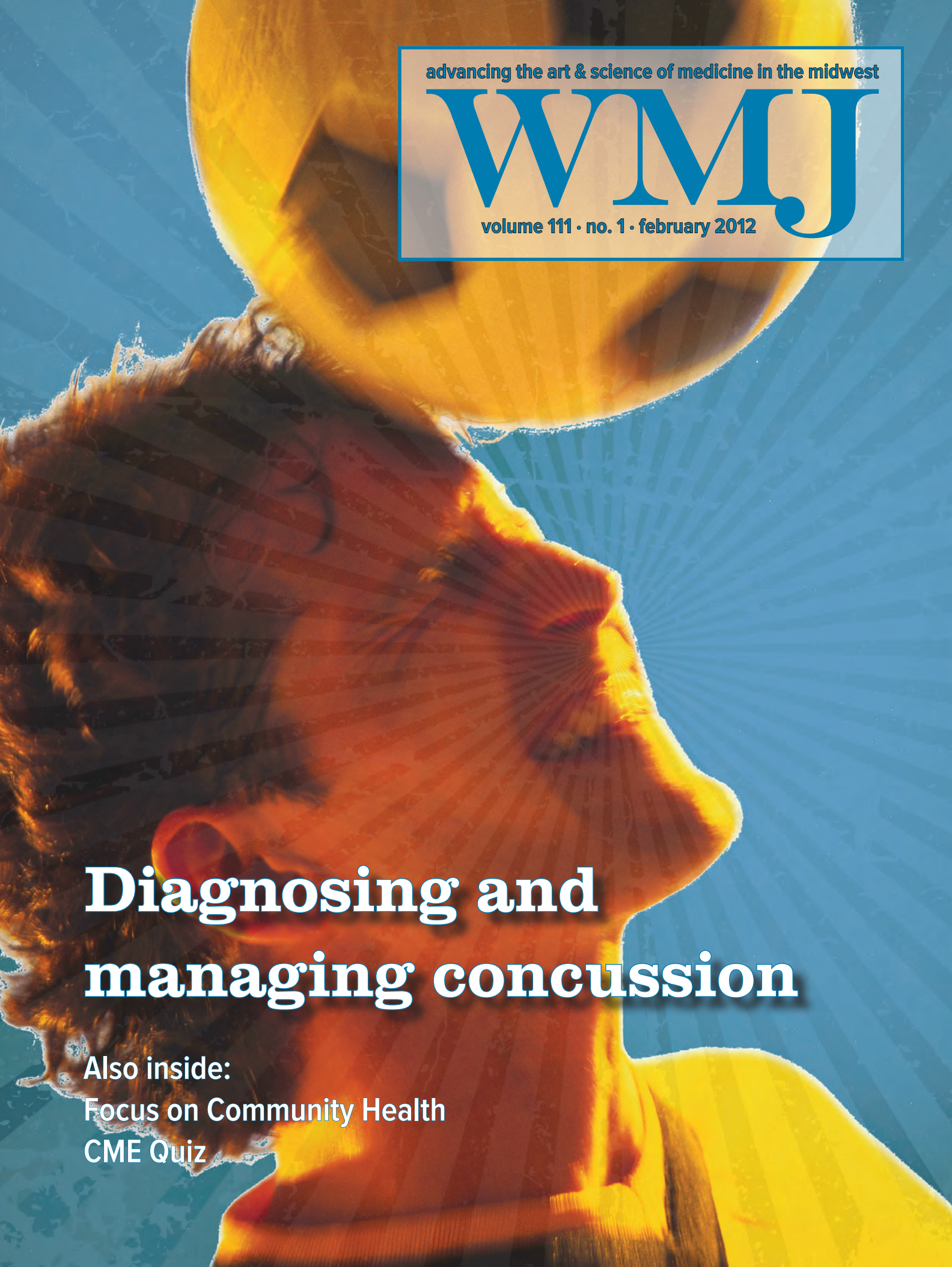

Diagnosing and managing concussion

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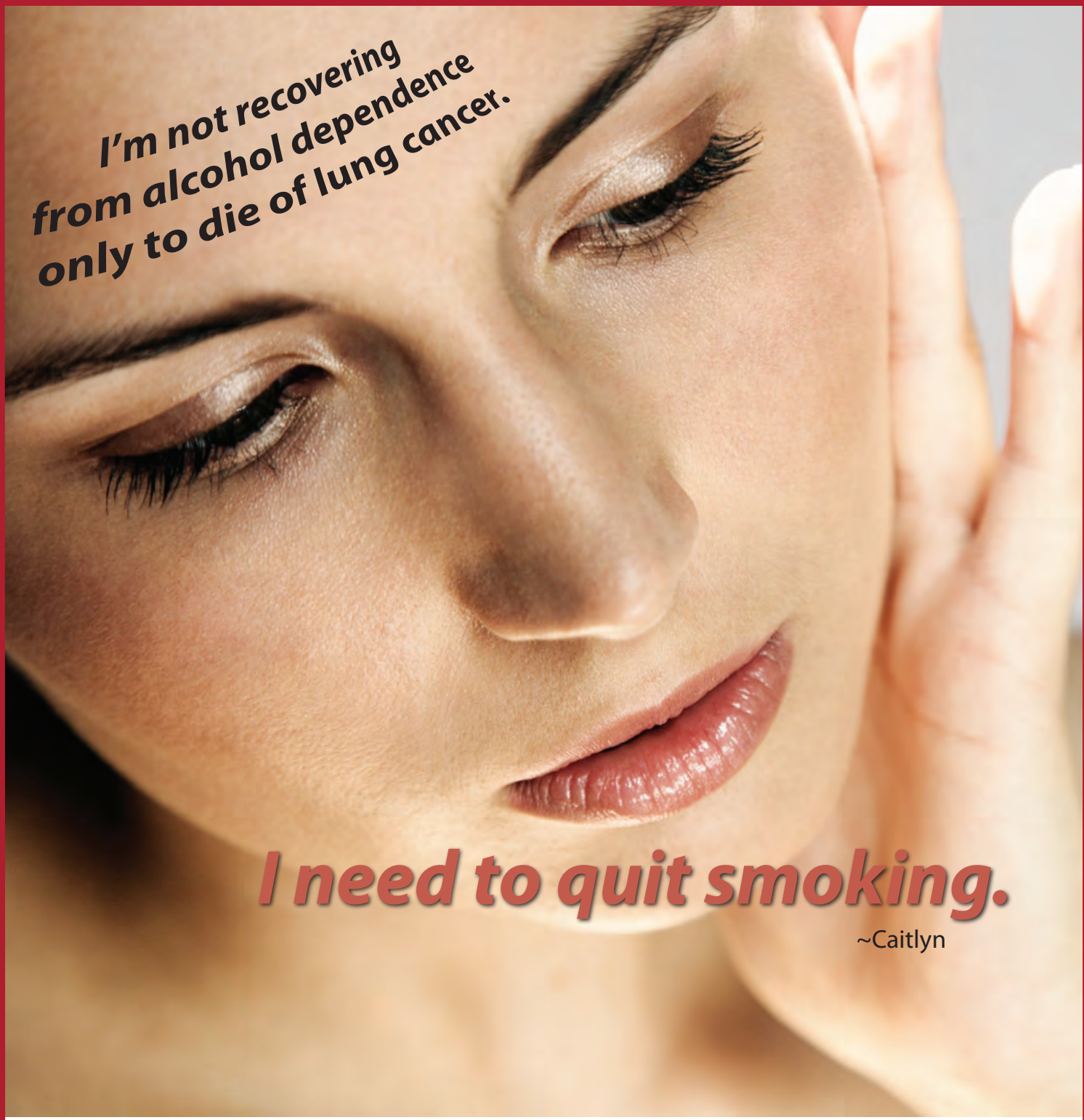

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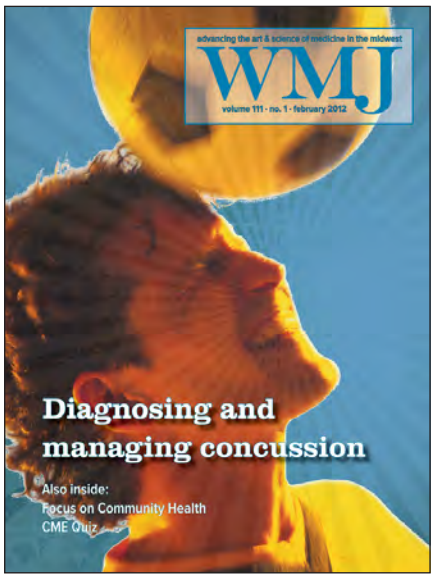

COVER THEME
Diagnosing and managing concussion

Concussion is a common medical problem with significant morbidity and sometimes devastating consequences. An article in this issue of *WMJ* reviews the current concepts of concussion pathophysiology and epidemiology, and provides an overview of proper diagnosis and management.

Cover design by Mary Kay Adams-Edgette.

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Hieronymus Bosch and Ergotism

Hieronymus Bosch was a Netherlandish painter living from 1450-1516. He grew up in a family of artists, including his father, grandfather, and uncles. There are limited records of his life or thoughts and only a few of his paintings. Like many artists of the day, religious motifs were predominant. He painted complex pictures that included satire, morality lessons, metaphors, and visual translations of verbal puns. The most original of his art was his portrayal of hell, monsters, demons, and chimeras. Some see a resemblance to surrealism. [1]

I theorize that Bosch had a near-death experience as portrayed in "The Ascent of the Blessed" (Figure), part of a 4-panel work that shows angels assisting a person approaching a tunnel of light with a being at the far end. This depiction corresponds to modern descriptions of near-death experiences.

I also theorize that hallucinations from ergotism may have been the source of his amazing depictions of hell, demons, punishment, and chimeras. Ergotism is also known as "St. Anthony's Fire," named after a Roman hermit saint who was born in Egypt in 251. The syndrome is caused by an alkaloid that grows in rye and sometimes wheat. The blight, which was identified in 1676—200 years after Bosch—caused occasional outbreaks recorded throughout history. The symptoms include a painful burning, vasoconstriction, and central nervous system manifestations including hallucinations, seizures, headaches, vomiting, and mania. Ergots have had a medicinal use in modern medicine for migraines, oxytocic effects postpartum, and the treatment of prolactinomas. LSD, a drug used in the drug cultures of the 1960s and 1970s, is an ergot alkaloid.[2]

Because of the saints that he painted—St. Anthony was depicted most extensively—I think it plausible that Bosch himself had lived through ergotism. These fantastic images are most prominent in "The Temptation of St. Anthony"[3] and "The Garden of Earthly Delights."[4]

Carl Vander Kooi, MD
Covenant Clinic, Cedar Falls, Iowa

Figure

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The Medical School Situation

A.W. Myers, MD, Editor; J.P. McMahon, MD, Managing Editor

Editor's note: The following is excerpted from an editorial published in *WMJ,* Volume 9 (No. 4), September 1910, pp. 227-229.

In an editorial in the August *Journal* the situation of Medical Education in Wisconsin was considered in connection with the Carnegie Report and the obvious suggestion was made that a single medical school was highly desirable….

…As Flexner has so clearly pointed out in the Carnegie Report a school entirely dependent upon the fees of its students for its support must sacrifice its independence. It must have students, and therefore must sometimes take them on their own terms. When in addition the student body is expected to carry the burden of a large bonded indebtedness the school's hands are completely tied. It can compel neither adequate preparation for the work nor conscientious completion of it.

Medical education today is extremely expensive. A good course costs all that the student can possibly pay. In fact the income from students ought to be supplemented by aid from endowments, instead of being depleted by interest charges.

By those whose ears are open the call of today can be heard to be not for more doctors but for better ones. We must ever strive to do better and better work and we must urge those who are to join us in the ranks to give themselves the most thorough and efficient training within their means.

Whatever truly tends to elevate the standards and ideals of medical education and medical practice in Wisconsin can count upon the support of a united profession, but to start a school with a burden of half a million of indebtedness, without a hospital to call its own, dependent on a great number of students for its very existence, is to pay too high a price for a reduction of one in the number of medical schools in the state. Surely some better plan can be devised.

Two Sides of the Same Coin

Barry Blackwell, MB, BCh, MD, FRC Psych

Separated by the Atlantic Ocean but united by a common heritage, Britain and America share a pressing problem on which they disagree fundamentally: health care—a rather abstract and philosophical debate that recently became personal.

Now an American citizen, beyond age 77, I visited my internist for an annual medical exam. Newly retired, we addressed several deferred decisions. Twenty youthful years of playing rugby and pushing in the serum had wreaked havoc with my joints. I have had a hip replaced (followed by a pulmonary embolus), both knees are arthritic, and I suffer from spinal stenosis, severe on x-ray but mercifully asymptomatic. In addition, I have an ataxia of undetermined origin so my gait resembles an inebriated penguin walking on stilts. My eligibility for safe surgery is compromised by atrial fibrillation and anticoagulants. Despite this depressing litany, both my internist and orthopedist contemplated bilateral knee surgery, separated and followed by several months of prolonged rehabilitation at an estimated cost probably in excess of $100,000. The alternative, a gradual progression from cane to walker to wheelchair eased by palliative analgesics might cost $5000.

Next, I had previously undergone 2 colonoscopies, 5 years apart. Despite best practice guidelines that suggest colonoscopy after age 75 is unproductive (even if positive you are more likely to die of something else), the gastroenterologist sent me a reminder for a repeat procedure and my internist felt I should go ahead, "just to be safe." I scheduled the colonoscopy but had second thoughts and cancelled the procedure, presumably saving Medicare a significant sum while short-changing the hospital and gastroenterologist.

Finally, a new concern raised its head. My platelet count was marginally low for no apparent reason (140,000). One possible cause was my Churchillian propensity for heavy social drinking, to which I willingly confessed. Might an enlarged and dysfunctional liver be suppressing splenic function? Perhaps I needed a nuclear medicine scan of both organs at the same time as a repeat platelet count. The latter came back normal, but the scan was already scheduled. It was reported as showing a liver and spleen both "twice the normal size." This led to scheduling a chest x-ray and CT scan of the abdomen and pelvis for a more definitive view of the liver. Alarmed, I embraced total sobriety during the 3-week hiatus before the results came back; they were normal. My internist concluded that the false positive scan likely was not due to my rigorous sobriety but to "an inexperienced radiologist." I estimate the cost of these procedures must have exceeded $10,000. (I was told that the brand new CT scanner, of which the hospital has three, cost over $1 million).

At exactly the same time these events occurred, my 84-year-old brother in England viewed the reverse side of the coin. A former Royal Marine and retired Superintendent of Police, he is legally blind, physically handicapped, totally housebound, and completely dependent on his 74-year-old wife for support. In the preceding 3 weeks, his wife suddenly had developed severe back pain and became bedridden. The pain had not responded to several pain killers and muscle relaxants and failed to benefit from 2 sessions of physiotherapy and a visit to a chiropractor. The local general practitioner had conducted a brief home visit and examination but made no definitive diagnosis and declined to request an x-ray. Concerned, my brother called the National Health Service regional hotline resulting in a phone diagnosis of "probable sciatica" and a prescription for Valium. When this failed to improve matters, he called the local hospital to suggest admission and request an x-ray but was turned away and told there were no x-rays available on weekends.

My brother's true predicament was that they had been shunted into the "care" continuum. So the issue became disposition, either in-home care or a long-term facility rather than diagnosis or treatment, now

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deemed irrelevant. This was the responsibility of social workers, not doctors, and of a new "for-profit" industry providing in-home assistance for $15 to $30 an hour. The only thing delaying this option was the fortunate fact that my brother's middle-aged son was laid off work and able to assume their care temporarily.

My first response was stereotypically American; it was outrageous that a more aggressive attempt had not been made to reach a definitive diagnosis. No x-ray, no CT scan, no referral to an orthopedist, just symptomatic treatment and disposition—all ineffective. But then I began to recall my early days as a family doctor in Britain and weigh the odds. Statistically, by far the most common cause of sudden onset back pain in a healthy 74-year-old woman would be musculoskeletal. Even if it was something more sinister, perhaps a metastatic lesion, the treatment was likely to be palliative. Hadn't we been taught that when scanning the diagnostic parking lot a Ford was far more common than a Rolls Royce? The reality of my brother's total disability and dependence on his wife, as well as their ages, made a move into a long-term care facility seem inevitable. Why not sooner than later? Even without a job, my brother's son had an independent life to lead. The psychiatrist in me wondered if part of the predicament and lack of recovery might be due to carrying a burden of care his wife no longer felt able or willing to bear. I sensed my brother already knew this and was beginning to accept its implications.

Back in America my anger melted, transformed into more support and less advice. But the policy implications lingered; as with so much these days the issues seem inflated by political rhetoric focused on exaggerating differences rather than attempting compromise.

In Britain, it might help to pay empathic and more nuanced attention to accurate diagnosis, easing acceptance of disposition before crossing the Rubicon from cure to care. In America, we might learn that not everybody can have everything, especially immortality. Clinical guidelines, firmly applied, might rationalize the fair distribution of resources and feel less like rationing, which Brits culturally are inclined to accept but Yanks fiercely resist.

Overall Britain appears to be holding the fiscal line while, in America, costs are escalating out of control in an aging population even though Medicare pays physicians less than market rates and politicians are debating radical change.

Community Connections Free Clinic Providing Health Care and More to Uninsured

Kendi Parvin, *WMJ* Managing Editor

When Aaron Dunn, MD, began seeing patients in his rural Wisconsin practice who couldn't afford to pay, he wanted to do something about it.

"Physicians are in a critical position to lead the change we want to see to make sure everyone has access to the care we can provide to keep everybody healthy," Dr Dunn said. So he picked up the phone, called the local county health department and said, "Hey, I'm new in the community. What can I do to help?"

That was in 2006. Dr Dunn recently had completed his residency in family medicine and joined a practice with clinics in southwestern Wisconsin. He wondered where those patients who couldn't pay were going, and wanted to know where he could volunteer. But when he spoke with June Meudt, director of the Iowa County Public Health Department, he learned such a place didn't exist.

"People knew there was a need and had been wanting to do something about it for a long time," said Dr Dunn. "Basically, all it took was me saying that I would be willing to see these patients."

So Dr Dunn and about a dozen community members, including Meudt, clergy and other community leaders decided to create a free clinic in Dodgeville to provide care for the uninsured. They sought the advice of Haakon Carlson, MD, a physician who volunteers at a free clinic in Sauk County, for a basic "recipe," then went to work. They modeled bylaws, policies, and other forms after those of other free clinics. Space came from the Southwestern Wisconsin Community Action Program, Inc. (SWCAP), an anti-poverty agency that recently had purchased a building to house some of its programs. Exam tables and other equipment were donated, and other volunteers stepped forward to staff the clinic.

In October 2006, Community Connections Free Clinic (CCFC) opened its doors. Dr Dunn and a retired physician staffed the clinic, which was open initially on Tuesday afternoons. Word spread, in part thanks to some television news coverage, and Dr Dunn says, "We've been full ever since."

More than 2000 individual patients have sought care at the CCFC since it opened; and to meet demand, the clinic expanded in 2009, relocating in what used to be the building's basement. Today it has 4 exam rooms, a lab, pharmacy, prescription assistance consult room, a social care room, and a kitchen and conference area for specialty services such as mental health counseling and physical therapy. The space is shared with the Reproductive Health Care Center, and public areas such as a reception and waiting room are shared with Access Dental Services of Dodgeville, which provides dental services to Medicaid and low income patients through a federally qualified community health center in the region.

CCFC is open 2 nights a week, and clinicians see 10 to 20 patients each evening on a first-come, first-served basis. There are no appointments. Approximately 80 to 90 active volunteers staff the clinic, including 10 physicians, nurse practitioners and physician assistants who provide primary care. Dr Dunn, who serves as medical director, said the schedule is full enough that no clinician is asked to work more than 2 nights per month. Volunteers also provide nursing, lab, and pharmacy services; serve as Spanish translators; and offer clerical support. There is 1 paid staff member, clinic manager Therese Hess.

"On any given night, we might see an ear infection, a cough, a rash. We'll also see back pain, belly pain, headaches," Dr Dunn said. "And then we see the people I think we really help the most—the chronically ill who have fallen out of the system. People who say, 'I'm diabetic, I had a heart attack 5 years ago.' We see a handful of those patients every night—where we say 'OK, what meds are you taking, how long have you been off of them, when did you last have your blood sugar and blood pressure checked? Let's start over and figure out what meds we can get you on, and get them for you ASAP.' "

Medications are provided at little or no cost to patients as needed. The clinic has a small inventory of antibiotics and other commonly dispensed medications purchased

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To learn more about Community Connections Free Clinic, visit www.ccfcwi.org.

Family physician Aaron Dunn, MD, talks with a patient about his back injury at the Community Connections Free Clinic in Dodgeville. Dr Dunn, who serves as medical director, spearheaded efforts to start the clinic, which opened in 2006.

from the local hospital, according to Dr Dunn. It also has a small supply of samples that may not have a generic alternative. If the clinic doesn't have a medication in its inventory, the clinic contracts with a local pharmacy that dispenses prescriptions to the patients but bills the clinic. Additionally, CCFC's drug assistance program provides a valuable resource for patients who need medications for chronic conditions.

"Arguably, the most impactful program we have is our drug assistance program," said Dr Dunn. Volunteers complete and submit applications for pharmaceutical assistance programs on behalf of patients, who then typically receive the medications in 1-month, 3-month, or 6-month supplies.

"We figure we've saved each patient in that program on average about $5000 a year," said Dr Dunn. "We've calculated about $600,000 a year in drug costs saved compared to the retail price."

In addition to providing medical care and prescription assistance, clinic volunteers work to connect patients with other community resources. Following a visit, each patient meets with a social care volunteer who tries to identify other needs the patient might have such as fuel assistance, food pantry resources, or social services.

As an extension of the clinic, a new English tutoring program was launched last year for Spanish-speaking patients who expressed an interest in learning to speak and read English.

"The idea started at the clinic with our interpreter team," said Dr Dunn. The clinic's intake survey asks if people would take advantage of an opportunity to learn English if it was available. Because so many patients said "yes," they decided to create a program.

CCFC volunteers and staff teamed up with members of Grassroots of Iowa County and the Iowa County Literacy Council to create a tutoring program. So far, about 20 volunteers have been trained and matched with learners.

"It speaks a lot to how special our volunteers are," said Dunn. "They're basically thinking on the fly, seeing a need and saying, 'let's just put this together and do it.'"

While volunteers are a critical component of CCFC's success, so is funding. The clinic receives limited financial support from the county, but the majority of funding is from the community—through donations from individuals, churches, local businesses, and some grants.

"We're making a difference, but at the same time, we're basically a lifeboat for people who are drowning. We are not a full-service clinic. We are not a solution to the broken health care system," said Dr Dunn. "That said, it's been a cool thing to see how the community has rallied around this issue. To have a clinic like this—a real clinic—from the minimal resources we had and the partnerships we've developed, the volunteer support we've had, and the continued funding stream is a testament to everything good about the community."

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It Takes a Team

John J. Frey, III, MD, *WMJ* Medical Editor

The *WMJ* continues to bring a wide array of interesting articles to readers, and this issue is no exception. A comprehensive review article by Almasi and Wilson[1] on diagnosing and managing concussions is not only authoritative (the senior author is one of the UW sports medicine physicians responsible for Badger football) but practical and timely. One does not have to see the finest professional hockey player of his era have a career-threatening concussion to understand that concussions have consequences, both acute and long-term, and that "shaking off" injuries, which was the method of handling sports injuries a few decades ago, is no longer appropriate. Many community physicians are involved with sports at the high school level, and this manuscript should be in their first aid kits. As the authors point out, all states need legislation to assure that young people are properly evaluated and treated prior to returning to sports. It is the least we can do for our children.

Villareal and colleagues[2] capitalize on the electronic data warehouse in their large health system to identify patients who have received broad spectrum antibiotics and who subsequently developed Irritable Bowel Syndrome (IBS) compared to patients who did not develop IBS. One of the more interesting possibilities with integrated electronic health records is to find linkages between diagnoses and clinical management that are expected, such as in diabetes, and at times unexpected, such as the possible causal linkage between tetracycline and macrolides and the development of IBS.

Tischendorf and Temte's[3] study in a single community practice demonstrates that giving receptionists at a busy urban practice the authority to ask patients to use masks if the patient's chief complaint suggests a respiratory or influenza-like illness is an effective way of decreasing the likelihood of transmission. Bringing staff into the decision-making process in the clinical environment is a wise choice. The authors' ability to link the use of face masks to diagnoses depended on billing and coding of information that would help them extrapolate rates of illness across 27 separate clinics from their findings in a single clinic. This study, just as the study on IBS, would have been virtually impossible to carry out without a well-functioning clinical data warehouse. Every community practice with a diagnostic data base should use the same approach to predicting the demand for facemasks in each flu season and, in the process, decrease viral illness in their community.

Tumerman and Carlson's article on team cohesion and leadership[4] tries to adapt a widely used process in the world of business and hospitals to a community clinic environment and finds the process challenging. The redesign of clinical practices, whether in primary care medical homes or specialty clinics, demands transparency, communication, and a culture of safety. Doing so requires the input of all members of teams—a fact well-known in industry but one not widely used in clinical practice in communities. The 2-year experience with the 360-degree process outlined by Tumerman and Carlson resulted in improvement in morale, collegiality, and team function. The process required commitment of time and resources and a willingness to stay with it. High levels of satisfaction for patients, doctors, and staff call for processes to improve and sustain teams that trust and depend on each other. Too many examples of a lack of professionalism and less-than-optimal clinical functioning arise in risk-averse systems that embrace hierarchy and passivity. The least successful component of the national demonstration project on transforming primary medical care was the establishment of well-functioning clinical teams, despite time and effort.[5] Talking constructively with colleagues shouldn't seem hard. It is, though.

High levels of satisfaction for patients, doctors, and staff call for processes to improve and sustain teams that trust and depend on each other.

The case report by Fawole and colleagues[6] demonstrates that a continuing search beyond the usual suspects for rapidly progressing renal failure can find a heretofore undescribed source from which others with a similar primary disease might benefit.

Finally, a word from 100 years ago on

medical education in the post-Flexner report era describing the need for quality in terms still translates to today's world.[7] The last part of this "Looking Back" piece refers to the University of Wisconsin, which had not developed a clinical service at that point and had little likelihood of doing so in the short term, something that might come as a surprise to many in Madison today. But other sections of the 1911 *WMJ* editorial mention that Milwaukee was not doing all that much better. The change from trade schools to a profession was expensive and still is.

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Face Mask Use by Patients in Primary Care

Jessica S. Tischendorf, BS; Jonathan L. Temte, MD, PhD

ABSTRACT

Context: Face masks are recommended for patients with respiratory symptoms to reduce influenza transmission. Little knowledge exists regarding actual utilization and acceptance of face masks in primary care.

Objective: Compare distribution of face masks to clinic and community trends in respiratory infection (RI) and influenza-like illness (ILI); estimate the annual need for face masks in primary care.

Design: Retrospective observational study of practice data from a 31-week period starting in October 2009.

Setting: Family practice clinic in Madison, Wis.

Patients: Patients with fever, cough, or other respiratory symptoms as evaluated by reception staff.

Main outcome measures: Age, sex, and weekly counts of individuals receiving a face mask, as well as counts of RI and ILI patients based on ICD-9 coding from 27 statewide clinics.

Results: Face mask counts were 80% of RI counts for the clinic and reflected the demographics of the clinic population. Distribution was correlated to prevalence of RI ($R = 0.783$, $P < 0.001$) and ILI ($R = 0.632$, $P < 0.001$). Annually, 8% of clinic visits were for RI.

Conclusions: The high percentage of face mask use among RI patients reflects the feasibility of this intervention to help control influenza transmission in a primary care setting. Using the present data, clinics can estimate the annual need for face masks.

INTRODUCTION

Seasonal and pandemic influenza viruses are transmitted via small particle aerosols, large droplets, and fomites.[1] Face mask use is presumed to be an effective barrier against droplet transmission of respiratory viruses and has shown some effectiveness in several studies.[2-4] During times of increased respiratory infection in the community, the Centers for Disease Control and Prevention (CDC) recommends use of masks in health care settings for patients with cough or symptoms of a respiratory infection and for personnel in contact with the patient.[5] In response to these guidelines and due to recent evidence suggesting no inferiority of surgical masks compared to N95 respirators,[6,7] many health care facilities implemented the use of surgical masks for patients presenting with symptoms suspicious of acute respiratory infection.

Swine-origin 2009 H1N1 influenza represented the first influenza pandemic since 1968.[1] In the United States, from April 2009 to April 2010, the CDC estimated about 61 million cases of H1N1 influenza, 274,000 related hospitalizations, and about 12,470 H1N1-associated deaths.[8] During the peak of the pandemic in fall 2009, sentinel providers reported influenza-like illness accounting for more than 7.5% of outpatient visits.[9] This reflects the importance of transmission control in the primary care setting.

While an estimation of cost for implementing guidelines to control respiratory infection transmission in a primary care clinic does exist,[10] the high infectivity of 2009 H1N1 sheds new light on the feasibility of face mask interventions and the stockpile of face masks needed in a primary care clinic. The H1N1 pandemic provided an opportunity to examine the demographics of mask use and whether mask use would reflect trends in illness in the population using routinely collected clinical information. We hypothesized that mask use reflected community trends of "all cause" acute respiratory infection (RI) and influenza-like illness (ILI). Also presented will be an estimate for stocking a family practice clinic with face masks based on clinic data and face mask acceptance and use.

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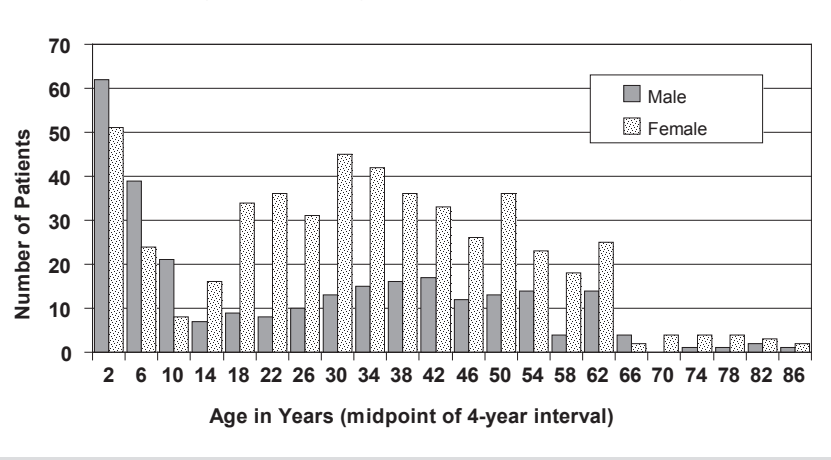
Table 1. Mask Use by Male and Female Patients During the 31-week Study Period

	Total	Male	Female
Masks Distributed (%)	793	286 (36.1%)	507 (63.9%)
Age of mask use (years ± SD)	29.72 ± 20.48	24.99 ± 21.69	32.38 ± 19.28

Figure 1. Demographics of Surgical Mask Distribution in Primary Care During Study Period, From Week Beginning October 25, 2009, to Week Beginning May 23, 2010.



METHODS

This retrospective observational study of practice data following the peak of the H1N1 pandemic in October 2009 encompasses data from the week beginning October 25, 2009, to the week beginning May 23, 2010—a total of 31 weeks. The family practice clinic examined is located in a multi-ethnic urban neighborhood that includes individuals of varying socioeconomic status.

Following CDC guidance, the clinic adopted a policy to provide surgical masks to any arriving patient with acute respiratory symptoms. Receptionists were instructed to offer a mask to all patients presenting with cough, sore throat, or fever or those identified prior to arrival by the triage nurse as needing a mask. For each mask dispensed by reception staff, an entry was logged indicating the date of mask use and the age and sex of the patient offered the mask. Each week, the data from the log was entered into a spreadsheet.

Using de-identified clinical data extracted from the University of Wisconsin-Department of Family Medicine (UW-DFM) Clinical Data Warehouse, counts of individuals diagnosed with RI and ILI were identified weekly. RI in this study was defined using ICD-9-CM codes 460.00 – 466.99 ("acute respiratory infections"), 381 – 382.9 ("nonsuppurative otitis media and Eustachian tube disorders" and "suppurative and unspecified otitis media"), and 480 – 488.1 ("pneumonia," "influenza," and "H1N1"). We used this broad definition to allow for an extreme "upper limit" of respiratory virus activity. ILI was defined as the subset of RI, which had a measured temperature of 100°F (37.8°C) or higher at the time of visit, thus setting a lower limit for respiratory virus and influenza activity.

To more accurately estimate annual face mask need, data were compiled for the clinical practice and for a regional composite using the entire UW-DFM, which consists of 27 statewide clinical practices. Total patient visits, total RI visits, and total ILI visits were compiled for a 4-year period from June 2006 to May 2010. Average visits per week, average RI visits per week, and average ILI visits per week ALSO were ascertained for the clinic and UW-DFM. From this data, percentage of yearly visits resulting in a diagnosis of RI was calculated. Based on the face mask distribution data collected during the study period, an estimation of the yearly supply of face masks needed for a primary care clinic was calculated.

Statistical Analysis

All statistical analyses were performed using Minitab statistical software (Minitab Inc, Release 13.1, 2000). Descriptive statistics were used to describe age distribution of the study population, both in aggregate and by gender. One-way Analysis of Variance (ANOVA) was performed to examine differences in age distribution based on gender. Threshold significance was set at $P \leq 0.05$.

Pearson Correlation was used to examine the relationship between weekly mask use and clinic population prevalence of RI and ILI during the study period. Additionally, Pearson Correlation was used to compare weekly clinic counts to the broader department-wide counts of RI and IRI to assess whether clinical trends followed community trends in illness.

To estimate face mask need, the percentage of individuals with RI receiving face masks during the study period was determined and applied to the estimated percentage of yearly visits for RI.

RESULTS

During the study period, there were 989 total visits for RI and 37 visits for ILI at the study clinical practice; that is, ILI accounted for 3.74% of RI visits. A total of 793 masks were distributed to patients during the study period (80% of those with RI).

Females received the majority of masks (63.9%), which closely reflects demographics of the clinic population for a year period ending in June 2010 (63.7% of total visits were with females). One-way ANOVA revealed a statistically significant difference for age of mask user between genders ($P < 0.001$), with the mean age of mask users greater in females than males (Table 1, Figure 1).

Distribution of face mask use on a weekly basis was correlated highly to RI prevalence ($r = 0.783$, $P < 0.001$) and ILI prevalence ($r = 0.632$, $P < 0.001$) within the clinic population. Face mask count exceeded the number of ILI cases every week (range: 9 - 54), and for several weeks, face mask count exceeded RI case count (Figure 2). Weekly counts of RI and ILI in the clinic were reflective of the larger community trends in RI ($R = 0.810$, $P < 0.001$) and ILI ($R = 0.753$, $P < 0.001$) for the study period.

Compilation of data from June 2006 to May 2010 revealed roughly 8% to 12% of visits to the clinic and department-wide were attributable to RI, reflecting a large portion of total visits for which face masks may be considered (Table 2).

Figure 2. Surgical Mask Distribution Per Week (line) Compared to Respiratory Infection (RI) and Influenza-like Illness (ILI) Patient Counts (bars - ILI is a subset of RI).

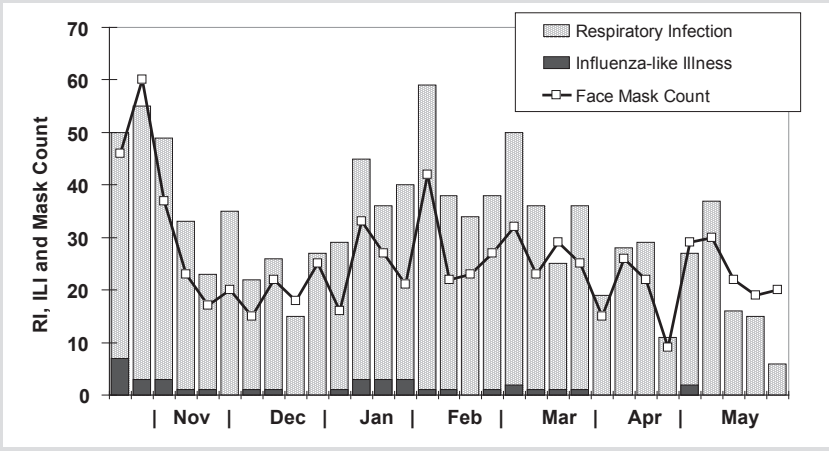


Table 2. Outpatient Visits for Respiratory Infection (RI) and Influenza-like Illness (ILI) over a 4-year Period

Four-year period from June 2006 through May 2010		
	UW-DFM (% of total)	**Study Clinic (% of total)**
Total visits	3,446,856	90,056
RI visits	274,468 (7.96 %)	11,170 (12.40 %)
ILI visits	6593 (0.19 %)	216 (0.24 %)
Average Weekly Visits over 4-year period		
	UW-DFM (% of total)	**Study Clinic (% of total)**
Visits per week	16,492	431
RI visits per week	1313 (7.96 %)	53.4 (12.40 %)
ILI visits per week	31.5 (0.19 %)	1.03 (0.24%)

Abbreviations: UW-DFM, University of Wisconsin-Department of Family Medicine

DISCUSSION

The effectiveness of face masks in preventing transmission of influenza relies on the efficacy of the face mask and the willingness of a symptomatic patient to wear it. The 2009 H1N1 pandemic provided a unique opportunity to assess this strategy for respiratory virus transmission control. This study suggests that roughly 80 % of individuals presenting to an outpatient clinic with "all-cause" RI will receive a face mask, demonstrating the willingness of patients to wear face masks and health care facility staff to distribute them. The uptake of mask use in the outpatient clinic is reflected by surveys suggesting 4 % to 8 % of the public reported themselves or their family members wearing a face mask in the early months of the H1N1 pandemic.[11] The acceptance of face mask interventions also has been demonstrated in other studies surrounding the possibility of pandemic influenza.[12,13] During the recent pandemic, policies aimed at masking individuals with symptoms of cough, sore throat, or fever were an attempt at reducing transmission of viral influenza. With ILI accounting for only 3.74 % of RI visits and the high incidence of masking shown in this study, presumably all individuals with infectious influenza were indentified and masked upon arrival to the clinic.

The gender-specific age distributions of face mask use resulted in a significant difference in mean age of mask use between males and females. Beyond childhood, females were more likely to be masked, until about age 60 when levels tend to equate; this trend reflects results observed in the Tecumseh study and Cleveland Family study concerning respiratory infection rates.[14,15] This observation of increased respiratory infection in women may be explained by the fact that women may more often be the caretakers for ill children, who have been identified as common sources of household influenza transmission.[14,16]

While correlations between mask use and RI prevalence and mask use and ILI prevalence were reasonably high, several factors may have been at play that decreased the likelihood of a patient with RI or ILI to be masked. While not detected at

appreciable levels in this study, based on discussion with the reception staff there may have been patient refusal to masking upon staff request. While reasons for refusal were not recorded in this study, a previous investigation reported decreased adherence because individuals found the masks uncomfortable or ill-fitting.[4] Staff also may have failed to identify an individual requiring a mask. More likely, however, the discrepancy between numbers of masks and patients presenting with RI was due to our definition of RI. To be fully inclusive, we included data from patients diagnosed with otitis media and acute sinusitis, conditions that would not present with symptoms that required masking per CDC recommendations.

This study was limited in that no measures of transmission were made due to the retrospective nature of assessment. Moreover, this evaluation occurred in the wake of an influenza pandemic during which patients may have been more accepting of face masks.

The use of face masks in an infection control program has demonstrated effectiveness in reducing transmissibility of respiratory viruses.[2-4,17-19] With the high volume of patients seen in primary care clinics for RI, it is important to have an adequate stock of face masks on hand.

By reviewing a 4-year period, we determined that about 8% to 12% of annual clinic visits are for RI; cases often have symptoms for which face masks would be recommended. This study revealed roughly 80% of those individuals with a diagnosis of RI are masked upon arrival to the clinic. Applying these numbers to a clinic population can provide an estimate for the number of face masks to be ordered yearly. For example, a clinic with 20,000 patient visits per year can expect 8% to 12%, or 1600 to 2400 of those visits to be for RI. With 80% of individuals with RI receiving a mask, as was determined in this study, 1280 to 1920 face masks (6.4% to 9.6% of annual volume) would be needed for a 1-year period.

The 2009 Influenza A H1N1 pandemic, through mass media and public recognition, created an opportunity to improve infection control in primary care. In response, many institutions implemented the use of face masks to reduce potential transmission. Through this study, we have been able to demonstrate that a large number of symptomatic patients received face masks and that mask distribution reflected community trends in respiratory infections. Moreover, their use was in excess of that necessary for influenza-like illnesses. Consequently, it is feasible for a primary care clinic to adhere to current recommendations for infection prevention in outpatient settings.[20]

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Use of Broad-Spectrum Antibiotics and the Development of Irritable Bowel Syndrome

Armando A. Villarreal, MD; Frank J. Aberger, MD; Ryan Benrud; Jacob D. Gundrum, MS

ABSTRACT

Background: Irritable bowel syndrome (IBS) is a functional bowel disorder with an estimated prevalence of 9% to 22% in the United States. It is responsible for 28% of gastroenterology visits, with associated health care costs of $8 billion annually. Yet, IBS etiology is the subject of much debate.

Objectives: Our study examines a possible relationship between IBS and exposure to broad-spectrum antibiotics. It is known that antibiotics alter the colonic flora; we hypothesize that this can create the manifestations seen in IBS patients.

Methods: Following approval by the Gundersen Clinic, Ltd Human Subjects Committee/IRB, the medical records of adults who were started on a broad-spectrum antibiotic at Gundersen Lutheran Health System between January 1, 2008, and December 31, 2008, were reviewed retrospectively. From this population, we identified those who developed IBS within 12 months and compared their demographic and clinical characteristics with the characteristics of those who did not.

Results: Of the 26,107 adult patients exposed to broad-spectrum antibiotics during the study period, 115 received an IBS diagnosis within 12 months. Most were women (84%; n=97), and they had a higher prevalence of associated comorbidities than those who did not develop IBS. Patients indicated for macrolide or tetracycline use had a higher proportion of IBS development within 12 months; indication for tetracycline use maintained significance even after controlling for sex and comorbid conditions (odds ratio; 1.48; *P*=.046).

Conclusion: Use of broad-spectrum antibiotics—particularly macrolides or tetracyclines—may be associated with IBS development. To date, we know of no other study that has associated these antibiotics with IBS development. Further studies are necessary.

INTRODUCTION

Irritable bowel syndrome (IBS) is a functional bowel disorder estimated to have a prevalence of 9% to 22% in the United States.[1] It is responsible for 28% of gastroenterology visits, with associated health care costs of $8 billion annually.[2] Features of IBS are abdominal discomfort or pain associated with defecation or a change in bowel habits and disordered defecation.[3] Traditionally, functional bowel disorders were identified only by symptoms. In 1984, a working team of international experts was set up to produce guidelines for the management and study of IBS. In 1988, the first Rome criteria were presented; the guidelines were published the following year.[4] Over the years, these classifications became known as Rome I, II, and III.

The Rome III criteria for the diagnosis of IBS established that the patients must have had "recurrent abdominal pain or discomfort at least 3 days per month in the last 3 months with symptom onset at least 6 months prior to diagnosis associated with 2 or more of the following: (1) relief with defecation, and/or (2) onset associated with change in frequency of stool, and/or (3) onset associated with change in form (appearance) of stool." The Rome III criteria go on to describe several different types of IBS: constipation-predominant (IBS-C); diarrhea-predominant (IBS-D); mixed (IBS-M), and unsubtyped (because of the lack of definite consistency of the stools).[3] IBS has many comorbid conditions, such as fatigue, depression, fibromyalgia, and chronic pelvic pain. According to Cole et al, those suffering from IBS have a 40% to 80% higher prevalence for 1 of the 3 aforementioned conditions.[5] It is possible that all will have the same underlying biological mechanism.

A number of hypotheses as to the etiology of this condition have been advanced—among them, bacterial overgrowth. In a recent article, Quigley[6] suggested that the likelihood of this hypothesis being a major factor in IBS is remote, based on recent findings of "dysfunctional interaction between the

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indigenous flora and the intestinal mucosa which, in turn, leads to immune activation in the colonic mucosa." Adding to the controversy, there is currently no explanation for why this condition is more common in women than men (women are 3 to 4 times more likely than men to be diagnosed with IBS[3]) and why in individuals there is a high correlation of IBS occurring with symptoms not necessarily related to the gastrointestinal tract, such as fatigue, depression, and fibromyalgia.

In the same article, Quigley[6] makes reference to a survey of 421 subjects performed in the United Kingdom that showed strong association between antibiotic use and an increased risk of IBS. We know that the use of broad-spectrum antibiotics, such as beta-lactam, cephalosporins, and macrolides are associated with alteration of the colonic flora.[7-11] In 2001, Acar[12] demonstrated that "Ampicillin-clavulanic acid and Ampicillin administration were associated with colonization with resistant strains of Enterobacteriacae as well as *Candida* spp. Ceftriaxone selected resistant strains of *Clostridium difficile* and *Candida* spp." While previous studies had indicated the "transient effect" of these drugs in the microflora, more recent ones are beginning to show a long-term effect[7,13]; moreover, we are unaware of any studies evaluating the effects that these drugs could have if they were used frequently on the same group of individuals. Our study provides a preliminary assessment of the relationship between exposure to these drugs and the development of IBS.

METHODS

Patients

Following approval by the Gundersen Clinic, Ltd Human Subjects Committee/IRB, the medical records of adults who were started on a broad-spectrum antibiotic (inpatient or outpatient) at Gundersen Lutheran Health System between January 1, 2008, and December 31, 2008, were reviewed retrospectively. Broad-spectrum categories included penicillins, macrolides, cephalosporins, tetracyclines, and betalactams; topical antibiotics were not included. We then used ICD-9 diagnosis code 564.1 to identify those patients with a subsequent IBS diagnosis within 12 months. We excluded (1) patients who were pregnant during antibiotic use; (2) patients with inflammatory bowel disease (IBD), Crohn disease, ulcerative colitis, gastrointestinal cancer, diverticulitis, celiac disease, or peptic ulcer prior to the start of antibiotics in 2008; (3) patients with diagnosis of gastroenteritis prior to the start of antibiotics in 2008; and (4) patients with a diagnosis of IBS prior to the start of antibiotics in 2008.

For those who developed IBS within 12 months, antibiotic use was assessed during the 1-year period prior to the IBS diagnosis. For those who did not develop IBS, antibiotic use was assessed over a random 1-year interval ending between the 2008 antibiotic start date and 1 year later. This provided an equal-length study period for each individual and study periods that reflected a variety of start/end dates, as did the cohort who developed IBS (an attempt to reduce antibiotic administration bias that may occur over time). For this study, we studied only indication for antibiotic use rather than duration and more refined measures.

Statistical Methods

Simple statistics such as means, standard deviations, frequencies, and percentages were calculated. For the primary analysis, the association of broad-spectrum antibiotic use (indication of use rather than verified use) between those who developed IBS within 1 year of the patient's 2008 antibiotic start date and those who did not was assessed via χ^2 tests for penicillin use, macrolide use, cephalosporin use, and tetracycline use—and via Fisher exact test for betalactam use due to low frequency of indication. As secondary measures, we compared the 2 study groups on demographic measures and comorbid conditions (identified by ICD codes) that existed prior to the start of the antibiotic time interval (fibromyalgia, anxiety, depression, pelvic pain, diabetes mellitus, chronic fatigue), and number of comorbid conditions existing prior to the start of the antibiotic time interval (excluding diabetes mellitus and chronic fatigue); continuous variables were assessed via *t* tests. Categorical (and ordinal) variables were assessed via χ^2 tests; if at least 25% of expected cell counts were less than 5, the Fisher exact test was used instead. In addition, a multivariate logistic regression model was built using significant univariate variables; a stepwise selection method was used with entry at the 0.05 level. A *P* value <.05 was considered significant. We report a C statistic (area under the receiver operating characteristic curve) for the multivariate model; the C statistic is a value from 0.5 to 1 in which values closer to 1 indicate a model that better differentiates between those who developed IBS within 1 year and those who did not than do models with a lower C statistic value.

RESULTS

After applying exclusionary criteria, 26,107 patients remained in the study. However, 4743 did not have at least 1 year of follow-up to be included in analysis. Of the remaining 21,364, 115 (.54%) developed IBS in the year after they began the antibiotic. Of these, 38 (33%) had a gastroenterology visit, and the remaining 77 (67%) did not. In addition, a retrospective review of the medical records of the 115 patients with an IBS diagnosis showed that 9 (8%) fulfilled Rome III criteria, while the medical records of the remaining 106 (92%) did not contain enough information to determine whether the criteria were met. The mean time to IBS was 5.9 ± 3.3 months.

Primary analysis showed that those who took a macrolide had a higher rate of IBS development than those who did

not take the antibiotic (0.71% [40 of 5595] vs 0.48% [75 of 15,769]; $P = .036$); likewise for those on a tetracycline (0.73% [40 of 5479] vs 0.47% [75 of 15,885]; $P < .025$). Those on a betalactam (0% [0 of 17] vs 0.54% [115 of 21,347]; $P > .999$), a cephalosporin (0.58% [27 of 4669] vs 0.53% [88 of 16,695]; $P = .673$), or a penicillin (0.58% [55 of 9387] vs 0.5% [60 of 11,922]; $P = .432$) did not exhibit the same pattern.

Secondary analyses revealed there were differences in sex, age, body mass index (BMI) class, and comorbid conditions between those who developed IBS and those who did not (Table 1). After including the significant univariate predictors of sex, age, or indications of fibromyalgia, anxiety, depression, pelvic pain, macrolide, and tetracycline into a multivariate model, the following were simultaneous significant predictors for IBS development: sex, fibromyalgia, anxiety, pelvic pain, and tetracycline (Table 2).

DISCUSSION

Irritable bowel syndrome is a functional bowel disorder of unknown etiology; several hypotheses have been formulated—among them, bacterial overgrowth has been extensively debated. We assume that in a healthy individual, antibiotics are responsible for the alteration of the intestinal microbiota. Whether that leads to bacterial or yeast overgrowth, the end results could be responsible in part for the development of IBS.

As mentioned previously, Quigley and others believe that bacterial overgrowth is less likely to contribute to the development of IBS, but the authors made no mention of yeast overgrowth. However, data regarding the efficacy of rifaximin in IBS would tend to support a bacterial overgrowth type of process. Santelmann et al[14] suggest that *Candida* overgrowth could be responsible in part for the development of IBS.

Candida is a genus of fungus that thrives in the abundance of sugar and can be cultured from 80% of human feces.[15] *Candida* is known to proliferate rapidly in the colon after antibacterial therapy.[16] *Candida* releases alcohol and glycoproteins that stimulate mast cells to release histamine and prostaglandins. Both of these aforementioned substances cause inflammation, which can cause the symptoms associated with IBS.[17]

Unfortunately, we do not have a test that distinguishes between yeast sensitivity and yeast overgrowth in the gut,[14] which makes diagnosis of this condition more challenging. We do know, however, that antibiotics that inhibit obligate anaerobes in the intestinal tract (ie, amoxicillin, erythromycin, and several cephalosporins[7,9,10,12]) may be more likely to promote overgrowth of *Candida* than those that do not.[11]

While the mechanisms, including causality, are beyond the scope of the study, and while the number of patients who received betalactams was too small to draw any real conclusion, some of the antibiotics seem to be associated with the development of IBS. Thus, further studies that investigate the IBS relationship between yeast sensitivity and overgrowth are recommended.

There are limitations to our study. For example, we were unable to confirm the diagnosis of IBS because in many of the medical records reviewed, the scientific criteria required for the diagnosis (ie, Rome III criteria) are not documented. This

Table 1. Demographic and Clinical Data for Patients Treated with Broad-Spectrum Antibiotics by Irritable Bowel Syndrome Status[a]

Characteristic	IBS (n=115)	No IBS (n=21,249)	*P* value
Age, mean years ± SD	46.2 ± 18.6	49.8 ± 18.6	.036
Women	97(84)	12,739 (60)	<.001
BMI class, kg/m2			<.001
Normal	22(19)	3027 (14)	
Overweight	26(23)	3888 (18)	
Obese	52(45)	6134 (29)	
Not available	15(13)	8200 (39)	
Comorbid condition			
Fibromyalgia	29 (25)	2269 (11)	<.001
Anxiety	33 (29)	2779 (13)	<.001
Depression	38 (33)	4493 (21)	<.001
Pelvic pain	26 (23)	1396 (7)	<.001
Diabetes mellitus	14 (12)	2524 (12)	.922
Chronic fatigue	0 (0)	20 (<1)	>.999
Number of comorbid conditions[b]			**<.001**
0	50 (44)	13,919 (66)	
1	25 (22)	4514 (21)	
2	23 (20)	2118 (10)	
3	13 (11)	605 (3)	
4	4 (3)	93 (<1)	
Antibiotic prescribed			
Betalactam	0 (0)	17 (<1)	>.999
Cephalosporin	27 (24)	4642 (22)	.673
Macrolide	40 (35)	5555 (26)	.036
Penicillin	55 (48)	9387 (44)	.432
Tetracycline	40 (35)	5439 (26)	.025

[a]Values are presented as number of patients (%) unless otherwise indicated.
[b]Comorbidities included were fibromyalgia, anxiety, depression, and pelvic pain.
Abbreviations: IBS = irritable bowel syndrome; SD = standard deviation; BMI = body mass index.

Table 2. Multivariate Logistic Regression

Variable	Odds Ratio	95% CI	*P* value
Sex (women vs men)	2.74	1.63-4.60	<.001
Fibromyalgia	2.03	1.31-3.14	.002
Anxiety	1.87	1.23-2.85	.003
Pelvic pain	2.49	1.57-3.95	<.001
Tetracycline	1.48	1.01-2.18	.046
Model C statistic	.71		

Abbreviation: CI = confidence interval.

does not mean that the attending did not make an effort to use scientific criteria.

Another limitation was the retrospective nature of the study, a circumstance in which we lack control over the assignment of patients to an antibiotic category. Moreover, we were not able to determine exactly how long (duration) patients were scheduled to be on the particular antibiotic(s), patient compliance during the scheduled period(s), or what specific antibiotic(s) patients were using; thus, we measured indication for use rather than confirmed use. In order to accurately capture duration and compliance data, a prospective study is needed. In addition, many patients were lost to follow-up (about 5000). This latter issue could have been related to the fact that we identified only 115 patients who developed IBS within a year of their 2008 antibiotic start date. Another confounding variable is that patients with IBS tend to seek healthcare more frequently, thereby increasing the likelihood that they will be exposed to antibiotics; however, we attempted to factor out pre-existing IBS and related diagnoses.

Even with the above-mentioned limitations, the study does show some interesting relationships. First, our results were consistent with findings from other studies regarding the associations of IBS with sex, age, BMI (although BMI was unavailable in a substantial number of records, the percentage of which differs between cohorts), and comorbid conditions. Further, we found an association between IBS development and antibiotic use in both univariate and multivariate models; however, with the apparently low overall IBS rate, it is also not known if the antibiotics relationships found in this study indicate that they increase the chance of IBS development or simply that they do not decrease it as much as other antibiotics. Further studies are needed, particularly those with a prospective, randomized, controlled format or those using a prospectively designed database geared toward a more elaborate matched case-control study.

CONCLUSION

The use of broad-spectrum antibiotics may have a relationship with the development of IBS, particularly when tetracyclines and macrolides are used. To date, we know of no other study that has associated use of these antibiotics with the development of this condition. Further studies are necessary.

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An Update on the Diagnosis and Management of Concussion

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ABSTRACT

Concussion is a common medical problem with significant morbidity and sometimes devastating consequences. Awareness of this injury has increased dramatically in recent years, and our understanding of its pathophysiology and treatment is rapidly evolving. This article reviews the current concepts of concussion pathophysiology and epidemiology, and will provide an overview of proper diagnosis and management. Complications and risk reduction also will be reviewed. By understanding the essentials of concussion medicine, health care professionals will be equipped to manage this injury, including common complications.

INTRODUCTION

Concussion is a common medical problem with significant morbidity and sometimes devastating complications. Awareness of this condition and the importance of proper management has increased significantly in recent years. High profile cases involving athletes, large numbers of US armed services personnel sustaining battlefield injuries, as well as new research revealing the long-term risks of this injury have brought concussion to the forefront of mainstream medicine and the mass media. The goal of this article is to provide physicians with a review of the current state of concussion medicine, including recommendations for management and strategies to minimize risk of both short- and long-term complications.

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CME available. See page 28 for more information.

Definition

The currently accepted definition of concussion, established in 2008, is as follows:

> Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:
>
> 1. Concussion may be caused by either a direct blow to the head, face, or neck or elsewhere on the body with an "impulsive" force transmitted to the head.
> 2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
> 3. Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
> 4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in a small percentage of cases post-concussive symptoms may be prolonged.
> 5. No abnormality on standard structural neuroimaging studies is seen in concussion.[1]

Notably absent from the current definition of concussion are the previously used grading systems that were abandoned in 2001.[2] In 2004, a classification system including simple and complex concussion was established.[3] A simple concussion was defined as an injury that progressively resolves without complication over 7 to 10 days. In contrast, complex concussion was defined as an injury with persistent symptoms, specific sequelae such as concussive convulsion, loss of consciousness lasting more than one minute or prolonged cognitive impairment. This classifica-

Table 1. Signs and Symptoms of Concussion

Physical	Cognitive	Emotional	Sleep
Headache	Feeling mentally "foggy"	Irritability	Drowsiness
Nausea	Feeling slowed down	Sadness	Sleeping less than usual
Vomiting	Difficulty concentrating	More emotional	Trouble falling asleep
Balance problems	Difficulty remembering	Nervousness	
Dizziness	Forgetful of recent information		
Visual problems	or conversations		
Fatigue			
Sensitivity to light	Confused about recent events		
Sensitivity to noise	Answers questions slowly		
Numbness/Tingling	Repeats questions		
Dazed or stunned			

tion system was discarded in 2008 amid concerns that it did not adequately describe concussions. It has been replaced by a group of modifying factors that help assess the severity of an injury (discussed further in the Management section).

Pathophysiology

The most common mechanism of head injury is dynamic loading caused by either direct impact to the head or by impulse, a sudden movement of the head produced by an impact elsewhere. Both impact and impulse injuries produce acceleration forces that can damage the brain.[4] It appears that rotation of the head is necessary to produce diffuse lesions in the brain, causing concussion, while translation of the head in the horizontal plane tends to produce focal lesions such as cerebral contusions and intracranial hematomas.[5]

The neurometabolic response to concussion has been studied in animal models. Biomechanical injury to the animal brain triggers unchecked neurotransmitter release and ion flux through channels in the axonal membrane. An acute efflux of potassium depolarizes the neuronal cellular membrane. The sodium-potassium pump utilizes increasing amounts of adenosine triphosphate in an effort to restore the membrane potential. This hypermetabolic state in the presence of relatively decreased cerebral blood flow creates an energy deficit that may account for post-concussive symptoms, as well as injury vulnerability, leaving the brain less able to respond to a second injury or leading to more persistent deficits.[6]

Epidemiology

Traumatic brain injury (TBI) is a common medical problem in the United States with an estimated 1 million to 1.5 million injuries occurring each year.[7] Of these injuries, approximately 85% are considered mild traumatic brain injuries or concussions.[8] Other estimates of the number of concussions occurring annually are as high as 3.8 million injuries per year.[9] The incidence is difficult to measure due to the difficulty in diagnosis, lack of public awareness, and athletes frequently underreporting symptoms with the goal of returning to play.[10] The leading causes of concussions treated in emergency departments are falls, motor vehicle collisions, unintentional head trauma, assaults, and sports. The frequency of these mechanisms varies with age. At the extremes of age, falls are the most common cause of concussion. Assaults and motor vehicle collisions are most common among middle-aged adults, while sports and bicycle accidents are most common in children and teens.[8]

A subset of the US population with an unfortunately high incidence of TBI is military personnel deployed to Iraq and Afghanistan. Since 2001, over 1.5 million American military personnel have served and an alarming rate of 22% of all wounded soldiers have suffered a traumatic brain injury.[11] A recent study of 2500 US Army infantry soldiers returning from a 1-year tour of duty found an incidence of concussion of 15%.[12] This study defined concussion as an injury involving loss of consciousness or altered mental status. Compared to previous US military conflicts, the incidence of TBI has increased significantly, for several likely reasons. Advanced body armor allows soldiers to survive blasts that would have been deadly in previous wars. The frequency of blast attacks from improvised explosive devices predisposes current soldiers to concussive injuries. Finally, both soldiers' and the medical community's understanding of these injuries has increased significantly, likely resulting in increased diagnosis.[13]

The epidemiology of sports-related concussion has been well studied. It is estimated that 1.6 million to 3.8 million sports-related concussions occur annually. Of these, only 300,000 result in a loss of consciousness.[9] Among 15- to 24-year-olds, sports-related concussions are second only to motor vehicle crashes as the leading cause of TBI.[14] Sports-related concussions are reported to be more common in females in sports with both male and female participants.[15] It has been postulated that this is due to relatively decreased lower neck strength and girth, which results in greater head acceleration after impact.[16] Among high school and collegiate athletes, concussion rates were highest in football and soccer.[15] In all sports, collegiate athletes had a higher rate of concussion than high school athletes.[15]

DIAGNOSIS

Signs and Symptoms

The signs and symptoms of concussion fall into 4 categories: physical, cognitive, emotional, and sleep (Table 1).[17] Headache is the most common symptom, with frequency between 40%

and 86%.[18] The constellation of signs and symptoms in a given patient traditionally has been thought to offer insight into the severity of injury and need for further diagnostic testing. However, the importance of various symptoms in terms of predicting injury severity and prognosis is unclear and remains an area of debate. One early review found that loss of consciousness (LOC) at the time of concussion signals a more serious injury and carries a greater risk of associated intracranial pathology.[19] However, a subsequent study found no difference in post-concussion neuropsychiatric testing results between patients who had or had not suffered LOC with their injury.[20] Another review found that amnesia, not loss of consciousness, was the symptom most predictive of symptom and neurocognitive deficits.[21]

Initial Evaluation

The initial evaluation of a patient with a suspected concussion, conducted in an emergency department, office setting, or sporting event, should focus on several important areas. The history should cover common symptoms of concussion and review any past head injuries. The physical exam should include a neurologic exam (focused on mental status, balance, and gait) and examination of the cervical spine and head. A brief assessment of cognitive function also should be conducted. This may include 5-word recall, naming the months in reverse order, and reading random digits back in reverse order. Pocket-card concussion assessment tools, such as the Sport Concussion Assessment Tool (SCAT2) guide clinicians through a standardized evaluation. The SCAT2 is a collection of several previously validated assessment tools and symptom lists.[1] The final step in the initial assessment is determining the need for neuroimaging. While early studies suggested that all patients with loss of consciousness or amnesia after head injury should have a cranial computed tomography (CT) scan in the emergency department, subsequent findings refuted this approach.[22] The majority of patients (65%-85%) presenting to emergency departments after minor to moderate head injury have a Glasgow Coma Scale (GCS) of 15. Often, these patients do not require neurologic imaging. One study examining 2143 patients presenting to a large, urban level 1 trauma center with head trauma and a GCS of 15 found that no patients with the absence of nausea, vomiting, severe headache, and skull depression required neurosurgical intervention. Only 3.7% of these patients had abnormalities on head CT, none of which were clinically significant.[23] The current International Conference on Concussion in Sport consensus recommends neurological imaging only in situations of prolonged alteration of consciousness, focal neurological deficit, or worsening symptoms.[1]

When imaging is necessary, CT is the test of choice for the diagnosis of intracranial pathology in the first 24 to 48 hours after injury due to its availability, relatively low cost, and capability to detect fracture and intracranial hemorrhage. Forty-eight to 72 hours after injury, magnetic resonance imaging (MRI) becomes the superior imaging modality due to its ability to detect hematoma, contusion, and axonal injury.[24] However, the majority of concussed patients have no structural pathology and will therefore not have any abnormality on CT or MRI. The abnormalities in these patients' brains are more likely to be metabolic, raising the potential application of functional MRI (fMRI).[25] This potential was demonstrated in a study of high school athletes when the degree of brain activation detected with fMRI was found to be associated with symptom duration and performance on neuropsychological testing.[26] For now, fMRI remains experimental and needs further research before being used for routine evaluation of concussion.

Neuropsychological Testing

Traditionally, the diagnosis and management of concussion has relied heavily on the patient's self-reporting of symptoms. Because symptom resolution often precedes cognitive recovery and because patients may not report symptoms in an effort to return to activity, the addition of neuropsychological testing can be a useful adjunctive tool in monitoring recovery after concussion.[27] Currently, neuropsychological testing is conducted most commonly with computerized tests, although paper versions are also available. While several computerized neuropsychological tests are available (Axon Sports, Concussion Vital Signs, Headminder, Automated Neuropsychological Assessment Metrics), the ImPACT (Immediate Post-concussion Assessment and Cognitive Testing) battery has been validated extensively and is used commonly.[28] The National Football League, National Hockey League, Major League Baseball, and many collegiate and high school teams currently use ImPACT testing.[29] Neuropsychological tests commonly evaluate the athlete's decision-making ability, reaction time, attention, memory, and cognitive processing speed in an objective fashion. The value of neuropsychological testing lies in its ability to detect patients who are asymptomatic following a concussion but still are suffering from lingering neurocognitive effects of the injury. Neuropsychological testing is used commonly to assist clinicians in determining whether to return an athlete to competitive play following a concussion. However, neurocognitive testing can miss concussions and therefore must be used along with clinical judgment, never in isolation, when making return-to-play decisions. It has been shown that athletes who have suffered a concussion but are asymptomatic perform below controls on neuropsychological testing, and their symptoms resolve prior to return of baseline cognitive function.[30] One study found that 2 days after concussion 64% of athletes had significant symptoms while 83% demonstrated poorer

Table 2. Factors Influencing Concussion Management and Return to Play

Factors	Modifier
Symptoms	Number Duration (>10 days) Severity
Signs	Prolonged loss of consciousness (>1 minute)
Sequelae	Concussive convulsions
Temporal	Frequency—repeated concussions over time Timing—injuries close together in time "Recency"—recent concussion or traumatic brain injury
Threshold	Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
Age	Pediatric (< 18 years old)
Co- and pre-morbidities	Migraine, depression or other mental health problems, attention deficit hyperactivity disorder, learning disabilities, sleep disorders
Medication	Psychoactive drugs, anticoagulants

performance on neurocognitive evaluation—a net increase of 19 % in sensitivity.[27]

MANAGEMENT

Cognitive and physical rest are the fundamental treatments of concussion. Considering the postulated energy crisis occurring in the brain after a concussion,this treatment regimen is intuitively logical.[6] Cognitive rest involves minimizing activities that require concentration and attention. Unnecessary reading, schoolwork, television watching, texting, and video games should be avoided. For acutely symptomatic patients, staying home from school or work is advisable in the initial days after concussion. Once symptoms have improved or resolved, patients may begin shortened work days with decreased work loads.[31] Students may benefit from short periods of reading and studying with frequent breaks, and may require extended time to complete examinations or assignments until they have fully recovered. Adequate physical rest involves avoiding any activity that could result in a second concussion and all strenuous activity including both aerobic and resistance training. Once patients are able to return to a full work or school schedule without symptoms or medications for concussion symptoms, they may initiate a return to physical activity. Athletes are currently advised to follow a slow, stepwise return to play. This involves slowly progressing from no activity to light aerobic exercise, sport-specific exercise, noncontact training drills, full-contact practice and finally return to play. Each step in this plan may be completed in 24 hours if no symptoms occur or recur. A recent study demonstrated that strenuous physical activity in patients suffering from concussion resulted in poorer neurocognitive testing scores when compared with patients engaging in intermediate levels of activity.[32] This finding supports the use of the currently accepted graded return to activity protocol. If symptoms do occur, the athlete should return to the previous activity level before progressing.[33]

Deciding when an athlete should return to play is rarely an easy decision. The fundamental rules are that an athlete should never return to play on the day of a concussion and must have full clinical and cognitive recovery before returning to play.[34] However, some experts agree that same-day return to play may be considered in adult athletes when adequate resources are present: a team physician experienced in concussion management, access to neurocognitive testing, and neuroimaging.[1] Several modifying factors also influence concussion management and return to play (Table 2).[1] When these factors are present, the patient should be cared for by a physician with experience in concussion management.[1]

Most patients will recover from concussion spontaneously within 1 week. However, the length of time to recover depends on age. Athletes younger than 18 years old may take from 7 to 14 days to recover.[35,36] The National Collegiate Athletic Association concussion study found that on average, concussed collegiate football players had resolution of symptoms within 7 days, regained baseline cognitive function within 5 to 7 days, and had normal balance within 5 days. However, 10 % of players required more than 7 days for symptoms to resolve.[37] If a patient's symptoms have exceeded the expected duration, or the symptoms are negatively affecting the ability to function, pharmacotherapy may be considered. Headache pain during the acute symptomatic period can be treated with analgesics such as acetaminophen and nonsteroidal anti-inflamatory drugs (NSAIDs). Aspirin should be avoided due to theoretical concerns of increased bleeding risk. If sleep hygiene is not adequate, diphenhydramine, melatonin, or other prescription sleep medications may be used for sleep disturbance. Finally, tricyclic antidepressants and selective serotonin reuptake inhibitor antidepressants may be used for persistent mood disturbances.[38]

COMPLICATIONS

The complications of concussion, though rare, are potentially serious. Recently, the potential for long-term complications of recurrent mild traumatic brain injury as commonly suffered in professional football players has gained widespread attention

in the mass media. However, the risk of recurrent mild head trauma has been appreciated in sport for many years. Originally studied in boxers, it was first known as the "punch drunk" or "slug nutty" state and eventually came to be called dementia pugilistica.[39] Currently, the clinical and neuropathologic consequences of repeated mild head injury are known as chronic traumatic encephalopathy (CTE). The disease manifests years or decades after the inciting head injury(ies) with effects on behavior, cognition, and movement. Behavioral changes are often the first sign and include increased irritability, anger, apathy, or suicidality. Cognitive changes may occur early in the disease course as well and may include loss of executive function and poor memory. Dementia, movement, and speech disorders can develop late in the course of the disease.[40] The characteristic neuropathology seen in CTE is the deposition of neurofibrillary tangles and neuropil threads throughout the neocortex. These neurofibrillary inclusions are made up of the tau protein.[41] The prevalence of this disease in people who have suffered concussions and the factors that increase susceptibility have yet to be elucidated.

Postconcussion syndrome (PCS) is another potential complication of concussion. It is defined as the persistence of postconcussive symptoms beyond the expected time frame of 1 to 6 weeks.[42] The incidence is estimated to be approximately 10%. Comorbid psychiatric illness, advanced age, heightened symptoms, and intense emotions at the time of injury are all apparent risk factors for developing PCS.[43]

A widely feared complication of concussion is the second-impact syndrome. While very rare, it may have devastating consequences. It is proposed to occur when someone who is still recovering from a recent concussion suffers a second head trauma. Significant morbidity and even death can result from the proposed mechanism of diffuse cerebral edema caused by cerebral vascular congestion, which can progress to brainstem herniation.[44] Some doubt that the cause of diffuse cerebral edema is 2 closely spaced injuries, arguing instead that a rare physiologic vulnerability may predispose some patients to developing cerebral edema after a single minor head trauma.[45,46] What appears to be more clear is that the risk of a second concussion is higher in the 7 to 10 days after an initial concussion.[46]

RISK REDUCTION

Concussion risk reduction initiatives include education, use of protective equipment, rule changes, and legislation. While public awareness and professional understanding of the frequency and dangers of concussion are improving, there is still significant progress to be made. A recent survey of high school and collegiate certified athletic trainers revealed that while they would not allow an athlete to return to play if still symptomatic (95%), they would allow an athlete still scoring below baseline on ImPACT testing to return to play (89%).[47] Another study found that 15% of concussed high school football players returned to play before the currently accepted guidelines would allow.[48] While athletic trainers are responsible for concussion management at many larger schools, this is often the responsibility of coaches and staff without any medical training at smaller schools. A survey of New England high school football coaches without access to athletic trainers found that the coaches had a much better understanding of concussion than the general public. However, 30% of coaches stated they would allow an athlete to return to play after a head injury that left them appearing to move clumsily, and 5% would allow an athlete back into the game after a loss of consciousness.[49] This study also offered an interesting insight into concussion education. It revealed that most coaches received concussion education from coaching associations and conferences. The Centers for Disease Control and Prevention (CDC) concussion kit, "Heads Up" was the most helpful source, but also the least used/received. The CDC has educational materials for coaches, clinicians, parents and athletes available for order at no charge from its website.[17]

The use of mouth guards, new football helmets, and proper heading technique for the prevention of concussion all have been studied. While mouth guard use significantly reduces the risk of orofacial injuries, there is no evidence of preventing concussion.[50] Recently, new football helmet designs have been introduced with the goal of reducing the risk of concussion. One study revealed decreased rates of concussion with the new helmets.[51] However, additional large trials are needed to conclusively prove that new helmet technology can prevent concussions. While the majority of concussions sustained in soccer are the result of collision rather than heading the ball, prevention has focused on the latter. Proper heading technique, including tensing the neck muscles prior to impact and striking the ball at the hairline on the forehead, are the most effective preventive strategies. There is currently insufficient evidence to support the use of protective headgear for preventing concussion in soccer.[52]

Rule changes and their enforcement are an essential element of concussion prevention. In 2010, the National Football League expanded rules protecting defenseless players by banning direct blows to the head.[53] The Wisconsin Interscholastic Athletic Association (WIAA), the governing body for high school athletics in Wisconsin, recently adopted a new rule that directs game officials to remove any football player from competition if he shows signs, symptoms, or behavior consistent with concussion. This supplements the WIAA protocol for

concussion which specifies that: (1) no athlete should return to play or practice on the day of a concussion; (2) any athlete suspected of having a concussion should be evaluated by a health professional that day and medically cleared prior to resuming practice or competition; and (3) after clearance, return to play should follow a stepwise protocol.[54]

Legislation regulating concussion management aims to prevent the potentially catastrophic effects of the injury. A law regulating concussion management was passed initially in the state of Washington in 2009 and many states have since passed similar legislation. In May 2011, a bill was introduced to the Wisconsin State Legislature that would require children and adolescents with symptoms consistent with concussion to receive written permission from a health professional before returning to organized athletic activities. The Wisconsin Medical Society, WIAA and Brain Injury Association of Wisconsin all support this legislation.[55]

CONCLUSION

Concussion is a common medical problem with significant morbidity and potentially devastating complications. As active research advances our knowledge of concussion, health care professionals must continue to improve their understanding of this injury in order to provide excellent patient care and to lead public health initiates aimed at risk reduction.

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CME

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Quiz: An Update on the Diagnosis and Management of Concussion

EDUCATIONAL OBJECTIVES

1. To understand the current concepts of the pathophysiology and epidemiology of concussion.
2. To understand the proper diagnosis and management of concussion.
3. To recognize the complications and late sequela of concussion.
4. To know strategies THAT are important to minimize the risk of short- and long-term complications of concussion.

PUBLICATION DATE: February 24, 2012

EXPIRATION DATE: February 24, 2013

QUESTIONS

1. Concussion is defined as a complex pathophysiologic process affecting the brain induced by traumatic biomechanical forces. Common features may include:
   - ❑ A. Concussion may be caused by a direct blow to the head, face, neck, or elsewhere on the body with an "impulsive" force transmitted to the head.
   - ❑ B. Concussion usually results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
   - ❑ C. The acute clinical symptoms of concussion generally reflect a structural brain injury.
   - ❑ D. A and B only
   - ❑ E. All of the above

• • •

You may earn CME credit by reading the designated article in this issue and successfully completing the quiz (75% correct). Return completed quiz to *WMJ* CME, 330 E Lakeside St, Madison, WI 53715 or fax to 608.442.3802. You must include your name, address, telephone number, and e-mail address.

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2. The current consensus on concussion in sport recommends neurologic imaging only in situations of prolonged alteration of consciousness, focal neurological deficits, or worsening symptoms.
   - ❑ True
   - ❑ False

3. When imaging is necessary after concussion, magnetic resonance imaging (MRI) is considered the test of choice in the first 24 to 48 hours after the injury.
   - ❑ True
   - ❑ False

4. The management of concussion is supportive and involves cognitive rest (which minimizes activities that require concentration and attention) and physical rest.
   - ❑ True
   - ❑ False

5. Complications of concussion, although rare, include the following:
   - ❑ A. chronic traumatic encephalopathy, which is long-term as a result of repeated mild head injury.
   - ❑ B. postconcussion syndrome, defined as the persistence of symptoms beyond the expected time frame of 1 to 6 weeks.
   - ❑ C. second-impact syndrome which occurs when an individual recovering from a concussion suffers a second head trauma which can result in diffuse cerebral edema, brainstem herniation, and death.
   - ❑ D. A and B only
   - ❑ E. All of the above

Immunoglobulin A Nephropathy Associated with Mesothelioma

Adewale Fawole, MD; Hamed Daw, MD; Harris Taylor, MD; Arash Rashidi, MD

ABSTRACT

Immunoglobulin A nephropathy (IgAN) has been identified in patients with various malignancies. Although membranous glomerulonephritis and minimal change disease have been described in patients with mesothelioma, to our knowledge IgAN associated with mesothelioma has not been reported. We present a case of IgAN, characterized by progressive deterioration of renal function from normal and confirmed by kidney biopsy. Despite improvement of renal function following treatment with cyclophosphamide and prednisone, the patient succumbed to acute respiratory failure 8 months later. We conclude that IgAN may be a potential complication of mesothelioma.

INTRODUCTION

Adult patients with cancer are at risk of developing acute renal failure from various causes including volume depletion, hypercalcemia, tumor lysis syndrome, chemotherapy, or accompanying paraneoplastic syndromes. Immunoglobulin A nephropathy (IgAN), once thought to be rare in patients with cancers, has now been described in association with renal cell carcinomas, lymphoma, and small cell lung carcinoma as well as membranous glomerulonephritis and minimal change disease.[1-3] We describe what is, to our knowledge, the first case of IgAN associated with renal failure in a patient with mesothelioma; membranous glomerulonephritis and minimal change disease have already been described in patients with mesothelioma.[4,5]

CASE REPORT

A 65-year-old man was admitted to hospital in February 2010 with chief complaints of progressive shortness of breath, dry cough and right-sided chest discomfort during the preceding 3 weeks. Past medical history was significant for diabetes mellitus, hypertension and dyslipidemia. He had a 20-pack per year history of cigarette smoking prior to quitting 25 years previously.

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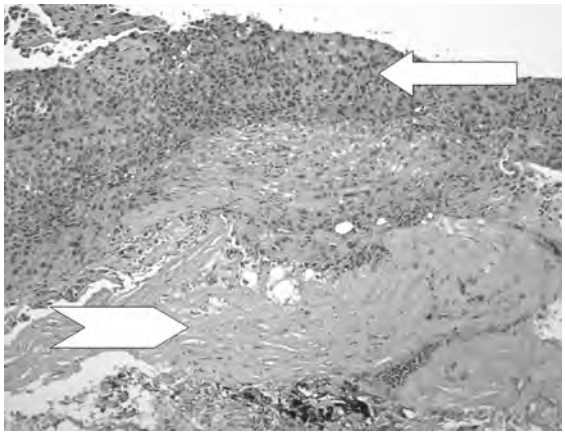
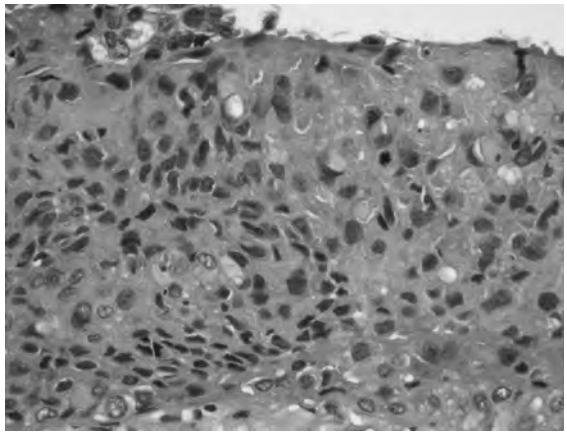
In addition, he experienced prolonged exposure to asbestos while working with the Navy and in the boiler industry. On physical examination he was dyspneic at rest. There was mediastinal shift to the left and dull percussion notes with absent breath sounds and vocal fremitus in his right hemithorax. The rest of the examination was normal. Complete blood count and serum electrolytes were normal. Serum creatinine (SCr) was 0.83 mg/dL. X-ray and computed tomographic scan of the chest showed a massive right pleural effusion. Following drainage of 4.8 liters of bloody pleural effusion, a talc pleurodesis to prevent recurrent effusion was performed. Histopathologic examination of a right parietal pleural biopsy revealed epithelioid mesothelioma (Figures 1A and 1B). Positron emission tomographic scan demonstrated direct right chest wall invasion by tumor, mediastinal adenopathy, and bilateral calcified pleural plaques.

At his office visit in April 2010, the patient's SCr was 1.0 mg/dL. Treatment with carboplatin and pemetrexed was initiated. After 5 cycles of carboplatin/pemetrexed, he was switched to gemcitabine in July 2010, because of poor clinical and radiologic response. One week after starting gemcitabine, SCr had risen to 1.5mg/dL. He was readmitted to hospital for pneumonia and worsening renal function in August 2010, 4 weeks after commencement of gemcitabine. At this time his SCr was 2.9 mg/dL. Urinalysis showed microscopic hematuria and proteinuria with a spot urinary protein to creatinine ratio of 1.96 mg/mg. Serum C3 and C4 levels were 143mg/dL (normal [nl] 90-180mg/dL) and 35mg/dL ([nl] 10-40mg/dL), respectively. Tests for antinuclear antibody, antineutrophil cytoplasmic antibody, hepatitis B surface antigen and hepatitis C virus antibody were negative. Serum and urine protein electrophoresis were negative for monoclonal gammopathy. White blood cell count was 7.6k/μL ([nl] 3.7-11.0k/μL), hemoglobin 9.3g/dL ([nl] 13.0-17.0g/dL) and platelet count 452 k/μL ([nl] 150-400 k/μL). The peripheral blood smear was normal with no schistocytes. The rapid progression

Figure 1. Histologic Findings in Lung Biopsy (A, B) and Kidney Biopsy (C-F) Specimens



A.



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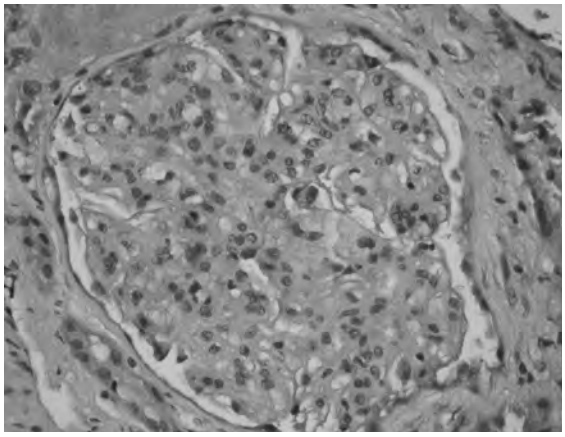

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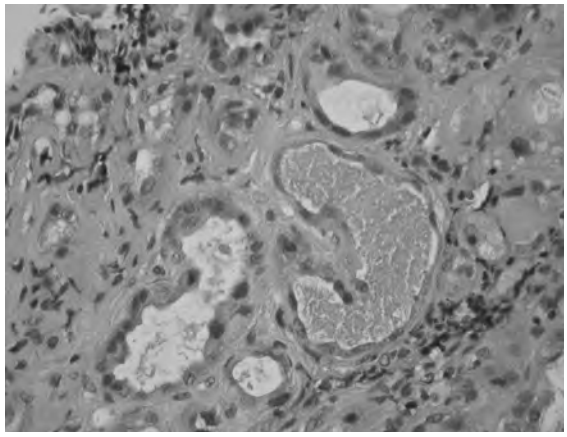

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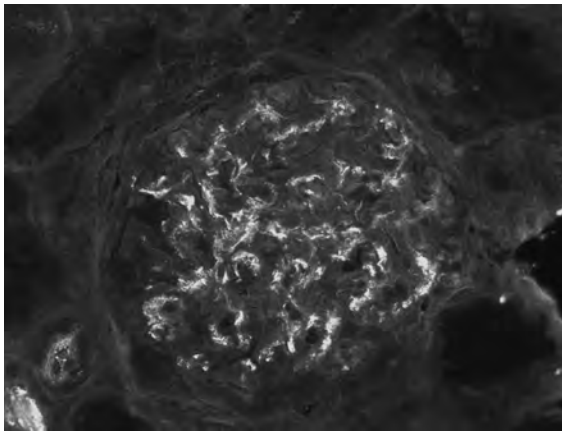

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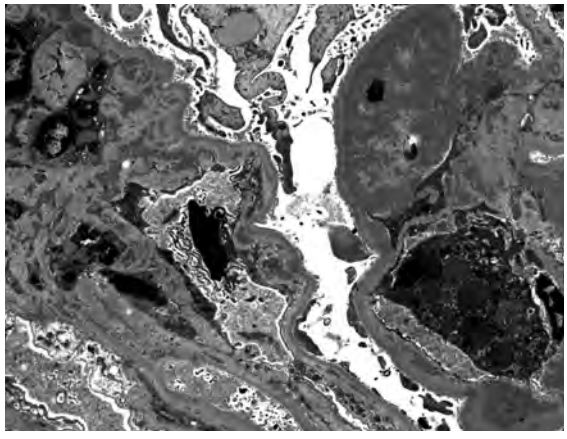

F

A. Epithelioid mesothelioma (arrow) on the surface of a fibrous pleural plaque (arrow head) (hematoxylin and eosin stain, magnification x 100) B. Epithelioid mesothelioma with ovoid nuclei, irregular nuclear membranes, prominent nucleoli, high mitotic activity, and abundant pink cytoplasm in a haphazard growth pattern (hematoxylin and eosin stain, magnification x 400) C. Mesangial hypercellularity (hematoxylin and eosin stain, magnification x 400) D. Acute tubular injury (hematoxylin and eosin stain, magnification x 400) E. Co-dominant moderate staining with IgA in mesangium (immunofluorescence stain, magnification x 400) F. Electron microscopy shows mesangial and subendothelial electron dense deposits (Electron micrograph, magnification x 4400).

Table 1. Reports of Immunoglobin A Nephropathy (IgAN) Associated with Neoplasias

Author	Age / Gender	Diagnosis	Interval between neoplasia and IgAN diagnosis / Treatment given	Clinical course of IgAN
Cherubini et al [2]	44 years / Male	Hodgkin's lymphoma	1 year / MPL, PS, MOPP, ABVD and dialysis	Renal failure but recovery at 6 months
Bergmann et al [13]	60 years / Female	Hodgkin's lymphoma	2 weeks / MPL, PS, CY, BEACOPP	Remission
Yacoub et al [3]	55 years / Male	Small cell lung carcinoma	Simultaneous / Dialysis and carboplatin	End stage renal disease
Mak et al [12]	62 years / Male	B cell lymphoma	Simultaneous / Chlorambucil	Remission at 20 months

Abbreviations: MPL, methylprednisone; PS, prednisone; MOPP, nitrogen mustard, oncovin, procarbazine, prednisone; ABVD, adriamycin, bleomycin, vinblastine, darcabazine; CY, cyclophosphamide; BEACOPP, bleomycin, etoposide, doxorubicin, cyclophosphamide, vincristine, procarbazine, prednisone; etoposide.

of his renal failure and the presence of microscopic hematuria and proteinuria necessitated a kidney biopsy. Light microscopy showed 9 glomeruli present; one was globally sclerotic and there was mesangial hypercellularity in the rest (Figure 1C). Focal tubular dilatation and flattening of the epithelium with granular debris were noted (Figure 1D). Moderate fibrointimal hyperplasia of the arterioles was present. Focal tubular atrophy and interstitial fibrosis were seen surrounding the sclerotic glomerulus.

Immunofluorescent staining showed mesangial positivity for C3 (2+), IgA (2+), lambda (trace) and kappa (trace). IgG, IgM and C1q were negative (Figure 1E.) Electron microscopy showed large mesangial and paramesangial electron dense deposits (Figure 1F). Rare subendothelial electron dense deposits were seen and the glomerular basement membranes were mildly thickened. These results were consistent with IgAN and acute tubular injury.

The patient was begun on cyclophosphamide 125mg daily and prednisone 60mg daily for treatment of his IgAN while gemcitabine was continued. At his subsequent office visit in early October 2010 his renal function had improved with SCr falling from 2.9 to 2.2 mg/dL and spot urine protein to creatinine ratio from 1.96 mg/mg to 1.7 mg/mg. He was readmitted for the last time in late October 2010 with acute respiratory failure. According to his wishes, life support measures were withdrawn and he died shortly thereafter.

DISCUSSION

Primary IgAN is an immune-complex mediated glomerulonephritis of unknown etiology characterized by the deposition of IgA in the glomerular mesangium demonstrable on immunohistological examination of the kidneys. Secondary causes of IgAN include diseases of the liver, intestine, human immunodeficiency virus infection, and neoplasias.[6] Case reports have described biopsy-proven paraneoplastic IgAN in some patients with renal cell carcinomas, lymphoma, and small cell lung carcinoma.[1-3] However, to our knowledge IgAN associated with mesothelioma has not been described previously. We believe that the IgAN in our patient is likely due to mesothelioma although chance association remains possible. Gemcitabine initially was suspected as the cause of renal failure based on previous reports of gemcitabine-induced thrombotic thrombocytopenic purpura-hemolytic uremic syndrome.[7-9] However, thrombocytosis and absence of typical red cell changes on peripheral smear negated this possibility. To our knowledge, gemcitabine is not known to cause IgAN which has, however, been described in patients with malignancies. More importantly, the improvement in his renal function while he continued to receive gemcitabine, cyclophosphamide, and prednisone made gemcitabine an unlikely cause of his renal insufficiency.

The exact pathogenesis of IgAN remains unknown. As in primary IgA nephropathy,[10] no specific antigen has been consistently identified in the circulating IgA-containing immune complexes and the kidney biopsies of patients with paraneoplastic IgAN. Mimura et al[11] found IgA and interleukin-6 in the plasma cells and lymphocytes around the renal cell carcinoma in their 3 patients. They believed that these infiltrating cells produced the IgA deposits in the glomerular mesangium. Mak et al[12] proposed a direct link between a B-cell lymphoma of mucosa-associated lymphoid tissue and simultaneously diagnosed IgAN in their patient. As demonstrated in Table 1, temporal relationships exist between the occurrence of IgAN and diagnosis of associated malignancies. IgAN has been diagnosed both concomitant with and after the diagnosis of cancer.[2,13] Our patient developed hematuria and proteinuria with renal failure 6 months following diagnosis of mesothelioma.

Because of our patient's deteriorating renal function, he received treatment with cyclophosphamide and prednisone with appreciable improvement in renal function before succumbing to respiratory failure.

CONCLUSION

We believe this is the first report of mesothelioma and coexisting IgAN and that it expands the number of cancers associated with paraneoplastic IgAN.

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Increasing Medical Team Cohesion and Leadership Behaviors Using a 360-Degree Evaluation Process

Marc Tumerman, MD; Leanne M. Hedberg Carlson, MBA

ABSTRACT

Current national health care issues of affordability, quality, and accessibility have prompted the development of Accountable Care Organizations (ACOs) and Patient-Centered Medical Homes (PCMHs). Components of ACOs and PCMHs call for increased capacities in areas of teamwork, engagement, and physician leadership skills and behaviors. Three hundred sixty degree feedback evaluation processes have been established in corporate environments as effective for increasing capacities in these areas. Recently, health care organizations have begun to adopt the use of such tools with positive outcomes. This article presents a case study of the development and implementation of a 360-degree evaluation process at a family medicine clinic. We also discuss the challenges, successes, and lessons learned along the way.

INTRODUCTION

A growing body of research demonstrates the significance of physicians' interpersonal skills in relationship to improved patient experience,[1] treatment effectiveness[2,3] and a culture of safety.[4] Additionally, interpersonal skills are recognized as playing a significant role in team cohesion[1,5] and leadership development,[6-8] both of which are components of the successful development of PCMHs and ACOs.[9-12] For example, the National Demonstration Project, which studied 36 primary care practices transitioning to the PCMH model, noted that integral to the transition are the physicians' capacity to communicate well and to develop trust among staff.[13]

Three hundred sixty degree evaluation processes increasingly are recognized as being effective in developing positive leadership behaviors,[14,15] especially when combined with coaching.[16] Positive leadership behaviors (for example, approachability and respect) in turn are shown to enhance team cohesion, physician and staff engagement,and an improved culture of safety, all three of which correlate to decreased frequency of errors.[17,18]

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Used initially in corporate settings, these processes recently have been adopted by healthcare organizations[19] as the leadership development of physicians is recognized as critical to organizational effectiveness.

In our clinic (in which the first author is a practicing physician and the second author was the consultant for this process), we had additional motivation for implementing a 360-degree evaluation process: the atmosphere in our medical practice did not allow for safe and productive process improvement communications between clinical and office staff. For example, a scheduling request made by a provider to an office staff member could result in a cascade of negative interactions, the repair of which consumed valuable time and energy.

In light of the perceived power imbalance and hierarchy typically found in health care organizations, our provider group decided it would be best for us to assume primary responsibility for these communication obstacles. Moreover, we thought the process might help us discover "blind spots" in our personal communication and practice habits.

A desired outcome was visible progress toward the creation of a "coaching culture"[20] in which levels of trust and communication would allow for respectful, productive coaching—both spontaneous and scheduled—to support achievement of organizational goals. The ideal environment would be one in which a staff member or allied health provider would feel safe providing ongoing feedback to the provider team, and in which the provider receiving the feedback would be able to accept and integrate it in the spirit of continuous improvement and both personal and professional growth.

BACKGROUND

This case study was conducted in a family medicine clinic in a rural central Wisconsin community, part of a large, integrated health system serving a tri-state area. The clinic is staffed by 6 full-time family physicians and 2 associate mid-level providers.

Table 1. 360-degree Evaluation Questions; Multisource Feedback Survey Questions

1. When this provider interacts with you at work, he/she always shows respect for you as a member of our health care team.
2. He/she provides compassionate care to every patient.
3. This provider supports your own professional growth as a member of our health care team. Examples: he/she encourages you to learn new skills, helps you understand treatment plans, or includes you in quality improvement initiatives.
4. This provider has demonstrated his/her willingness to listen to feedback and to change and improve their practice habits as part of a culture of practice enhancement and innovations. Here we are most interested in the provider's willingness to listen and change when appropriate.
5. This provider regularly gives positive feedback and recognition to those with whom he/she works.
6. This provider is an excellent clinician. He/she practices quality medicine through the use of evidence-based medicine and the most up-to-date practice recommendations.
7. This provider's work habits support the success of the team by being timely, efficient, and available to meet the needs of our patients and fellow team members.
8. Would you refer your family or friends to this provider?

Each question had a 5-point Likert scale and a space for comment.

Providers range in age from 35 to 55 years, with a similar number of males and females. Years in practice range from 3 to 27. The 42-member support staff consists of allied health providers including nurses, laboratory and radiology staff, and business office personnel.

METHODS

In this study, a 360-degree evaluation is defined as a performance evaluation of providers (physicians and associate providers) that focuses on interpersonal and communication skills and which is completed by all clinic staff and the providers themselves. Although not included for this specific process, evaluations also could have been requested from patients, suppliers, and referring physicians.

There was initial apprehension that using a 360-degree evaluation process in an environment where tensions already existed might aggravate rather than improve negative behaviors and relationships. Therefore, the provider team decided to partner with an external consultant[21] possessing expertise in organizational development and leadership coaching, who worked directly with the lead physician. The use of an external consultant provided a sense of objectivity and trust in maintaining anonymity with regard to the provider feedback (ie, the external consultant was not perceived as being embedded in the culture and politics of the organization). The consultant developed the evaluation survey in partnership with the lead physician and with input from the provider team. The consultant gathered, analyzed, and delivered the feedback data. During year 1, the consultant provided professional development on coaching skills. During year 2, the consultant provided the feedback to each provider during one-on-one coaching sessions and facilitated group processes/meetings. The consultant spent approximately 80 total hours on each annual process. The administrative leadership of the clinic served as a champion for the process, encouraging trust and participation from staff.

While a number of "off-the-shelf" 360-degree evaluation tools with standardized questions exist, our practice decided to develop a unique feedback process that used our organizational values as the benchmark for measurement and evaluation. When providers join our practice, they are asked to sign a "values compact," a document that spells out system-wide, agreed-upon organizational values as outlined below. Developing and using a tool based on longstanding organizational values served the dual role of educating staff about those values and reinforcing them.[22]

The organizational values measured in this process were:

- teamwork
- efficiency
- compassion
- support of team members
- quality of care
- respect
- willingness to change

The survey was administered in 2009 and 2010 using Survey Monkey (www.surveymonkey.com). The survey tool provided anonymity, analysis, and reporting of data. The survey consisted of 8 questions (Table 1) and used a 5-point Likert scale. Providers were established as a separate response group from the rest of the staff. Participation in the process was voluntary. Precautionary measures were taken to maximize internal validity including evidence of temporal precedence and no plausible alternate explanations for the results. (See Results).

Year 1

The survey response rate was 75% (6/8) for the provider group and 81% (34/42) for the staff group. Individual feedback, along with blinded aggregate data, was given to each provider in writing. Within 2 weeks of receiving feedback, the providers participated in a professional development session facilitated by the consultant during an annual retreat in which training was provided on coaching and communication skills. Providers were not asked to share their feedback with one another, although one provider did so in the spirit of fostering an open group dynamic.

Participants generally felt the first year's feedback was

"benign" in nature. Providers' ratings were fairly high and there was little specific feedback, either positive or negative. Upon reflection, the provider team concluded that staff training was needed on how to deliver useful feedback. They also concluded that the benign feedback was likely due to a lack of trust in the confidentiality, anonymity, and usefulness of the process. Although providers expressed disappointment in the lack of specificity, they agreed that an important and unanticipated need for this first year was to establish a sense of trust in the process. After the retreat, the provider team agreed to implement the process the following year and also to modify the survey for year 2 by including comment fields after each question. Unfortunately, due to the relative lack of feedback from year 1, providers found it difficult to develop and implement action plans.

The provider team followed up with staff members via e-mail, describing the process outcomes, thanking them for their participation, and letting them know that the feedback was important to providers' continued professional development.

Year 2

In year 2, the response rate was 86% (5/6) for the provider group and 83% (35/42) for the staff group. The quality of feedback in year 2 differed from that of year 1 in that it was more specific and included negative as well as positive responses. Therefore, the feedback was delivered to providers during individual coaching sessions. Following the individual sessions, the provider group held a 2-hour, off-campus session facilitated by the consultant, with the objectives of transparently reviewing the results and having an opportunity to receive and provide peer coaching. Although names were assigned a code to blind results, all providers were able to see their own results with comparative data for the provider team as a whole. Each provider was given an opportunity to address concerns regarding his or her own or the group results. The consultant's presence during this session was necessary to establish a safe environment and to guide providers as they practiced a supportive coaching style of feedback with their colleagues.

The consultant used the guiding principles of CoachInc (www.coachinc.com) as the basis for her work with the providers. For example, instead of "telling a partner what we thought they should do better," providers were encouraged to ask the partner how he/she might envision a different approach to a difficult conversation with a staff member. Or they might ask the partner to recall a time when he/she successfully navigated a difficult conversation to build a positive relationship with a coworker.

This session was instrumental not only in developing and practicing coaching skills, but also allowed for the development

Figure 1. Provider Improvements on Core Values

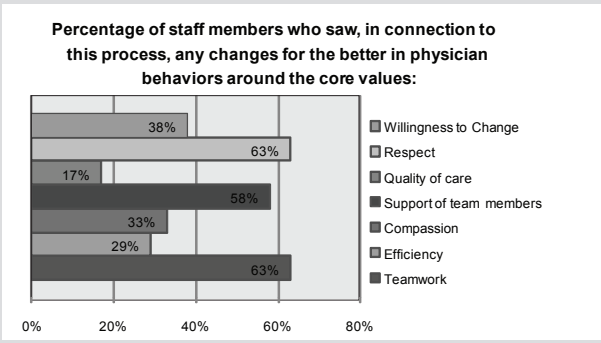
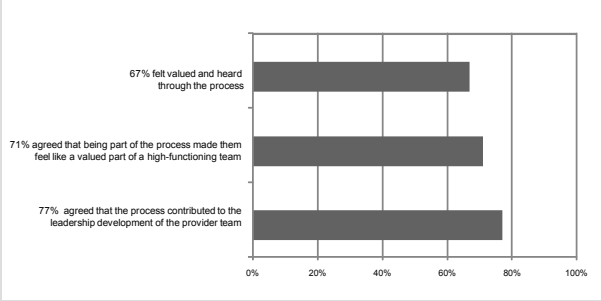


Figure 2. Staff Evaluation of the Process.



of individual action plans. For example, one provider chose to form an alliance with a receptionist to provide real-time feedback on his communication with reception staff. This alliance provided coaching to the provider, as well as an opportunity to transform the power imbalance that traditionally exists between support staff and physicians.

As with year 1, providers followed up with staff via e-mail, again thanking them for their participation and explaining how the feedback was delivered to the physicians and how it was used during the facilitated session and in the development of action plans.

RESULTS

Following the completion of the second year of the 360-degree evaluation process, the campus achieved the highest score within our entire system on a culture of safety survey, ranking nationally in the top 10%. There is no statistical evidence establishing a direct correlation between the 360-degree evaluation intervention and the culture of safety survey score. However, anecdotal evidence points to the 360-degree evaluation process as being a significant factor contributing to the clinic's high culture of safety scores.

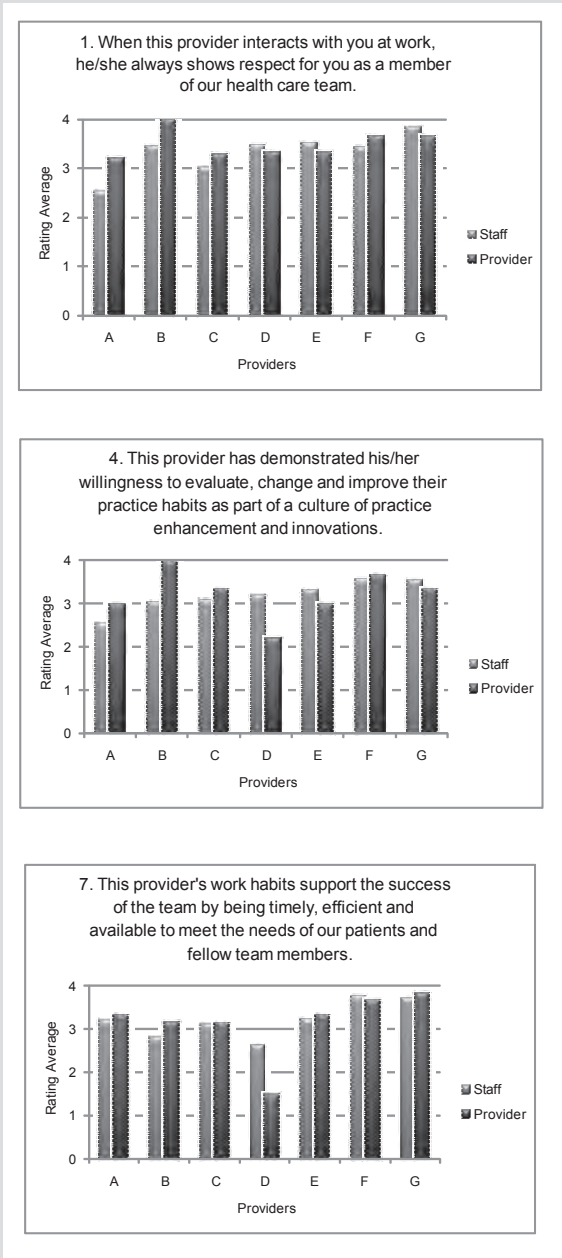
Also following the second year of implementation, staff members were asked how they perceived provider behavior changes with regard to the core values that were measured by

Table 2. Year-Two Process Evaluation Survey Questions

1. I believe this survey process has contributed to the leadership development of our physician team.
2. By being part of this process, I feel like I am a valued member of a highly functioning team.
3. This survey asked the right questions and has allowed me to give the kind of feedback to the providers on our team that I think is valuable.
4. What other questions should have been asked?
5. How can we improve this process for next year?

Questions 1-3 included a 5-point Likert scale and space for comments.
Questions 4-5 included only spaces for comments.

Figure 3. Samples of 360-degree Feedback Results



the 360-degree evaluation (Figure 1). Additionally, staff members were asked to evaluate the process (Table 2 and Figure 2). Below are staff comments from the process evaluation:

> "I really did feel that [the process] made a difference. Some of the providers that had been more difficult to work with really seemed to change. It was great!"

> "This was helpful to some who did not realize how they were coming across, and they are making an effort to improve that."

> "While this is a new process and we have not used the results as fully as we might have, just being part of a team that is willing to do this type of hard stuff is very satisfying and makes me proud."

DISCUSSION

Over the course of 2 years, the use of a 360-degree evaluation process with providers at a family medicine clinic produced positive outcomes for both providers and staff (Figure 3). Our key recommendations for a successful process are as follows:

- Readiness and preparation:
  1. Achieve initial consensus from all providers and local leadership.
  2. Train providers in facilitated coaching.
  3. Develop a locally relevant survey tool, approved by providers.
  4. Keep staff informed, assure confidentiality, and build trust.
- Make participation voluntary.
- Use an external consultant/coach. An experienced facilitator/coach from outside the organization will help providers receive, frame, and learn from negative feedback.
- Develop action plans. Encourage providers to develop action plans to address "opportunities for improvement" identified within their results.
- Follow up with staff. Feedback will contribute to staff satisfaction. For example, staff reported high satisfaction with feedback about the development of providers' action plans, and they appreciated acknowledgement that their survey responses had been heard.

Lessons Learned for Future Reviews

- *Staff support and training.* It would have been helpful to provide staff training on how to provide instructive feedback and coaching. While our efforts have made significant strides in equalizing feelings around power differentials and have improved communication, such training might have decreased staff discomfort with giving performance reviews to providers.
- *Action plans.* It would have been helpful to build in follow-up and accountability to ensure successful completion.

Some providers' action plans were quite successful. Others would have benefited from a third party (clinic manager or outside facilitator) to provide additional support.

Future Steps

The providers have agreed to undertake this process for 1 additional year. There is some interest in moving from a retrospective, 360-degree evaluation process to a process that integrates an Appreciative Inquiry[23] approach. The former tends to focus on areas that are not working well, whereas Appreciative Inquiry is based on the assumption that inquiring about existing strengths, successes, values, and dreams can in itself cause transformation.[24] While this study focused on providers, in the future it may also be beneficial to provide feedback and development for nonprovider staff. Moreover, as trust and confidence in this process grows, it may be beneficial to consider integrating both physicians and staff members into an oversight team.

CONCLUSION

ACOs and PCMHs are two key initiatives being touted as solutions to some of the challenges faced by the US health care system, with physician engagement seen as critical to their success. Based on the results of the post-process survey, our clinic found that implementing a 360-degree evaluation process led to increased team cohesiveness and improved physician leader behaviors.

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Shedding Light on What the Sunshine Act Will Mean for Physicians

Alyce C. Katayama, JD

The "Sunshine Act" requires manufacturers of drugs, devices, biological, and medical supplies to report to U.S. Department of Health and Human Services (HHS) certain payments and "transfers of value" to physicians and teaching hospitals. These "transparency reports" are required beginning in March 2013, and will cover the previous calendar year's payments. The following Q and As are designed to help ensure physicians understand the new law and what it means to them.

What is the Sunshine Act?

The Sunshine Act is the popular name for Section 6002 of the Patient Protection and Affordable Care Act (PPACA), which was signed into law by President Obama on March 23, 2010. As noted above, the law requires manufacturers of drugs, devices, biological, and medical supplies to report to HHS certain payments and "transfers of value" to physicians and teaching hospitals. These are referred to as "transparency reports." It also requires these manufacturers and group purchasing organizations (GPOs), including those owned by physicians, to submit reports regarding ownership or investment interests held by physicians or their immediate family members. The Sunshine Act does not prohibit the reported payments or ownership interests.

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How will the Sunshine Act be implemented?

The Secretary of the HHS is required to write rules to implement this reporting scheme. The Centers for Medicare and Medicaid Services (CMS) published proposed rules December 19, 2011.

What amounts trigger reporting?

Transparency reports are required for a single payment or transfer worth $10 or more or cumulative payments/transfers of $100 or more in a calendar year. However, determining when the $10/$100 reporting threshold has been triggered is not always easy. For example, if a sales rep brings $25 worth of bagels and coffee to a solo physician's office for a meeting, the reportable "per covered recipient cost" is $25 because there is only 1 physician. Since this is above the $10 minimum threshold for reporting, this must be reported. However, if the same bagels went to a group of 5 physicians, the per-covered recipient cost would be $5, and this "payment" would not need to be reported.

CMS proposes not requiring transparency reports of buffet meals, snacks, or coffee at conference booths and similar events where it would be difficult to establish the identities of the individuals who accept the offerings.

This threshold is lower than some state sunshine-type reporting requirements and far lower than the $5000 threshold used by the National Institutes of Health in its regulations governing disclosure of its grantees' financial conflicts of interest. These numbers will be adjusted annually for inflation.

What ownership/investment interests are reportable?

Ownership/investment interests are defined broadly as direct or indirect debt, equity or other interests, including stock options (other than those received as compensation, until they are exercised), partnership shares, LLC memberships, loans, bonds, and other financial instruments.

The Sunshine Act and the rule make a key distinction between manufacturer reports of payments/transfers on the one hand and manufacturer/GPO reports of ownership/investment interests on the other hand. When a manufacturer makes a payment to an employed physician, the payment is not reportable. However, the ownership and investment interests of physicians and their immediate family members, as well as payments/transfers to those owner/investor physicians, are reportable by the manufacturer/GPO, regardless of whether the physician is also an employee. (Immediate family will be defined as spouse; natural or adoptive parent, child or sibling; stepparent, stepchild, stepbrother, or stepsister; father-, mother-, daughter-, son-, brother- or sister-in-law; grandparent or grandchild; or spouse of a grandparent or grandchild.)

CMS is using this rule-making opportunity to address physician-owned distributors (PODs) and other physician-owned intermediary companies (POCs) in the medical device supply chain. These companies, often owned by orthopedists and cardiologists, have been on the CMS radar for several years, since CMS is concerned about the potential for

inappropriate payments, which PODs and POCs present. By requiring these transparency reports, CMS will get those relationships out in the open.

What information will be reported?

Required transparency reports must include the name, business address of the recipient, and, if the recipient is a physician, his or her specialty and National Provider Identifier (NPI). The amount and dates of the payment or other transfer also must be reported. In addition, the report must include a description of the form of payment, whether cash or cash equivalent, in-kind items or services, stock or stock options, or any other form of payment. The nature or purpose of the payment must also be reported in one of 15 categories: consulting fees, compensation for services other than consulting, honoraria, gift, entertainment, food and beverage, travel and lodging, education, research, charitable contribution, royalty/license, current or prospective ownership or investment interest, compensation for serving as a faculty member or speaker for medical education program, grant, and other. Payments for speaking are reportable even if the speaking is not in the context of accredited CME or a formal program.

CMS is proposing that payment to a physician include payment to the physician through his or her physician group. Payments provided through a group are to be reported individually under the name of the physician recipient. If a payment is made at a physician's request to another individual or entity, the other individual or entity's name also must be reported to "maximize transparency about the details of the payment or other transfer of value, by allowing end users to discern whether a physician actually received the payment, and if not, where the payment went."[1]

Are any payments or ownership interests exempt from reporting?

Payments/transfers below the $10/$100 thresholds are exempt from reporting. Also exempt are ownership or investment interests in a publicly traded security or mutual fund and interests that arise from a retirement plan offered by a manufacturer to the physician or member of his immediate family through employment.

In addition, stock options and convertible securities received as compensation are not reportable until the stock options are exercised or the convertible securities are converted into equity. Transfers of educational materials to benefit patients, short-term loans of medical devices, rebates, discounts, and items provided under warranty also are not reportable.

What do physicians need to prepare for?

The first transparency reports are required by March 31, 2013 and will cover the previous calendar year's payments. HHS will review and compile the information and give the reporting entities a chance to correct it. CMS anticipates that physicians may be interested in reviewing the data reported about them. Therefore, CMS proposes to allow, but not require, physician recipients and owners/investors, to register with CMS to ensure they receive communication about the data submitted and the review processes. If a physician wishes to dispute a transparency report, it will be up to him or her to do that directly with the manufacturer or GPO. CMS will not be actively involved in arbitrating such disputes. There will be a mechanism for reporting to CMS concerning disputes and the resolution of those disputes during the 45-day information review period, prior to public disclosure. On September 30, 2013, and each year thereafter, CMS will make the information available to the public on searchable website.

The CMS website will indicate that the disclosure of a payment does not necessarily indicate that there is a conflict of interest or wrongdoing, but the website will also state that the disclosure does not indicate that the payment was legitimate. Physicians will need to prepare themselves for the scrutiny and reactions from patients and others that public knowledge of payments and ownership interests may cause.[2] Furthermore, since the Sunshine Act will provide complete transparency about payments flowing from manufacturers and GPOs to physicians and teaching hospitals, it will make it far easier for the government, the media and the public to identify inappropriate payments when those occur. Thus, the law creates a platform for more vigorous enforcement activity relating to the Federal Anti-Kickback Statute and the Federal False Claims Act.

Sunshine is the best disinfectant

At least that is what legendary US Supreme Court Justice Louis Brandeis once said. That's why CMS hopes that this new regulatory scheme will tend to reduce or eliminate those payments from manufacturers to physicians and teaching hospitals which can introduce conflicts of interest that inappropriately influence research, education, and clinical decision-making. The CMS commentary accompanying the proposed rule notes that some drug and device companies may decide that the costs of reporting outweigh the benefit of having reportable relationships.

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Community-based Medical School Expansion Holds Potential for Addressing Physician Shortage

Joseph E. Kerschner, MD

Collaboration is a hallmark of the Medical College of Wisconsin, and we have made it a priority to reach out to our peers and potential partners to explore ways to improve access and quality of health care in Wisconsin. We believe these relationships will have great significance as we consider the best response to the Wisconsin Hospital Association's (WHA) recent projection of a significant physician shortage in the state.

Wisconsin needs 100 additional new physicians per year to avoid a projected shortfall of 2,000 physicians by 2030, according to the WHA report released in November.[1] The Association offered numerous recommendations for addressing the shortage through changes to the state's medical education and training system.

The Medical College is committed to working with WHA, hospitals statewide, the University of Wisconsin School of Medicine and Public Health and others to find a solution to the likely impending physician deficit. We are beginning feasibility analyses of placing community-based medical school components in one or more regions throughout Wisconsin. The project will be staged over a multi-year period with a goal of launching the first program as early as 2014 and no later than 2015. Although we are in the preliminary stages of evaluating such an expansion, our belief is that it could be an important component in a plan to address physician supply, particularly as it pertains to the need for more primary care physicians.

Our vision is for a community-based medical education program designed to alleviate shortages in rural and underserved areas of the state. We are committed to providing this program in an efficient and cost-effective manner using the expertise and infrastructure that is already in place at the Medical College and connecting this to a program of medical education nodes embedded in the community that also use local resources and talent. Students would learn from both community health care professionals and Medical College teaching faculty. We also will seek opportunities for medical students to share pre-clinical classroom training with students of other health professions, including dentistry, nursing and physician assistant programs, to build climates of respect and trust, and to model the health delivery teams of the future.

> The community-based model limits start-up costs … and minimizes the need for new bricks and mortar by working with existing institutions' facilities.

To achieve a viable program, the Medical College is exploring possible partnerships with a number of rural and community-based hospital systems that have the infrastructure to accommodate the model and have mutual interest in neutralizing physician shortages in their respective regions. Geographic regions under consideration are: Green Bay, Fox River Valley (Appleton, Oshkosh, Fond du Lac), North Central Wisconsin (Wausau, Stevens Point, Marshfield), Northwest Wisconsin, Eau Claire, La Crosse, Janesville/Beloit, and Racine/Kenosha. The curriculum would be based on immersion in a primary care setting. As these medical students learn and live in the community, they would be

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Doctor Kerschner is Dean and Executive Vice President of the Medical College of Wisconsin.

exposed to the corresponding lifestyle and to role models who practice primary care medicine.

Our focus is expanding the primary care work force. The WHA report estimates the demand for primary care physicians will be the most urgent in the state, with general surgeons and psychiatrists also in diminished supply.

Wisconsin ranks 19th among U.S. states with 95.4 active primary care physicians per 100,000 population, according to the Association of American Medical College's (AAMC) Center for Workforce Studies.[2] While this places Wisconsin in the top 50 percent of states, there are corresponding signs that portend physician supply difficulties for Wisconsin. Based on the percentage of active physicians who are age 60 or older (21.6%), the AAMC ranks Wisconsin 49th out of 50 states. One can infer that physician attrition by retirement is likely to disproportionately affect Wisconsin, making a preemptive response even more critical.

To maximize impact for the partners and the students, the Medical College's expansion plan emphasizes value. The community-based model limits the start-up costs associated with creating a new medical school and minimizes the need for new bricks and mortar by working with existing institutions' facilities.

Although it requires further financial analysis, we would like to explore the idea of offering incentives for entering a primary care field. Other incentives could be offered to students who matriculate to a residency program in Wisconsin. Such an incentive program would be the first of its kind, to our knowledge, and could have significant value for the state. When graduates of a Wisconsin medical school also complete their residencies in a Wisconsin program, there is a 70% chance that they will practice in Wisconsin, according to the WHA report, which cites American Medical Association data. Such retention would be an enormous advantage in mitigating the projected physician shortage.

For any of this to have an impact, however, the number of residency slots available in Wisconsin will need to increase. This is the limiting factor in developing new physicians, and unfortunately, the funding streams for residency programs are under duress because much of the cost is subsidized by the federal and state governments. New slots must be created and will require support from all those interested in addressing the physician shortage, including the state, hospitals, the medical schools and even insurance companies (precedent for the latter exists in California).

I believe we can overcome this and other challenges by maintaining our commitment to value through simultaneous emphases on high quality and cost-efficiency. By adhering to the Institute for Healthcare Improvement's Triple Aim—the simultaneous pursuit of 3 aims: improving the experience of care, improving the health of populations, and reducing per capita costs of health care—we can ensure our medical school expansion brings value to the people and communities in which it is based.

In the final analysis, we may discover new solutions to the complex issue of physician supply that either complement or supersede these ideas, but we are dedicated to a thorough assessment of all options. We are open to novel collaborations with all genuinely interested parties. And we are pledged to seeking value-driven health care for people throughout Wisconsin.

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