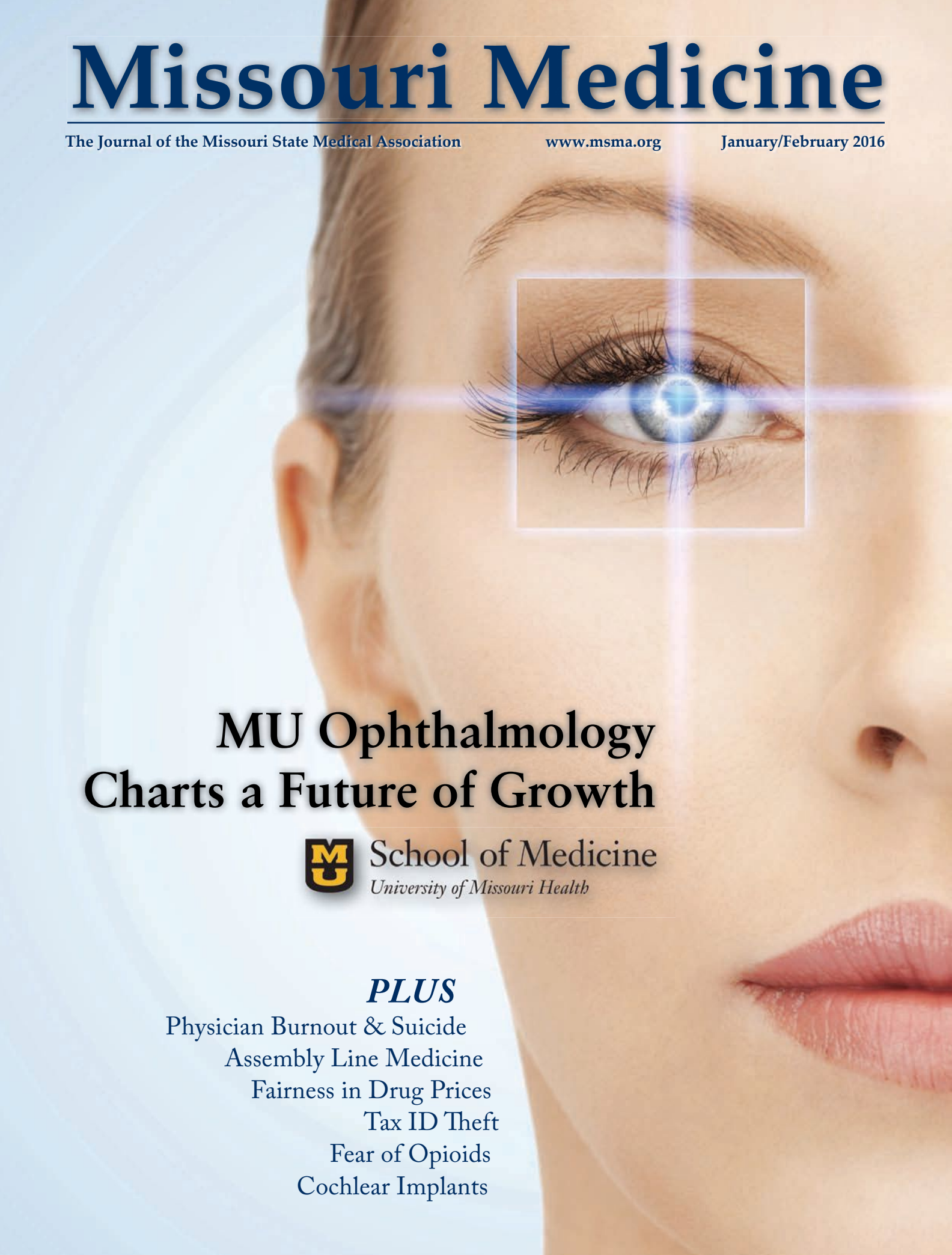
Missouri Medicine

The Journal of the Missouri State Medical Association www.msma.org January/February 2016



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Making "Someday" Happen- The Years of Living Dangerously

by John C. Hagan, III, MD

Bring adventure, mental, and physical challenge, change and calculated risk-taking into your life. I made "someday" happen. You can also. "Someday" it may be too late.

Somewhere, sometime "someday" slips into our lives. Sometimes "someday" is restless as in, "Someday I would like to travel to all seven continents." Sometimes "someday" is bold and fearless—"Someday I want to climb mountains." Sometimes "someday" is intellectual (learn a second language), athletic (windsurf) or it involves new motor skills (play a musical instrument).

"Someday" I will do all the exciting, unusual and venturesome things that have instilled in me awe and a sense of wonder from childhood. Someday I will indulge my wanderlust and travel to exotic faraway places.

For many of us "someday" is elusive. We burn through the years of our lives with relentless toil and work. Our days belong to our families, our patients, our profession, our churches and our communities-they are anything but "our" days. The inexorable passage of our days does not include the proverbial "someday."

This is the personal epiphany of an obsessive-compulsive, workaholic, personality type-A physician who fortunately "got it" in time and spent ten adrenaline-soaked, memory-producing years making "someday" happen.

My message is perhaps most appropriate for physicians ages 40 to 65. Medical school, internship, residency and the early years of establishing a medical practice are pretty much survival situations. Time and money are precious, obligations to family and practice dear. However, it's never too early to draft a personal list of unique life experiences to do "someday." With proper planning even the young physician may be able to cross a few items off their life list.

The ideal time to make "someday" happen is that great ennui-inducing epoch called middle age. Without shaking things up, without indulging whim and passion, the middle third of our lives will morph into "muddle age." The vagaries of health, our inevitable decrease in stamina, the certainty of death and the uncertainty of lifespan make the deferment of making "someday" happen an injudicious proposition.

The idea of creating a list of extraordinary things to do in your lifetime is not unique and has been written about extensively. Indeed, doing a Google search of "things to do before you die" listed 28,200 hits and various life list iterations up to a thousand items long.

A urologist I know was my inspiration to get my act together. He frequently operated the same day I did at North Kansas City Hospital. We're roughly the same age. Shortly after we both turned 40, whenever I saw him and inquired what he was up to, the answers were esoterically diverse and uniquely spellbinding: "windsurfing off the north shore of Venezuela;" "climbing mountains in the Americas and Europe;" "backpacking in Patagonia;" "living with a family in Mexico for a month to learn Spanish;" and "photographing exotic wildlife in Africa." You get the idea.

"And you, John? What have you been up to?

What could I say? The most exciting things I experienced were living vicariously through his travels and adventures.

"Well, I went to the Amish festival in Jamesport and…ah...ummh...the crafts exhibit at Silver Dollar City."

He was always gracious enough not to say "Far out, John, you're really living life on the edge."



John C. Hagan, III, MD, FACS, is a Kansas City ophthalmologist and *Missouri Medicine* Editor since 2000. He is seen at left working on his Bucket List with his wife Becky, bagging their seventh and last continent-Antarctica.
Contact: jhagan@bizkc.rr.com

Eventually I asked why he was doing all these things.

"We're getting old; we're not going to live forever. We've got to go for it with both hands and make these things happen. We've got the money, we can spare the time without short changing our practices and families. In another 10-15 years we may not be able to physically do a lot of these adventures. Hell, we could even be dead. Just do it!"

Time, money, not living forever, getting old, going for it. I got it! I also would make "someday" happen.

Over the next several weeks I cobbled together an extensive list of things I had longed to do "someday". (See next page.) My wife and I began to travel. We visited all seven continents. Not ones for constructing itineraries and logistics, we used the services of Abercrombie and Kent (A & K) travel company. Their trips are spectacular. For adventure travel to third world and remote locations we used Mountain Travel Sobek. Memorable days and marvelous months of high adventure followed.

The most exciting day was in Queensland, New Zealand where I parachuted from 9,000 feet, rode a jet boat on the Shotover River and bungee jumped off the Kawarau River Bridge (see right). The most dangerous adventure was mountain climbing. On Mt. Rainer a winter storm created a chill factor of -30 degrees below zero. Fierce winds, up to 90 mph, blew two Japanese climbers into a crevasse. Our climbing party turned back 500 feet below the summit. A year later, I successfully reached the summit of 19, 340 ft. Mt. Kilimanjaro. Two of our climbing party, suffering from high altitude cerebral and pulmonary edema, were rushed to safety down the mountain by native porters.

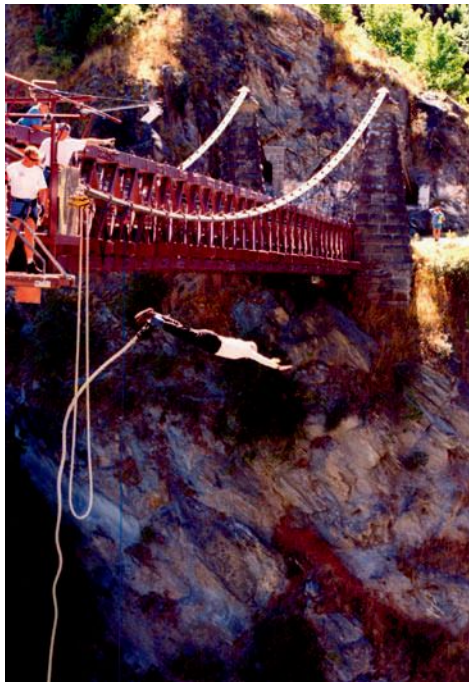
For ten years I happily and enthusiastically whittled away at my life list and scratched off most. Then the years of living dangerously came to an abrupt halt. My mother's health failed and I had to manage her affairs and look after her needs. She died last year. A son-in-law was diagnosed with a brain tumor. In the interim I developed a number of moderately severe arthritic



Top, tandem skydiving, free fall from 9,000 feet, Queensland, New Zealand.



Right, after the fall, parachute jumping, another "someday" happens.





A leap of faith - bungee jumping off the Kawarau bridge, Queensland, New Zealand.

and degenerative joint diseases that curtailed my intense aerobic exercise program and the high level of physical fitness that enabled me to complete many of these very strenuous endeavors.

I'm 61 years of age. I do not remember my 347th patient encounter or the 157,353rd. I do not remember my 6,782th cataract surgical procedure. But I do remember the years of living dangerously. I remember in blazing Technicolor and Dolby sound when each "someday" became the here and now.

I hope and believe there are other adventures to come. I still would like to hike the Inca Trail. There are other countries I hope to visit. I still want to fly in the open cockpit of a biplane. Presently I greatly enjoy golfing with my buddies Ken, Carl and Chuck-I have yet to break 90.

I urge you to formulate your own list. Bring change, adventure, mental rigor, physical challenge and calculated risk-taking into your life.

I made "someday" happen. You can also. "Someday" it may be too late.

Carpe diem!

[Editor's Note: This editorial, written in 2005, is still one of the most favorably commented on that I have written for Missouri Medicine. I hope that those of your reading it for the second time have used the last decade to make inroads into your personal 'bucket list' (things to do before kicking the bucket). If not better get started, its later than you think, and time and tide wait for no one. Those reading it for the first time be aware you will not be young (or middle aged) forever. As for me, having completed almost everything on my bucket list has been a tremendous source of satisfaction and contentment. Although in excellent shape for age 72, I could no longer physically do many of these adventures. I am so happy I made "someday" happen and I hope you will also before it's too late.] **MM**

Life List to "Make Happen"

* = completed ? = not completed

"Someday I would like to..."

- Visit all seven continents*
- Climb the highest mountain on a continent* (Mt. Kilimanjaro) (See below.)



- Trek in Nepal, Bhutan and see Mt. Everest*
- Parachute, parasail, paraglide, bungee jump*
- Whitewater raft*
- Fly in a glider* and open cockpit biplane?
- Backpack and live in a tent for a week*
- Canoe the boundary waters of Minnesota*
- Go to NASA's Adult Space Camp*
- Go to NASA's Aviation Challenge*
- Fly in a World War II bomber*
- Try rock climbing and rappelling*
- Take a course in combat pistol shooting*
- Learn to fly fish*
- Do a llama hut-to-hut hike on the 10th Mountain Division trail*
- Drive a team of sled dogs and winter backpack*
- Visit most of the islands in the Caribbean in the winter*
- Helicopter through the Islands of Hawaii and on the glaciers of Alaska*
- Run a marathon (6)*, complete half Ironman Triathlon (2)*
- Go to a film festival*
- Complete an Outward Bound experience (2)*
- Scuba dive and snorkel*
- Hike into and out of the Grand Canyon*
- Hike the Alps*
- Fund a Chair in Ophthalmology*
- Ride a bicycle a hundred miles in a day*
- Meditate in the Potala in Lhasa, Tibet*
- Win a travel picture contest* (*Kansas City Star*)
- Buy a Porsche and go to high performance driving school*
- Achieve marksman expertise with Olympic air rifle*
- Hike the Inca Trail and visit Machu Pecchu?
- Learn to play golf* and break 90*

Make "someday" happen soon!

The Hospital as a Factory and the Physician as an Assembly Line Worker

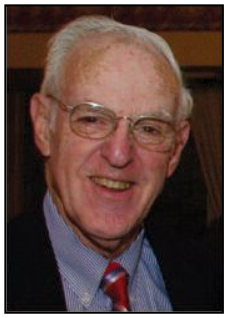
by Arthur H. Gale, MD

MBAs tell physicians how to practice Medicine. Costs rise and quality drops. Patients, physicians suffer.

"We see the hospital as a factory and our hospitalist group as an assembly line that is in the business of manufacturing perfect discharges."[1] These words are not hyperbole. They are the exact words written by David J. Yu, MD, MBA, medical director of Adult Inpatient Medicine Services at Presbyterian Hospital in Albuquerque N.M. Yu cites the work of management guru W. Edwards Deming as a major authority for this approach to patient care. Deming's business principles have been given much of the credit for Japan's industrial revival after World War Two.

Theory is not practice. Ever since management and business school "experts" took charge of health care in the 1970s and 1980s not only have medical costs not decreased they have skyrocketed. There was no health care crisis in the 1970s and 1980s.[2] It was manufactured by the medical industrial complex composed of hospitals, insurance companies and drug companies for their own financial gain.

Exhibit 1 illustrates this. The graph shows that health care costs in the United States (U.S.) were essentially the same in the U.S. as they were in other OECD (Organization for Economic Cooperation and Development) countries until the early 1980s. In 1973 the Nixon administration introduced the Federal HMO act that required businesses with over 25 employees to offer HMOs to their employees.[3] And in the early 1980s, ostensibly to improve hospital efficiency, Diagnostic Related Groups or DRGs were introduced by Robert B. Fetter PhD of the Yale School of Management and John D Thompson MPH of the Yale School of Public Health.[4]



Arthur H. Gale, MD, MSMA member since 1976, is a *Missouri Medicine* Contributing Editor. He practices Internal Medicine in St. Louis.
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The graph shows how health care costs spiraled out of control compared to other OECD countries only after HMOs, managed care, and DRGs were introduced nearly 40 years ago. The medical industrial complex has profited handsomely. Physicians are blamed for high health care costs. Patients are rushed through hospitals (and doctors' offices as well) and are often discharged before they are ready.

Diagnostic Related Groups

Under Diagnostic Related Groups (DRGs) Medicare pays hospitals a fixed fee for specific diagnoses like congestive heart failure or knee replacement surgery. Simply put the hospital loses money if a patient is hospitalized too long and makes money with shorter stays. (There are certain exceptions for outliers which is beyond the scope of this discussion.) Hence hospitals put pressure on hospitalists like Dr. Yu to discharge patients as soon as possible. Hospitalists are well paid. The average yearly salary of a hospitalist is $251,000.[5]

In order to prevent patients from being discharged too soon, Medicare penalizes the hospital financially. Centers for Medicare & Medicaid Services (CMS) defines the return of patients to the hospital within one month of discharge as 'poor quality care.' To any physician with even a modicum of experience this rule is nonsense. Physicians can't control patient compliance nor can they control certain unavoidable complications of an illness or surgery. Only when officious bureaucrats are put in charge of a profession, which they do not understand and is beyond their level of competence, can the return of critically ill patients to the hospital within one month of discharge be labeled poor quality care.

So what do hospitals do when patients with serious illnesses return to the hospital within 30 days of discharge? In order to avoid financial penalties they skirt the rules by devious means. A recent *Wall Street Journal* (WSJ) study showed that hospitals often change the status of patients who are readmitted to the hospital within 30 days to "observation status." Patients can remain on observation for days and receive the same care that they would receive as an acute care admission.[6]

The problem with this is that Medicare won't pay for post-hospitalization admission to a rehabilitation or skilled nursing facility after an observation admission. So the hospital shifts more costs to the patient. The WSJ cites the case of an 87-year-old wife of a school teacher who spent four days in the hospital on observation and two months in a nursing home which cost $20,000. To pay the non-insurance covered bills "the couple liquidated a life insurance policy and cashed certificates of deposit that had been set aside to pay for their burials."

Medical education has also suffered under DRGs. In his recent book "Let Me Heal," Kenneth Ludmerer, MD, Professor of Medicine and Professor of the History of Medicine at Washington University School of Medicine in St. Louis, describes the "turnstile" effect on residency training:[7]

"In all specialties residency training came to be dominated by an overriding goal; discharging patients as soon as possible. House officers were instructed to begin discharge planning on day one of a hospitalization sometimes even before meeting the patient." He notes how the late David Kipnis, MD, former Chairman of the Department of Medicine Washington University School of Medicine, stopped teaching residents in the 1990s because house officers only wanted to talk about discharge and not about disease. He describes how the pressure to discharge stifles curiosity and the desire to learn. Ludmerer believes that the requirement that residents see as many patients as possible in as short a time as possible is a major cause of "burnout" among house officers.

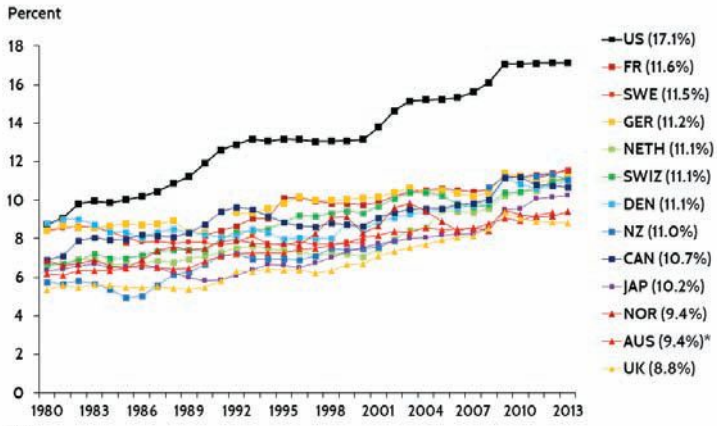
Ludmerer blames the "dysfunctional largely commercialized health care system" for the harm it has done to medical education. But he also delivers a scathing indictment of his faculty colleagues and medical leaders for their role in allowing these harmful changes to occur:

"Academic leaders, faculty members, clinical departments, medical schools and teaching hospitals behaved in this way for a reason: They benefitted too much from the enhanced revenues they received for succumbing to the forces to increase throughput. They followed the money, resting content with the status quo as long as clinical revenues and their own pay continued to grow even if graduate medical education and patient care might have suffered in the process."

DRGs have wrung all the savings that it can from hospitals even to the point that hospitals as noted above are engaging in subterfuge in order to comply with impossible Medicare rules and regulations.

Hospitals are the main driver of high health care costs consuming about 30% of the health care dollar.[8] If Medicare was really serious about lowering hospital costs it would stop focusing on DRGs and physicians and develop policies based on the findings of recent independent objective research which show that hospital consolidation and hospital integration increase costs.

Exhibit 1. Health Care Spending as a Percentage of GDP, 1980–2013



* 2012.
Notes: GDP refers to gross domestic product. Dutch and Swiss data are for current spending only, and exclude spending on capital formation of health care providers.
Source: OECD Health Data 2015.

In the1990's hospital boards of directors and administrators promised that hospital consolidation (coordination of care) and the purchase of physician practices (integration of care) would achieve economies of scale that would lead to greater efficiencies and cost savings. A landmark 2014 JAMA article explodes this theory.[9] This research showed that expenditures in consolidated and integrated hospitals in California were significantly higher than in physician owned organizations.[9]

This finding should come as no surprise. Hospital consolidation and/or hospital mergers have led to monopolies and price fixing. The journalist Steven Brill pointed out in his landmark Time magazine article "Bitter Pill" how hospitals use the "charge master" to charge outrageous prices to consumers and their third party payers.[10]

Don't expect the Federal Trade Commission (FTC) to engage in a serious effort to break up hospital mergers. This government agency is part of the problem not the solution. The FTC orchestrated the managed care takeover of Medicine in the 1970's and 1980's that allowed hospital monopolies to flourish. Ever since it filed suit against the American Medical Association in 1975 to remove the Hippocratic Oath from its Principles of Medical Ethics, the FTC, as one observer put it, has been out to "get the doctors."[11]

We see the hospital as a factory and our hospitalist group as an assembly line that is in the business of manufacturing perfect discharges."

- David J. Yu MD, MBA



Source: http://ophelia.sdsu.edu:8080/ford/03-03-2012/innovation/innovation-features/innovation-detail/heritage-model-a-production-begins-at-rouge.html



Source: Ontario Hospital 2014 Medical Assembly Line The Canadian Press http://news.nationalpost.com/full-comment/michael-schweitzer-canadas-assembly-line-health-care

Likewise recent studies have shown that hospital integration of physician practices also leads to higher prices.[12] When private insurance companies and Medicare pay at least 70% more for office visits, laboratory tests, imaging studies, and outpatient surgery such as colonoscopies to hospital owned physicians than they pay to private independent practitioners for the very same services how can that possibly result in lower prices to the consumer? You don't need an MBA or be a government "expert" to figure that one out. An average primary school fifth grader can give the correct answer to that question without doing any research at all!

MedPac the Medicare Patient Advisory Commission has long recommended that that this disparity in payments to hospital based and independent private physicians be corrected.[13] But the ultra-powerful hospital lobby has been successful in preventing MedPac's recommendations from being implemented. It's much easier to blame physicians for the high costs of health care than blame hospital inefficiencies and waste. Administrative costs alone in U.S. hospitals are at least 25% higher than other OECD countries.[14] In order to control hospital costs the government should break up hospital mergers and stop over paying hospital employed physicians and stop overpaying for their overpriced outpatient services. Medicare should also stop focusing on DRGs because they are not working.

When hospitals are factories and hospitalists are assembly line workers it follows that patients can easily become widgets. The take home message is this: If you or a loved one is admitted to a hospital with an acute illness and discharged before you think you are well enough to be discharged, protest. You can start with the patient advocate and hospitalist and go right on up the ladder from there to the CEO of the hospital if necessary. You're not a widget. You're a human being living in a free country. Your taxes paid for Medicare and you should have a right to see that it functions properly for your benefit and not for the hospital's bottom line.

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Sustainable Growth Rate Repeal: Why the "Why" Matters

by Patrick K. Price, MD

Why did Congress repeal Medicare's Sustainable Growth Rate (SGR) payment system January 6, 2015? In 1997 SGR replaced Medicare Volume Performance Standards (MPVS), which served as physician payment mechanism between 1990 and 1997. Prior to 1990 physician charges was the basis of Medicare payments.[1]

During 30 years, since 1989, annual increases in the valuation of physician work and the increase in the consumer price index (CPI) are similar. Overall government fixed physician charges the last 14 years, since 1998, are less than CPI.[2,3]

Centers for Medicare and Medicaid Services (CMS) contained high annual fee percentage increases. Did SGR need to be fixed based upon these outcomes?

Second, politicians and physician based political action committees (PACs) may say it was keeping a bargain to fix SGR in trade for endorsement by the American Medical Association (AMA) supporting the Affordable Care Act (ACA). Maybe, however, fulfilling a political quid pro quo promise to fix doctor payment in exchange for use of the AMA brand has not been a high priority since 2010. Was keeping a promise the reason or were there other reasons?

Another reason might lie within the 2015 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds. This and previous annual reports find Medicare deficits year after year. In 2014 CMS paid out $613.3 billion and total income was $599.3 billion. Furthermore, in order to mitigate ACA costs Medicare funds have been transferred to ACA insurance programs. Trustees report ACA contains roughly 165 provisions affecting the Medicare program by reducing costs, increasing revenue…, identify alternative provider payment mechanisms, health care delivery systems and other changes to improve quality and reduce costs. About these ACA changes to Medicare Trustees write… "The most important of which are the reductions in the annual payment rate updates for most categories of Medicare providers." Physician fee schedule services total approximately $69.2 billion compared to hospital inpatient and outpatient expenditures totaling about $183.3 billion. Yet it is physician fee schedule services, which are targeted, to reduce Medicare costs. Repeal of SGR should reduce Medicare payments. Between 2015 and 2019 physician update amounts will equal a little over 2¢ per $1.00. This is not per year. The SGR repeal says 2¢ for five years. After five years the increase is zero per year. Physician's fixed updates do not vary based upon economic conditions, technologies physicians employ to care for patients, or physician costs to comply with expensive regulation. Trustees hope finally Medicare physician costs will be predicable.[5]

But Trustees warn all of the following: if the health sector cannot transition to more efficient models of care delivery and achieve productivity increases commensurate with economy-wide productivity, and if the provider reimbursement rates paid by commercial insurers continue to follow the same negotiated process used to date, then the availability and quality of health care received by Medicare beneficiaries would, under current law, fall relative to that received by those with private insurance. These Trustees know new interventions and therapies created by economic incentive may make some current untreatable diseases routinely treatable and generally this increases costs.[4]

Most ominous, however, Section 13 (A) and (B) (iv) of the SGR repeal grants the Secretary of CMS broad authority without administrative or judicial review to establish methodology of a merit-based incentive payment system (MIPS) based upon performance scores. A committee



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Table 1 - A Tabulation of annual percentage increases in physician payments

Years	Methodolgy	Annual Percent Increase
1980 - 1990	Physician Fee for Service (FFS)	13.40%
1990 - 1997	Medicare Volume Performance Standard (MVPS)	9.35%
1997 - 2013	Sustainable Growth Rate (SGR)	5.23%

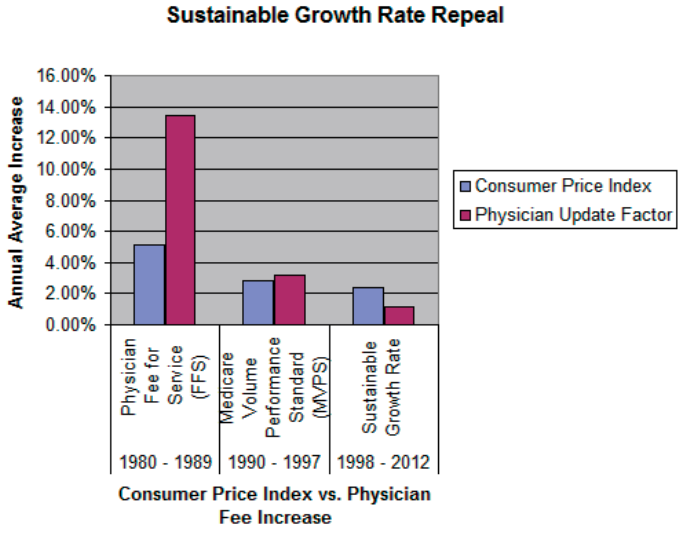
of 11 members (no more than five can be physicians or persons who provide services to patients) appointed by the Comptroller General of the United States shall advise the Secretary and determine a performance number using the following four measures (1) quality, (2) resource use, (3) clinical practice improvement, and (4) meaningful use of electronic health records (EHR). Beginning January 1, 2019, this committee's decisions - exempt from administrative and judicial review - will apply to merit-based incentive payments (MIPS), determine physician performance standards and thereby physician payment updates.[7] Like the unpopular Independent Payment Advisory Board (IPAB) created by ACA, Section 13 (A) and (B) (iv), gives this CMS committee authority free of review.

Fis custodia ipsa custodium - who will watch the watchers - applies to our Federal executive branch just as it did to the Roman Senate. Without administrative or judicial review should be a red flag for Medicare patients and physicians From its beginning CMS in its administration and entitlement manuals states: "The law (i.e. Medicare) does not permit the Federal Government to exercise supervision or control over the practice of medicine, the manner in which medical services are provided, and the administration or operation of medical facilities. The patient is free to choose any qualified institution, agency, or person offering him/her services. The responsibility for treatment and the control of care remains [sic] with the individual's physician and the hospital or other facility or agency furnishing services."[8]

Can the Federal government find eleven disinterested experts - the majority of whom have never cared for patients - to determine what constitutes good patient care? Are these appointees somehow free of bias and able to craft (1) quality, (2) resource use, (3) clinical practice improvement activities better than physicians or other Medicare providers who take care of Medicare patients? Should a committee, whose decisions cannot be reviewed, like IPAB or the Center for Medicare and Medicaid Innovation, be allotted $ 5,000,000.00 annually to determine or replace physician standards?[5]

Here is a better alternative. The new SGR repeal law encourages physician registries. These are guides to and assessment of good clinical practice. Quality, resource use, and clinical practice improvement (i.e. 1, 2, and 3 above) should be the purview of physician registries. Registries already exist in cardiothoracic surgery, ophthalmology's Intelligent Research in Sight (IRIS) among others. Registry performance should be the standard by which providers are judged in 3:4 categories the Secretary uses for MIPS performance scoring.

What follows is a pragmatic example. Dementia affects 10% of people older than 65; it could be a focus of performance. Clinicians, members of the American Academy of Neurology (AAN), have extensive experience diagnosing and caring for patients with dementia. These practicing doctors crafted guidelines to identify which resources are best employed to categorize patients with dementia due to Alzheimer's disease (AD), dementia with Lewy bodies (DLB), frontotemporal dementia (FTD), vascular dementia (VAD) and other causes.



Accurate diagnoses may distinguish who might respond better to traditional antipsychotics versus serotonin reuptake inhibitors. Use of AAN guidelines should fulfill 3:4 performance criteria and should immunize primary care physicians, neurologists and others against performance downgrade in this area.[10]

A book, *By the People,* author Charles Murray, a W.H. Brady scholar at American Enterprise Institute, suggests instruments like physician-generated registries could be used by legal defense funds to challenge regulations, which are arbitrary and capricious based upon prima-facie circumstances or facts.[11] Physicians could subscribe to his concept, an indemnity, similar to Ophthalmology Mutual Insurance Company's successful malpractice insurance model.

We are not lawyers or alchemist who can transform a bureaucratic contrivance "commensurate with economy-wide productivity" into good care for a sick individual. We are doctors responsible for diagnosis and treatment of a patient's illness along the patient, the hospital, or other facility or agency furnishing services as written in Medicare Manual 100-1 chapter 1 section 20. This is my 2¢ worth.

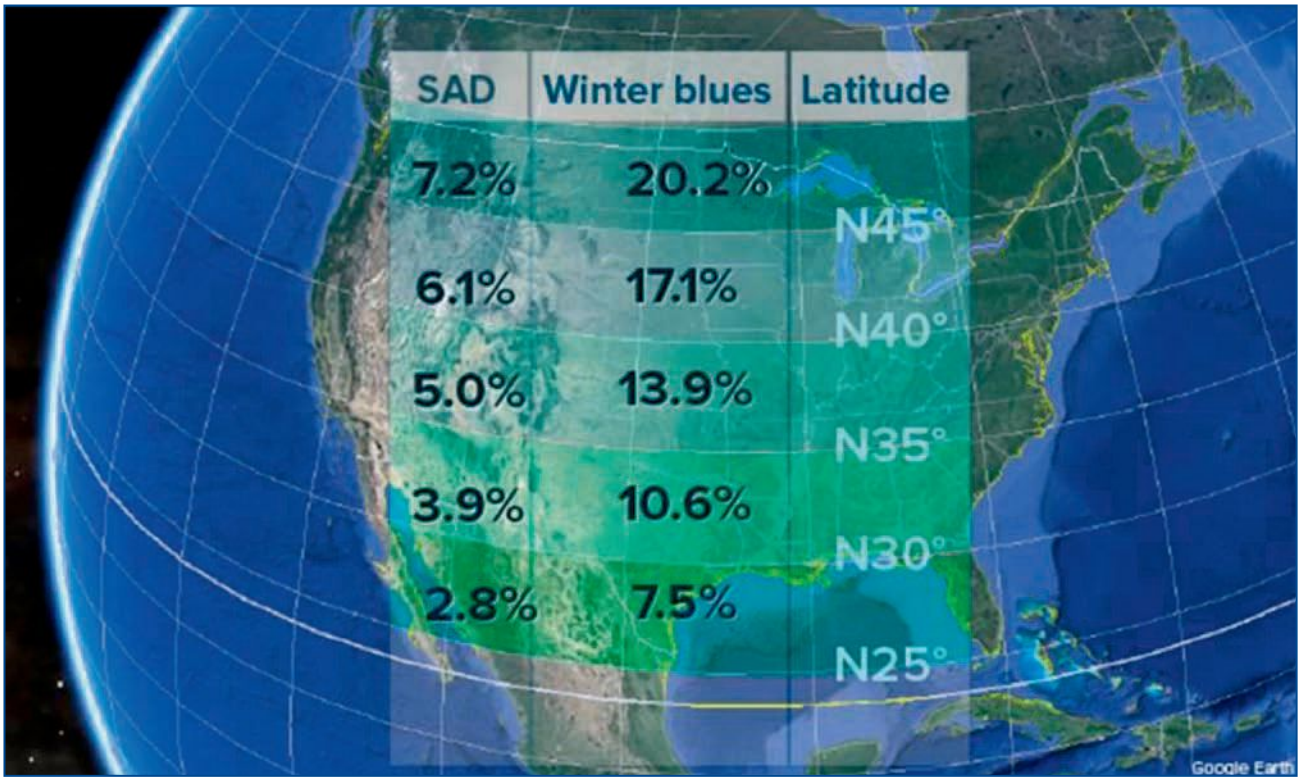
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1 Picture = 1,000 Words

Medscape: Latitude as a Predictor of Winter Blues



Source: Medscape / Google Earth (Background)

KANSAS CITY AREA LIFE SCIENCES INSTITUTE, INC.

Growing the Life Sciences in Missouri & Kansas into A Global Epicenter – Path to 2025

by Wayne O. Carter, DVM, PhD

In 2005, a significant regional strategy was developed and identified the animal health strength which led to the development of the Animal Health Corridor, now recognized around the world as the epicenter for animal health development.

The Kansas City Area Life Sciences Institute has published "Path to 2025," a 10-year vision and plan that positions the region at the "…nexus of human and animal health."*

The Kansas City Area Life Sciences Institute (KCALSI) was formed by community leaders in 1999 when they considered how to best grow the regional life sciences after Jim and Virginia Stowers committed funds to build the Stowers Institute for Medical Research. KCALSI has continued this quest for over 15 years and the region has seen unprecedented growth in both human and animal health.

In 2005, a significant regional strategy was developed and identified the animal health strength which led to the development of the Animal Health Corridor, now recognized around the world as the epicenter for animal health development. This subsequently led to the successful bid for the $1.25 billion National Bio and Agro-Defense facility in Manhattan, Kansas, which will focus on emerging and zoonotic diseases. Cancer research and care was another area of focus ten years ago that led to the University of Kansas Cancer Center receiving NCI designation in 2012 under the leadership of Dr. Roy Jensen.

In 2014, the KCALSI board of directors decided it was time to reassess our strategy and compare our region to other life sciences clusters around the world. We used a model referred to as "collective impact" from Stanford University that recognizes a region working cooperatively can achieve far more than the sum of groups working individually. KCALSI retained Deloitte to conduct the regional strategic assessment, and the resulting report was based on interviews with more than 150 area leaders and a survey sent to more than 1,200 people.

According to the Path to 2025 report, the Kansas City region has a number of strengths in the life sciences, notably health information technology (hIT) represented by Cerner Corporation along with many other established and startup hIT companies, entrepreneurial, and infrastructure assets in this sector. Another strength that fits synergistically with hIT is outcomes research. Led by world renowned experts like John Spertus, MD, and David Cohen, MD, at Saint Luke's Health System,



Wayne O. Carter, DVM, PhD, became President and Chief Executive Officer of the Kansas City Area Life Sciences Institute (KCALSI) in June 2012. Prior to joining KCALSI, Wayne was the Vice President of Global Research at Hill's Pet Nutrition in Topeka, Kansas where he led nutrigenomics research for new product discoveries and commercialization.
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the entire region is capitalizing on PCORI (Patient-Centered Outcomes Research Institute) grants made available through the Affordable Care Act. We are already recognized for this strength nationally but we appreciate the tremendous opportunity for the region provided we focus on the ecosystem necessary to support this strength.

Animal health will continue to be a regional area of focus and we will specifically look for opportunities at the nexus of human and animal health. There is frequently a naturally occurring disease in animals similar to the human disease. One example of the opportunity resides in research at the University of Missouri that used dogs with a naturally occurring dystrophin muscle dystrophy as a model for Duchenne Muscle Dystrophy. The genetic defect is identical in dogs and humans and University of Missouri scientists have successfully treated affected dogs with gene therapy. Human clinical trials are currently being planned. With our regional strength in animal health, we hope to leverage our expertise in advancing human and animal medicine.

Two other areas of scientific strength were selected by the steering committee comprised of community, academic, and business leaders. Cancer research and care is a continuing strength for the region and will be an emphasis area, especially as the University of Kansas Cancer Center works to get comprehensive cancer center designation. We also hope to expand the utilization of other assets like the University of Missouri research reactor (MURR) that could significantly improve cancer diagnosis and treatment with many radiopharmaceutical applications. As noted above, naturally occurring cancer in our pets is an excellent opportunity for our region to advance cancer research and therapeutics at the nexus of human and animal health. Our region is also noted nationally for strength in neuroscience and this will be the fourth area of focus, specifically in neurodegeneration and neurodevelopmental disorders.

In addition to the scientific areas, the strategic assessment looked at eight drivers of cluster enhancement to help advance our life science ecosystem. Through a SWOT analysis (strength, weakness, opportunity and threat), the Path to 2025 report identified regional weaknesses that threaten future growth. Startup companies often lack access to capital and are at risk for leaving the region to find it. Even taking the size of their economies into account, Kansas, and Missouri get just a small fraction of the venture capital investment of major biotech states like Minnesota, Washington and Massachusetts. Workforce development is another weakness, exemplified by the fact that only 3% and 4% of high school seniors in MO and KS respectively score at least a "3" on the advanced placement calculus exam compared to 7% as a national average.

Two significant cluster strengths for the region include entrepreneurship and collaboration. Because

the region is separated by 300 miles between Manhattan, KS and Columbia, MO, collaboration is critical to drive innovation and improve our ability to be globally competitive. Many of us talk about wanting to collaborate more, but collaboration that "sticks" is usually driven by defining a problem and identifying incentives for the solution. We plan to work to find tools to aid collaboration activities and develop programs for their implementation.

The final driver of cluster enhancement is messaging and marketing. If we raise the local and national awareness of the opportunities and discoveries from our region, companies will likely consider moving to the greater Kansas City area.

The vision statement for the region reads, "The Kansas City region is a global leader at the nexus of human and animal health, benefitting all our citizens and the economy." The nexus of human and animal health is a recognized opportunity as we leverage our strength in each area and look for the many intersections including oncology, neurology, and infectious diseases. There is also a desire of the community-led steering committee that prioritized these opportunities to reduce health care disparities in our region and improve health care for all our citizens. This will be a central tenet as we develop programs throughout the region.

Individual scientific working groups and cross-cutting capability task forces are now meeting to develop objectives, performance metrics, and timelines for all of these areas. We plan to develop a dashboard to monitor our progress at least annually to ensure we are substantially advancing our region and ecosystem to achieve our vision.

The complete report is available online at www.kclifesciences.org/news/path-to-2025/ and includes recommended steps to keep the region globally competitive. Most importantly our success is interdependent on each of us whether it is improving education, investing locally in startup companies or working collaboratively to solve our tough research challenges.

*The "Path to 2025" report of the Kansas City Area Life Sciences is available as a free download at www.kclifesciences.org/reports/path-to-2025.



Figure 1

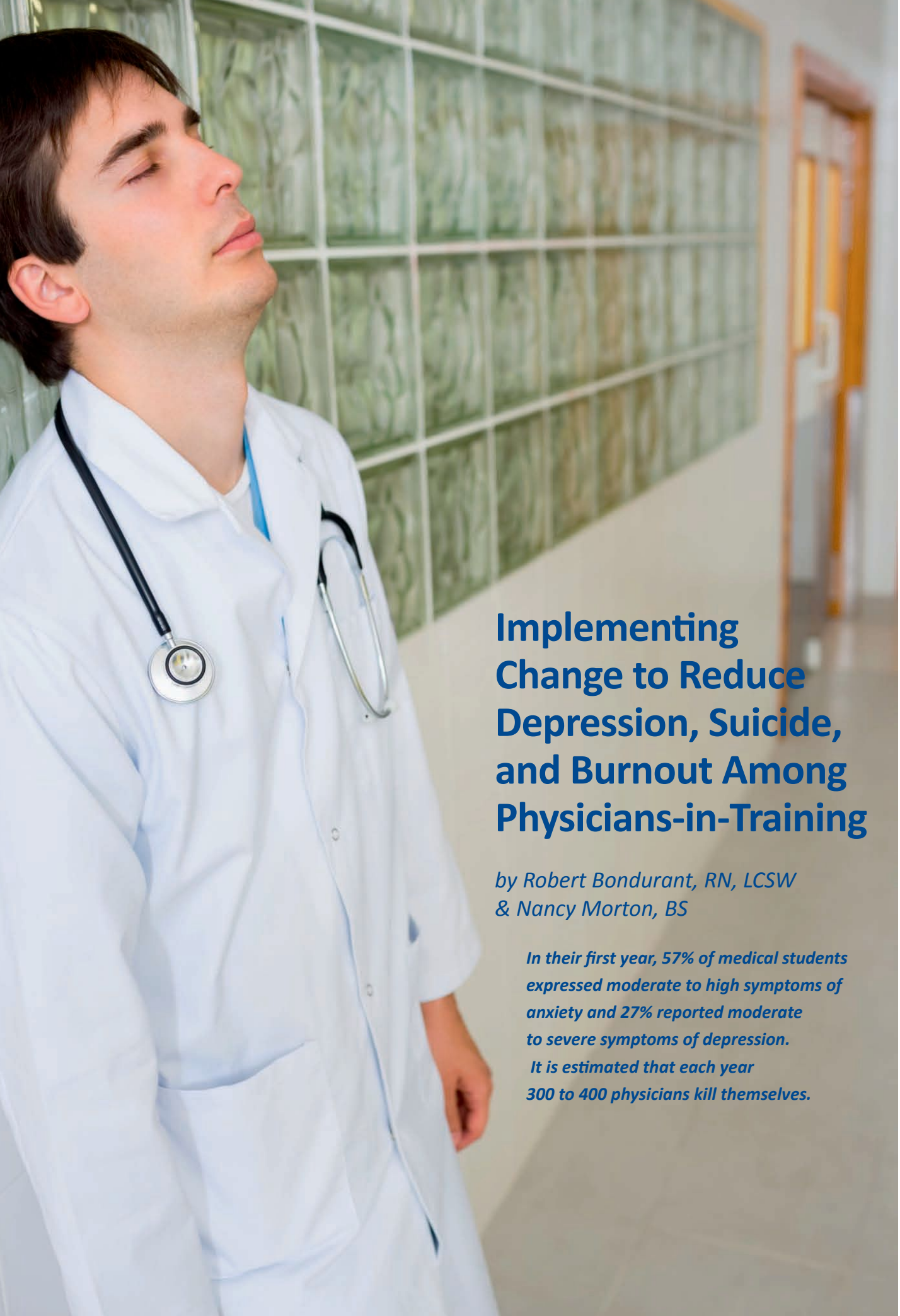
The need for greater high school STEM engagement was reiterated in the Path to 2025 by weakness in national advanced placement scores. KCALSI continue to work in many STEM areas including support for the Greater Kansas City Science & Engineering Fair, BioGENEius (the only international competitive bioscience program for high school students), and including high school students at all of our professional education programs.



Figure 2

KCALSI's research grant program continues to be one of its most successful programs. In 2015, four outcomes research grants through Blue Cross and Blue Shield of Kansas City and three grants for childhood genetic diseases through the Paul Patton Trust, Ted C McCarter, William Evans Jr., and Bank of America, N.A. Trustees were funded. Funding of their research proposals has resulted in an over 850% return on investment in the form of additional grant dollars that come back to the community and to the researchers to continue their research and quest for new treatments and better patient outcomes.

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Implementing Change to Reduce Depression, Suicide, and Burnout Among Physicians-in-Training

by Robert Bondurant, RN, LCSW & Nancy Morton, BS

In their first year, 57% of medical students expressed moderate to high symptoms of anxiety and 27% reported moderate to severe symptoms of depression. It is estimated that each year 300 to 400 physicians kill themselves.

Often it takes a tragedy for a discussion to open up about medical student and resident suicide. People will wonder why a bright young medical student or physician decided to end his or her life, but it rarely translates into positive changes within the training environment.

However, changes are in the works. The Accreditation Council for Graduate Medical Education, the governing body for 9,600 residency programs is developing a national program designed to curb the epidemic of physician distress. In addition, some pioneering medical schools have implemented changes in the learning environment to improve this situation.

Rather than elaborate on the problem that has been thoroughly presented elsewhere, this article intends to show how a select group of medical schools have approached the problem with programs that are having a significant impact. According to Dr. Srijan Sen, a psychiatrist from the University of Michigan who directs an on-going research project on clinical depression of more than 10,000 interns at 55 institutions, "only 22% of interns who are depressed get any help."[1]

Prior to their internship, about 4% of doctors have clinical depression, which is comparable to the general population. However, as interns, the frequency rises to as much as 25%. Programs detailed below have attempted to impact these numbers.

The first is the Healer Education Assessment and Referral (HEAR) program at the University of California, San Diego (UCSD). We first reported on this program in our March 2012 issue of The Physician Lifeline, the Missouri Physicians Health Program e-newsletter. HEAR is designed to identify and assist students, residents, fellows, and faculty members who are depressed and may be at risk for suicide. Their process begins with an invitation to participate in a web-based, brief, anonymous survey. Each respondent is then grouped according to his or her responses in three tiers based on risk level with Tier 1 as the highest risk category. A counselor reviews all questionnaire responses and responds with a personalized reply based on their individualized assessment. The counselor invites each respondent to communicate online if desired via an anonymous website dialogue page. All Tier 1 and 2 students are urged to contact the counselor to schedule an in-person evaluation. The counselor then evaluates the participant more fully, discusses treatment options, and makes referrals as appropriate. This program has achieved a high percentage of those categorized as either high or moderate risk accepting referral. As reported previously, participants who were surveyed indicated that they would not have made an appointment to see a mental health professional without the online screening program.[2]

Second, is a pilot program at Stanford University to improve work-life balance for emergency medicine doctors that includes providing meals, house cleaning, and babysitting in exchange for long hours.

Stanford also put together a program to "promote psychological well-being, physical health and mentoring. Every week one of the six groups of surgery residents has a mandatory psychotherapy session with a psychologist. Each senior resident mentors a junior resident and residents are given time for team bonding."[3] Additionally, they are given information on recommended professionals for medical and dental care, as many residents don't have a personal physician or take the time to visit one, plus a refrigerator in the surgery residents' lounge stocked with healthy foods. The Balance in Life program has to constantly battle for operating funds, but they justify it by reminding other faculty that it was a response to a recent physician suicide at their institution.

The State University of New York Downstate Medical Center has provided free counseling for medical students and physicians for 20 years. Their program incorporates peer support, which has helped alleviate the stigma involved with asking for help. The service is provided confidentially and does not become part of the student's record.

Closer to home, Saint Louis University (SLU) has implemented a significant curriculum revision to address issues of stress, depression, and anxiety and to impact the occurrence of medical student suicide. Stuart Slavin, MD, MEd, began by surveying the medical students at SLU to develop an accurate picture of the problem. "In their first year, 57% expressed moderate to high symptoms of anxiety; 27% reported moderate to severe symptoms of depression."[4] Students cited the demands of the curriculum and competition for grades as their primary stressors.

With the support of SLU leadership, Dr. Slavin initiated curricular changes starting with the class of 2013. A pass/fail grading system for preclinical courses was implemented; contact hours were reduced by 10% the first two years to give students more time to "participate in new learning communities and longitudinal electives. This change allowed students more freedom to explore their interests, to create mentorship relationships with faculty and SLU School of Medicine alumni and to engage in service and/or research with more continuity. The learning communities were given the task of designing and implementing new electives, developing a lunch lecture series, identifying faculty mentors, and expanding service and research opportunities."[5] Later, additional changes were implemented including a required resilience and mindfulness program. The third set of changes involved the demanding anatomy course, which was a major source of reported stress. Further, students were given more time to choose a specialty.

All these changes have had a very significant reduction

Students are afflicted with paranoia and mistrust that utilizing services that are available from their respective schools may jeopardize their future careers. Thus, many students suffer in silence and don't reach out for help.

in the frequency of depression and anxiety. Among first year students, moderate to severe depression has been reduced to 8% down from the starting figure of 27%, and moderate to severe symptoms of anxiety were reduced to 23% down from 57%. Critical to the success of any of these programs is confidentiality. Students are afflicted with paranoia and mistrust that utilizing services that are available from their respective schools may jeopardize their future careers. Thus, many students suffer in silence and don't reach out for help.

Medical schools could benefit from utilizing an independent third party, such as the Missouri Physicians Health Program (MPHP), which is not part of the administration of the university. Students would not need to fear exposure by conferring with a MPHP representative.

As an example, recently a third year resident in Missouri hadn't told anyone of his heroin addiction until he heard a talk given by Robert Bondurant, RN, LCSW, Executive Director of the MPHP. After hearing his presentation, the student felt safe enough to contact us. The MPHP then advocated on his behalf to secure the help he needed to get clean and into recovery. If he hadn't heard this presentation, his story may have turned into a tragedy.

It is also vital that the training facility feel that the MPHP is credible and a safe place with which to entrust their students. Another student with addiction issues, an eating disorder, and family issues was recently referred to us by her school. The MPHP isn't a monolithic approach. We deal with a broad range of issues, not just addiction, that have the potential of leading to suicidal thoughts and behaviors.

People often ask how many suicides we have aborted. We have only physically intervened in two instances where we literally stopped someone from killing themselves. However, the real question is how many suicides have been prevented by resolving other issues, any one of which could have led to a suicide. It is impossible to say, but, by our involvement, we changed the dynamics involved which otherwise may have led to a death by suicide.

One reason we seek to speak annually to incoming medical students, as well as residents and faculty at every training facility in the state is to inform every listener that there is a confidential and safe source of help available to them. Virtually every time we speak, a referral results because the individual feels a sense of safety and comfort in doing so. Typically, it is a situation where the individual has not disclosed his or her problem to anyone before. They often didn't know that the MPHP was designed to help physicians in training and senior physicians as well, with a breadth of issues, such as mental health, including burnout, addiction, behavioral issues such as "disruptive behavior", licensure issues, boundary violations, and even physical illness that may be affecting their performance.

Just recently another presentation to residents resulted in a phone call. This resident, after hearing Mr. Bondurant speak, felt safe in contacting us. This time, the problem was with his spouse. She had had a medical problem and was prescribed opiates, which quickly turned into an addiction to narcotics. Her desire for more drugs led her to procure additional scripts through on-line sources. Eventually, she tearfully went to her husband and informed him of her addiction. Her husband felt safe in calling Mr. Bondurant after hearing his presentation, who assisted him in determining the best source of detox and treatment, which was covered by their insurance. We often receive calls such as this. We do not only help physicians, but physicians' family members as well.

Another advantage that we bring to the table is that we have many years of experience in handling these issues. We are familiar with their challenges, and know the best resources for professional assistance. In the case of addiction, where the individual has accepted referral to a treatment facility, we provide long term monitoring of their recovery to ensure their success, which separates us from other programs that don't offer rigorous monitoring and follow-up.

Yes, the data on physician suicide and depression is of deep concern. This article has detailed some of the innovative approaches that we have encountered across the country. We are hopeful that more training facilities will strive to better inform their students and residents that there is hope and help available.

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MM

Web-Based Cognitive Behavioral Therapy Intervention for the Prevention of Suicidal Ideation in Medical Interns: A Randomized Clinical Trial

by Constance Guille, MD, Zhuo Zhao, MS, John Krystal, MD, Breck Nichols, MD, Kathleen Brady, MD, Srijan Sen, MD



Source: JAMA Psychiatry. Published online November 04, 2015. doi:10.1001/jamapsychiatry.2015.1880.

ABSTRACT

Importance

In the United States, approximately 1 physician dies by suicide every day. Training physicians are at particularly high risk, with suicidal ideation increasing more than 4-fold during the first 3 months of internship year. Despite this increase, to our knowledge, very few efforts have been made to prevent the escalation of suicidal thoughts among training physicians.

Objective

To assess the effectiveness of a web-based cognitive behavioral therapy (wCBT) program delivered prior to the start of internship year in the prevention of suicidal ideation in medical interns.

Design, Setting, and Participants

A randomized clinical trial conducted at 2 university hospitals with 199 interns from multiple specialties during academic years 2009-2010 or 2011-2012. The current study was conducted from May 2009 to June 2010 and May 2011 to June 2012, and data were analyzed using intent-to-treat principles, including last observation carried forward.

Interventions

Interns were randomly assigned to 2 study groups (wCBT and attention-control group [ACG]), and completed study activities lasting 30 minutes each week for 4 weeks prior to starting internship year. Participants assigned to wCBT completed online CBT modules and those assigned to ACG received emails with general information about depression, suicidal thinking, and local mental health professionals.

Main Outcomes and Measures

The Patient Health Questionnaire–9 was used to assess suicidal ideation (ie, "thoughts that you would be better off dead or hurting yourself in some way") prior to the start of intern year and at 3-month intervals throughout the year.

Results

A total of 62.2% of interns (199 of 320) agreed to take part in the study; 100 were assigned to the wCBT group and 99 to the ACG. During at least 1 point over the course of internship year, 12% of interns (12 of 100) assigned to wCBT endorsed suicidal ideation compared with 21.2% of interns (21 of 99) assigned to ACG. After adjusting for covariates identified a priori that have previously shown to increase the risk for suicidal ideation, interns assigned to wCBT were less likely to endorse suicidal ideation during internship year (relative risk, 0.40; 95% CI, 0.17- 0.91; P = .03) compared with those assigned to ACG.

Conclusions and Relevance

This study demonstrates that a free, easily accessible, brief wCBT program is associated with reduced likelihood of suicidal ideation among medical interns. Prevention programs with these characteristics could be easily disseminated to medical training programs across the country.

Trial Registration

anzctr.org.au Identifier: ACTRN12610000628044

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Contributors to the MPHP 2015 Fund Raising Campaign

The Missouri Physicians Health Program is proud to recognize the following organizations and individuals who contributed to our annual fund drive. We are truly grateful for their generosity which helps provide crucial support as we strive to provide high quality physician health care services and meet the demand for our services statewide. Many of our participants are physicians in training who are unable to pay for services rendered. Your contribution helps us to defray those costs. We encourage you to generously contribute to this effort as we reach toward our goal for 2016. Thank you.

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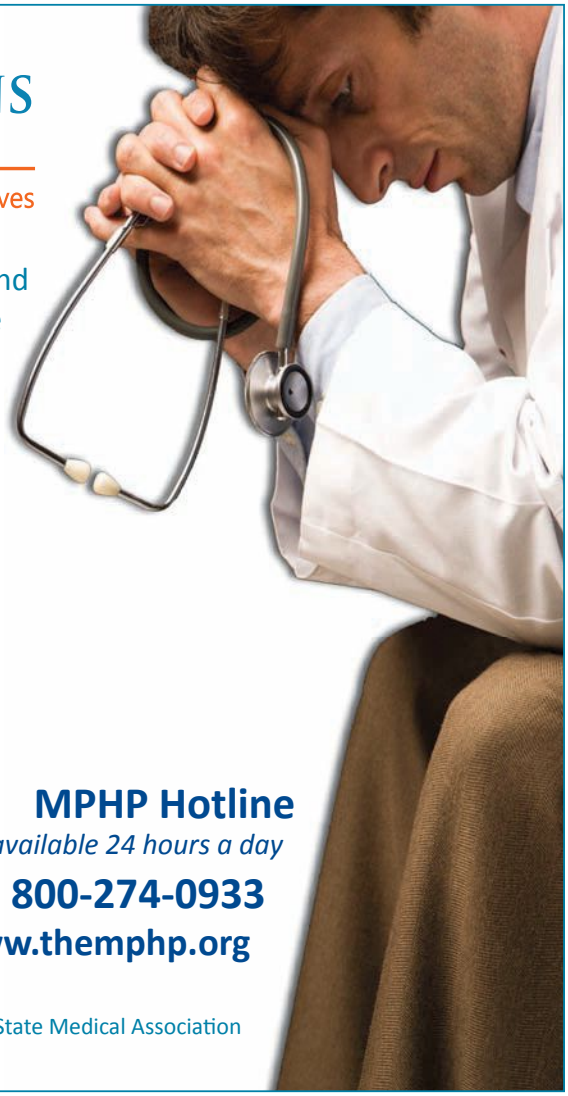
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Protecting Against Tax ID Theft and Avoiding Other Fraudulent Tax Schemes

by Mark Milton, Esq.

In recent years, tax identity theft has impacted millions of honest taxpayers, including health care professionals. The problem keeps worsening, with no end in sight. This article provides guidance to health care professionals for preventing and remedying tax ID theft and highlights other tax schemes to avoid.

Tax ID Theft

Tax identity theft involves fraudsters filing bogus tax returns using someone else's name and Social Security number in order to obtain a fraudulent refund. Scammers route the stolen refunds to difficult-to-trace bank accounts or have the checks sent to vacant addresses for retrieval. Often the funds are reaped before the IRS or the tax ID theft victim has any idea a return has been filed in his or her name. Honest taxpayers typically learn of the fraud when they go to electronically file their tax returns, only to have their return rejected by the IRS because a return has already been filed under their name and Social Security number. Fraudsters file the bogus tax returns often in the first few weeks of tax season, which can create major headaches for taxpayers who wait until the end of filing season to file their returns, only to learn one has already been filed.

Missourians have been hit hard by tax ID fraud in recent years. From January through early April 2015, the Missouri Attorney General's Office reportedly received 388 complaints of tax ID theft, up from about 200 complaints the prior year.[1] In St. Louis County alone, there were 750 reports of tax ID theft in 2015.[2]

Targeting Health Care Professionals

While tax ID theft affects taxpayers of all types, health care professionals appear to have been especially targeted by such schemes in recent years. Physicians make good prey because they are presumed by fraudsters to have higher incomes, which can generate larger refunds. Such individuals' personal information may also be more susceptible to compromise due to participation in government and private health insurance programs. Indeed, some suspect the epidemic among health care professionals stems from a data breach at a large health care insurer.

In addition, many health care professionals are self-employed and/or independent contractors, making them more likely to report their income on a Schedule C



This article was written by Mark Milton, an associate in the St. Louis office of Husch Blackwell LLP and former Trial Attorney with the U.S. Department of Justice, Tax Division. Husch Blackwell serves as outside general counsel to the Association. The information contained in this article should not be construed as legal advice or a legal opinion on any specific facts or circumstances. The contents are intended for general information purposes only, and readers are urged to consult their own attorney concerning their own situation and any specific legal questions.
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(Profit or Loss from Business) or as Schedule E income from a pass-through entity. Such tax forms are easier for fraudsters to manipulate and the information on these forms can be difficult for the IRS to verify before processing the refunds. Even for physicians who earn W-2 wages, the IRS does match these records to information submitted electronically until after processing the fraudulent refunds.

In 2014, the Michigan Dental Association reported receiving 350 identity theft complaints from members.[3] In Washington, D.C., the Medical Society of the District of Columbia reported more than two dozen doctors were victims of tax ID theft in 2014.[4] Similar incidents of tax ID theft have been reported by state medical associations in Indiana, Massachusetts, Maine, New Hampshire, South Dakota, Iowa, North Carolina, Colorado, Connecticut and Vermont.[5]

What is the IRS Doing about Tax ID Theft?

The IRS and the U.S. Department of Justice ("DOJ"), Tax Division, have made prosecuting individuals who use stolen identities to claim fraudulent tax refunds a top priority. Through the Stolen Identity Refund Fraud ("SIRF") Enforcement task force, the IRS and DOJ have prosecuted hundreds of individuals for tax ID theft, resulting in long sentences for those convicted of SIRF crimes.

In July 2013, a St. Louis woman was sentenced to 144 months in prison and ordered to pay $835,883 in restitution to the IRS after pleading guilty to theft of government funds and aggravated identity theft.[6] According to her plea agreement and other court documents, the woman stole the identities of more than 400 individuals, many of whom were deceased, and filed fraudulent tax returns using their names and Social Security account numbers.[7] Between August and November 2012, she allegedly filed 236 fraudulent tax returns, using a network of family and friends to collect refund checks or prepaid debit cards for the refund amounts.[8]

Still, the problem persists, and the feds have yet to develop a widespread solution to the problem.

How Can You Protect Yourself from Tax ID Theft?

Filing your tax returns as early in the tax season as possible can help mitigate the risk of tax ID theft. While this may not be practical for most physicians, who likely need to wait for tax forms from financial institutions and other third party payers before they can file their returns, the sooner you file your return, the less risk you face of someone else filing a fraudulent return on your behalf.

To protect against tax ID theft, eligible taxpayers may request an Identity Protection PIN (IP PIN) from the IRS.[9] The IP PIN is a unique six-digit number that can help prevent misuse of your Social Security on fraudulent tax returns. You must use this PIN to confirm your identity on all tax returns you file. Thus, a fraudster cannot e-file your return without this PIN. However, if you request a PIN and do not use it when e-filing your return, it will likely be rejected by the IRS. So, if you request an IP PIN, make sure you use it or provide it to your tax return preparer to use when filing your return to avoid any complications.

What if You Become a Tax ID Theft Victim?

If you do fall victim to tax ID theft, there are steps you can take to remedy the situation. Start by completing an IRS Form 14039 ("Identity Theft Affidavit"), attesting that your personal information has been compromised and that you believe a fraudulent tax return was filed using your Social Security number and other personal information. In some instances, the IRS may notify you that you are a possible victim of identity theft by way of a 5071C letter. The 5071C letter may ask you to call the IRS and verify certain information and to confirm that the return electronically filed in your name was fraudulent. If you received the 5071C letter from the IRS, you should attach this to your affidavit (Form 14039).

Next, you should prepare (or have prepared) a correct paper copy of your tax return and mail it to the IRS. The IRS should eventually process your correct return and any associated refund. According to the IRS, it can take up to four months to process paper-filed returns.

Other Tax Scams to Avoid

While tax ID theft can strike unsuspecting taxpayers, other tax scams provide warnings signs and should be avoided at all costs. Given their higher incomes and associated tax brackets, physicians may fall prey to illegal tax avoidance schemes promoted by individuals claiming to possess specialized or secret knowledge of the inner-workings of the Tax Code. While the popular tax shelter schemes of the 1970s and 1980s have mostly been thwarted by IRS and DOJ enforcement efforts, promoters of illegal tax avoidance schemes still exist

today. Such schemes often involve the use of multiple flow-through entities or accounts, including offshore accounts, and multi-layer transactions intended to conceal the true nature and/or ownership of taxable income or assets. Such schemes also often involve the payment of personal expenses disguised as business expenses. Misuse of trusts is another common scheme, whereby promoters encourage taxpayers to transfer their income and/or assets into trusts with promises to escape taxation. Participation in such schemes can have devastating civil consequences and could lead to criminal charges.

Some examples of health care professionals being prosecuted for participation in such schemes are highlighted here:

- In June 2014, a jury convicted a Fresno, California-based oral surgeon of tax-related offenses for his participation in a trust scheme where he claimed millions of dollars' worth of personal expenditures as business expenses.[10] The illegal trust scheme was promoted by an attorney who helped the doctor funnel business earnings into shell companies in order reduce his taxable income, according to the government.[11] The surgeon was ultimately sentenced to 18 months in federal prison for obstructing and impeding the IRS.[12]
- In December 2014, a Mississippi doctor was sentenced to 75 months in prison for tax evasion and obstructing IRS laws.[13] The doctor, an orthopedic physician, "used a complex tax evasion scheme involving an entity in Utah, which claimed it was a tax exempt church, to evade his taxes," according to the government.[14] The physician had allegedly not filed any tax returns or paid tax since 2003.[15]
- Finally, in January 2015, a San Diego doctor and his wife were sentenced to four years in prison and ordered to pay almost half a million dollars in restitution to the IRS for their participation in various tax fraud schemes.[16] Despite earning as much as $1 million a year from their osteopathic medical practice, the doctor and wife paid almost no federal income tax for a decade, according to the government.[17] They also responded to the government's investigation by making widely-rejected and frivolous tax protestor arguments as to why they owed no taxes, such as that they were not citizens of the United States and federal tax laws did not apply to them.[18]

You should avoid any tax arrangement that sounds too good to be true. It likely is. You should also be weary of anyone claiming to have found a "loophole" in our tax system whereby you can escape federal taxes altogether or that our nation's tax laws somehow do not apply to you. Finally, and probably most importantly, prior to entering into any tax avoidance strategy, obtain a second opinion regarding the legitimacy of the deal or transaction from a CPA or tax attorney. The cost of doing so will pale in comparison to the tax, penalties (civil and/or criminal), and interest you may face if the transaction later proves to be a sham.

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BEWARE

Tax Identity Theft Scam Targets Physicians Again

MSMA has learned that a large-scale federal tax scam that hit physicians in the last two years is rearing its ugly head again. Physicians in Missouri and other states have again been made victims of an identity theft scam involving federal income tax returns.

MSMA is working with the U.S. Secret Service on this matter. If you have any reason to believe you are a victim of this scam, take the following action as soon as possible!



Take these steps as soon as possible:

1. Call the IRS at (800) 908-4490, and report your suspected identity theft.
2. Call the Social Security Administration at (800) 772-1213, and let them know.
3. Place a fraud alert on your credit file by contacting one of the three credit reporting companies. The company you contact is required to contact the other two, which will then place a full alert on your credit report. The three companies are:
   - Equifax - (800) 525-6285 – http://www.equifax.com/home/en_us
   - Trans Union - (800) 680-7289 – http://www.transunion.com/
   - Experian - (888) 397-3742 – http://www.experian.com/
4. Fill out and submit the IRS Form14039, which can be found at this site: http://www.irs.gov/pub/irs-pdf/f14039.pdf
5. Please e-mail MSMA Executive Vice President Tom Holloway at tholloway@msma.org and provide your full name, home address, and telephone number. MSMA is working with the U.S. Secret Service and has been asked to provide the names of suspected victims.

Consider visiting these websites for more information and tools to help you:

- Federal Trade Commission
  http://www.consumer.ftc.gov/articles/0008-tax-related-identity-theft

- Internal Revenue Service
  http://www.irs.gov/Individuals/Identity-Protection

- Social Security Administration
  http://www.socialsecurity.gov/pubs/EN-05-10064.pdf

MM



A Call for Fairness in Drug Prices

by John O. Stanley, MD

In my family medicine practice, there is never a day without at least one complaint from a patient about the cost of his or her medications. This problem of drug cost is not a new one, but I do think that it is a larger problem now than it was in years past. It's a multifaceted problem, with many forces that affect not only the cost of medications, but also their availability. According to a *US News and World Report* article, total spending on prescription medicine in the U.S. has reached its highest level in 13 years. It is projected that drug spending will soon reach $305 billion per year, and will continue to increase.[3] Prices for all medicines, both name-brand and generic, are increasing. Some generics now actually cost more than they did when they were being sold as name-brand products. In contrast to past years, new medications are now entering the market at prices equal to or above similar drugs in their classes. These prices seem to have more to do with what price the market will bear than with the actual cost of the medication.

What are some of the influences on the pharmaceutical cost? How significant is it that the U.S. government is unable to negotiate prices for Medicare drug plans? Why are we physicians so frequently being called upon to change our patients' medications after their insurance company renegotiates prices with pharmaceutical companies? How are these drug prices reached? How much influence does the pharmaceutical industry have on patient advocate groups? These are just some of the questions facing us as we try to improve patient care and control costs. At times I



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feel that my hands are tied when I try to treat a patient while working around the ever-increasing cost of medication.

You have probably read about the prohibitive costs of certain cancer treatments. Consider that one out of three Americans will develop cancer in her or her lifetime, and that the average price of cancer drugs is increasing by about $8,500 a year, while the average household income is down 8% from a decade ago. This means that many of us run the risk of not being able to afford these potentially life-saving treatments. The price of cancer drugs in 2000 was between $5,000 and $10,000 per year, and is now greater than $120,000 per year. Even with insurance, the out-of-pocket expense is around 20-25% of that total. For a family of four with an annual income of $52,000, a single cancer drug could eat up 50% of their income. The high price of cancer drugs may be shortening the lives of those who cannot afford expensive treatments, or do not qualify for financial aid, and destroy the financial stability of others who are able to pay, but impoverish themselves in the process. It's a real injustice for cancer treatment to be so strongly based upon a patient's ability to pay.[12]

Drug treatment for hepatitis C has also made headlines. Two drugs, Sovaldi and Harvoni, exemplify the problem. Sovaldi costs $84,000 and Harvoni $95,000 for a typical 12-week course of treatment. These drugs are undeniably beneficial, offering a possible cure of Hepatits C. The overall benefit is hard to quantify when you consider treatment could prevent liver cancer, liver failure, need for transplant and prevention of further spread of the disease. This is not a trivial disease, with about 20,000 deaths attributable to hepatitis C in 2013. As with the cancer drugs mentioned above, patients who cannot afford this treatment, or do not qualify for discounts, are facing an agonizing dilemma.[1]

A story that demonstrated the seemingly arbitrary way that certain drugs are priced came to light recently with the case of Martin Shkreli, the former CEO of Turing Pharmaceuticals. Shkreli's firm acquired a drug called Daraprim, which treats toxoplasmosis, and quickly raised the price from $13.50 a pill to $750 a pill. He was nicknamed "Pharma Bro," and became an internet villain overnight. He has since been arrested for unrelated securities fraud charges.[2]

A similar, though less dramatic, situation that hits close to home for me, is the cost of an old generic drug, doxycycline. This drug used to cost pennies a dose but now costs at least a dollar a pill. It has been dropped from some drug plans or moved to a third tier, presumably due to its cost, despite it being one of the few oral antibiotics available that can effectively treat Methicillin-resistant Staphylococcus Aureus, a common and frequently devastating infection.

In all these situations, one has to wonder how the pharmaceutical firms in question came up with the prices for the drugs. According to a recent *New York Times* article, drug companies are coming under pressure to disclose the development costs and profits of their medicines and the rationale for charging what they do. "The price charged for an individual drug is not a reflection of developmental cost," says Ken Kaitlin, director of the Tufts Center for the Study of Drug Development. "Pricing strategies are based on therapeutic value, market size, usage, patent life, competition, and other factors."[4] At least six state legislatures in the past



year have introduced legislation calling for pharmaceutical cost transparency. However, according to the journal Mayo Clinic Proceedings, there appears to be no relief in sight, because drug companies continue to challenge the market with even higher prices. Are the drugs priced based on reasonable expectation of return on investment or is it what the market can bear? Former President Bill Clinton spoke to pharmaceutical executives last year and said it would be in the industry's best interest to say more about cost and pricing."Explain, explain, explain, and disclose, disclose, disclose."[5] Time will tell if they heed his advice.

The pharmaceutical industry has already changed some of its practices. As many of you know, they are required to report payments that they make to doctors for research, consulting and giving promotional speeches, and this includes the cost of meals and entertainment. They have also started to disclose more of their clinical trial results and raw data. Whether this is a beginning of a trend toward more transparency on cost and pricing remains to be seen. Cost transparency bills have been introduced in New York, California, Massachusetts, North Carolina, Oregon, and Pennsylvania. At this writing, none of these bills has made much progress, presumably because of the huge political influence pharmaceutical companies exert at both the state and national level.[5]

Interestingly, pharmaceutical companies also have a huge influence on patient advocacy groups. An article in the January 22 issue of *USA Today* revealed some interesting facts on how the industry influences these national groups. For example, the Leukemia and Lymphoma Society received $50 million a year from drug makers, which is about 16 percent of their funding. The National Patient Advocate Foundation received 60 percent of its $2 million budget from the pharmaceutical industry. Several other groups get up to 20 percent of their revenue from drug companies. This influence may be stifling key voices in the policy debate over soaring drug prices, especially those concerning cancer. One of the reasons for the apparent lack of interest in the soaring drug costs by these patient groups is their focus on funding research to develop drugs to cure their respective diseases. Patients and patient advocates seem to care less about the cost of individual drugs, and more about curing disease, regardless of the cost.[13]

Is there a simple solution to this problem of skyrocketing drug costs? Obviously not. I believe that improved transparency on the part of pharmaceutical manufacturers will be an important part of the solution. The mysterious ways that medications are priced leads to mistrust of the industry, and begs for more rules and regulations. How can we accept the argument that the cost is reflective of the research and development of the drug when we know that the pharmaceutical industry is spends more on marketing medicines than they do on basic research?[6] Direct-to-consumer advertising doesn't improve patient care, but does improve the bottom line for drug companies, and I'm convinced that it raises the cost of treatment.



According to the *Wall Street Journal's Pharmalot* publication, recent studies show that the federal government could save between $15.2 billion and $16 billion annually if it negotiated with drug makers for Medicare part D medicines, to obtain the same prices that are paid by Medicaid and the Veterans Health Administration. Medicare has been banned from negotiating prices for their Medicare part D program, while Medicaid is able to negotiate prices, as is the Veterans Health Administration. The pharmacy industry's argument is that Medicare part D medicines includes rebates that are negotiated by private plan sponsors.[7] Why did we need to develop a system that includes insurance companies acting as middlemen in the delivery of medicines when Medicare part D was adopted? The state of Missouri has about 50 of these "middleman," companies, which I believe could be eliminated if Medicare were to negotiate directly for drugs.

Another costs-saving idea would be for the current system of drug approval by the FDA, especially for generics, to be improved. Currently there is a backlog of about 4,000 applications, with a wait time of 27 months, for generics. It's possible that speeding up the approval process would stimulate the market and drive prices down.[10]

The AMA voted at their 2015 interim meeting to convene a task force and launch an advocacy campaign to drive solutions and help make prescription drugs more affordable. Actions called for in this new task force include:

- supporting legislation to shorten the exclusivity period for biologics;
- encouraging federal regulators to limit anti-competitive behavior by pharmaceutical companies;
- encouraging prescription drug price and cost transparency among pharmaceutical companies;
- monitoring pharmaceutical company mergers and acquisitions;[14]
- supporting a balance between incentives for innovation and efforts to reduce regulatory and statutory barriers to competition as the patent system is evaluated.

While I realize that I have not offered any definitive solutions to this complex problem, I do hope I have piqued your interest.

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- OB/GYN - Traditional
- OB/GYN Hospitalist
- Occupational Medicine
- Ophthalmology
- Optometry
- Oral & Maxillofacial Surgery
- Orthopedic Surgery
- Otolaryngology
- Pain Management
- Pathology
- Plastic Surgery
- Podiatry
- Psychiatry
- Pediatrics
- Pediatric Emergency Medicine
- Pediatric Endocrinology
- Pediatric GI
- Pediatric Hem/Onc
- Pediatric Internal Medicine
- Pediatric Neurology
- Pediatric Surgery
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For more information, please contact: Angie Abraham, MBA
Executive Director of Physician Recruitment • Mercy Clinic
Phone: 877-880-6650 | Fax: 888-290-8300
Email: angie.abraham@mercy.net

AA/EOE

Mercy

MSMA Members in the News

Read more about what our members are doing at www.facebook.com/momedical

Missouri Medicine welcomes added experts in 2015-2016: Elizabeth A. Piontek, MD (Urology), C. Daniel Kingsley, MD, (Hematology & Oncology), Katherine R. Lichtenberg, DO (Public Health) and Gregory R. Galakatos, MD (Orthopedics). We thank Pamela Honeycutt, MD, PhD, (Hematology & Oncology), James Magera, MD (Urology) and Roger P. Jackson, MD, (Orthopedics) for their past service.

Missouri Medicine would like to publicly thank non-Editorial Board experts who have done peer-review of submitted manuscripts in 2015: Doug Bogart, MD, Joel Shenker, MD, PhD, and Lenard Politte, MD.



Congratulations to Patricia Benoist, MD, of Houston, for achieving the degree of Fellow of the American Academy of Family Physicians. MSMA appreciates her support since 2011.



An MSMA member since 1976, John Bentley, MD, of Springfield has been honored with the Doctor of Public Affairs degree by Missouri State University.

Chitra Dinakar, MD, FACAAI, MSMA member since 2002, was presented with the Woman in Allergy Award from the American College of Allergy, Asthma, and Immunology which honors an individual who has advanced the role of women in medicine or made a significant contribution to the specialty. Dr. Dinakar is on the *Missouri Medicine* Editorial Board.



MSMA commends Kansas City University of Medicine and Biosciences (KCU) on the construction of its new administration building. Marc Hahn, DO, KCU President, has been an MSMA member since 2012 and spoke during the ribbon cutting.

John B. Holds MD, FACS, St. Louis, MSMA member since 1991, was awarded a Life Achievement Honor Award at the 2015 American Academy of Ophthalmology meeting in Las Vegas in November. This award is the final step of three awards given by the American Academy of Ophthalmology for service to the Academy.



Michael Montgomery, MD, has been a member since 1982, and is the recipient of Kansas City Medical Society's 2015 Lifetime Achievement Award. Photographed to his left is Lancer Gates, DO, Immediate Past President of KCMS and MSMA Vice Speaker.



Charles Norris, MD, MSMA member since 2006, served as honorary chair of the 39th Annual Ball hosted by Lake Regional Hospital Auxiliary, benefitting the Cardiac Catheterization Lab, Emergency Department, Cancer Center, Family Birth Center, Surgery Center, and more.



A valued MSMA member for 15 years, Pranav Parikh, MD, has been named Chief Medical Officer of Hannibal Regional Healthcare System. We wish him all the best in his new role.



James Petersen, MD, now sees patients in Lincoln and Lake St. Louis. MSMA appreciates his support since 1993.



Congratulations to Jeffrey Piontek, MD, member since 2010, for being honored as the Mission Exceptional Recognition Physician Winner at SSM Health Medical Group in Holts Summit in December.



Richard Price, MD, now sees patients at Garden City Medical Clinic, in addition to Harrisonville Medical Clinic. He's been an MSMA member since 1983.



Lisa Roark, MD, of Cassville, offered up a lesson on the skeletal system for first-graders in her community over the Halloween weekend. They assembled and labeled skeletons, learning where bones are located. MSMA is extremely proud to have her as a member since 2010. **MM**


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Greene County Medical Society on the Move

Founded in 1874, the Greene County Medical Society has provided a voice for generations of southwest Missouri physicians. As with most membership organizations, the GCMS needed to address changes in medicine and membership. To remain relevant we had to evaluate how we "do" organized medicine in Springfield, Missouri. Under the leadership of 2015 President Robert B. Shaw, Jr., MD, our Society made plans to modernize our society in hopes of continuing our success in today's changing times.

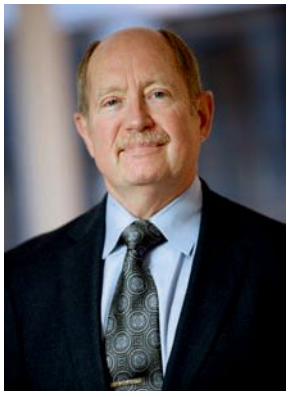
Setting Goals in 2015

Our first goal was to be more aggressive in showing younger physicians the relevance of becoming a member. We began the communication process by setting up a Facebook page and establishing new procedures to reach out to young physicians when they move to our area. We looked for opportunities to share how much GCMS advocates for all physicians and how important it is to be involved with legislative decision-making at the local, state and national level. This was a great year to show that relevance as Missouri did pass Tort reform. Our Society was involved with White Coat day in Jefferson City and individual physicians lobbied many local politicians to help the cause.

Our second goal was to improve our relationships with the nearby hospitals. GCMS leadership had meetings with our local hospitals and identified areas where we can work together. The biggest one at this time is Medicaid expansion. We will also continuing to partner with the hospitals in the public health domain. Together, we can fight for improving patient care and access, which will benefit us all.

The third goal was to become more efficient and make sound economic decisions. With that goal in mind, we sold the Woodhurst building, our home for 29 years, and moved into a more efficient, modern space. This was a difficult but necessary decision that allows us to spend less money per month and not be strapped to an aging building that would likely require much investment in the future. We also now have funds to create a financial plan to help ensure our successful continuation for decades to come.

Through the year of change and evaluation, the GCMS continued regular activities, including CME programs, Retired Physician lunches, Committees, Advocacy, Public Health activities, as well as social events such as the annual picnic and golf tournament.



2016 GCMS President
Alexander Hover, MD



2015 GCMS President
Robert B. Shaw, Jr., MD

GMCS Alliance

While continuing promotion of their educational DVDs, Smoking Makes Me Ugly! and Pills Are Not A Party!, the GCMS Alliance moved forward with new projects. The 2015 Doctors' Day project raised $15,000 to purchase a van for the LifeHouse Crisis Maternity Home. In September in recognition of the 20th anniversary of the Stop America's Violence Everywhere (SAVE) initiative, the GMCS Alliance distributed 4,000 copies of the booklet "I Can Be Safe" to first grade students in Springfield and surrounding towns.

For the 2016 Doctors' Day project, the GCMSA has invited Kim Blackham, LMFT, and physician spouse from Tampa, Florida, to speak on "Nurturing the

Medical Marriage." The Alliance will honor Springfield doctors and their spouses with a buffet dinner and this presentation on Tuesday, March 29. The GCMS Alliance will continue other health education projects as well as popular monthly social activities, including Coffee, Crepes and Conversation (a morning gathering for brunch) and Tuesday Social Hour (a 4-6 p.m. afternoon event).

Moving Forward in 2016

Following several months of downsizing, packing and moving, the GCMS invited members to an Open House in December to see our new office space which is located near the Mercy Springfield campus. In a much smaller space, we were still able to incorporate a number of our interesting medical "antiques" in the décor, and our Journal archives are available for member use. In addition to our own office suite, the new building offers large shared conference and media rooms that are available for Society needs.

The year is off to a busy start. In addition to regular Board and Committee, the Executive Council members will participate in a strategic planning retreat in February to review the Greene County Medical Society's position and action needed for Public Health issues, Mission/Vision statement, Advocacy, and Engagement of Members. The officers will meet with financial advisers to map out an investment plan for the future. CME activities resume in February. In addition, the GCMS Journal is celebrating 75 years of publication.

2016 President Alex Hover has encouraged our members to face challenges and opportunities. First, we must engage young physicians and help them recognize the value of organized medicine. Second, as a part of organized medicine, we must be an effective voice for new models for health care delivery and payment reform from the physician perspective. To address these opportunities, the GCMS leadership will seek to increase general and educational meetings, increase input communication from GCMS members on advocacy topics, and further collaborative relationships with other community groups with the aim of improving health care delivery within Southwest Missouri and at the state and national level.

The Need for Organized Medicine

Dr. Hover sees a bright future for the practice of medicine. Whenever I get a chance to speak to students beginning their journey to learn to provide some aspect of medical care, I take every opportunity to encourage them. I like to say that, "If you like people and you like applying science to help people, don't worry about the detractions and distractions. You will have a satisfying career." We active physicians absolutely must be engaged in changes in health care for that to remain true. Our first duty is to be an advocate for patients. That requires we also be an advocate for the direction of health care changes we think important to deliver care our patients value. I truly believe that whether you are an independent or employed physician, small office practice or large health care system, we can advocate for common issues that are important to patients and the practice of medicine.

I recognize that not all practicing physicians recognize the value of professional advocacy at this time and particularly not for young professionals just starting their career. However, if physicians do not lead health care changes, the void will be filled by many other organized health care business entities such as government regulatory agencies, payers, insurance companies, other providers, advocacy interest groups, device manufacturers, pharmaceutical companies, and non-medically trained practitioners. I don't mean to imply that any of these groups are inherently bad, but all may have a different directional view for the future of medicine than physicians.

Yes, politics is messy and organized medicine is imperfect. However, we all have an opportunity to use our collective efforts to be the most effective voice for our patients and our profession. It is the intent, and reflected in the mission of Greene County Medical Society, Missouri State Medical Association, and the American Medical Association that physician involvement is necessary to lead the successful transition of our current health care to better meet individual patient and population needs, and that organized medicine can provide physician guidance to meet those needed changes.

Think of the potential if we can effectively collaborate and influence other organized health care providers such as government, hospital associations, payers, and health systems. We treat one patient at a time to effect a cure, but we have to treat all of national health care delivery to improve our systems. Please encourage physicians who wonder about the value of joining them to join the members of GCMS, MSMA, and AMA. Together, we can treat all of the national health care delivery system effectively.

This article includes excerpts from the November 2015 and January 2016 GCMS Journal. **MM**



March 18-20, 2016
St. Louis Renaissance Airport Hotel
www.msma.org/annual-convention

GENERAL SESSIONS & EVENTS



American Medical Association Presentation

Steven Stack, MD
AMA President
Friday, March 18 • 8:00 am

OMSS Presentation EMRs: Lessons Learned

Saturday, March 19 • 3:30 pm



What Physicians Need to Know about MACRA, MIPs & APMs

Richard Deem
Senior Vice President
AMA Advocacy Group
Saturday, March 19 • 8:00 am



Fifty Shades of Genomics

John Lantos, MD
Director, Pediatric Bioethics
Children's Mercy Hospital
Friday, March 18 • 1:30 pm

CME MOC ACCREDITED



Acute Ischemic Stroke: Current Status & Future Directions

Raghav Govindarajan, MD
Assistant Professor, Neurology
University of Missouri
Saturday, March 19 • 10:00 am

CME MOC ACCREDITED



Drug Pricing: Can We Afford the Cure?

Steve Miller, MD
Senior Vice President
Express Scripts, Inc.
Friday, March 18 • 3:30 pm

CME MOC ACCREDITED



Burning Out in Medicine: Causes, Consequences & Strategies

Lotte Dyrbye, MD
Associate Chair, Staff Satisfaction, Faculty Development and Diversity, College of Medicine, Mayo Clinic
Saturday, March 19 • 1:30 pm

CME MOC ACCREDITED

FREE CME to Members

• Multiple Medical Specialties Programming • Two-Day Exhibit Showcase
• House of Delegates • Wild Wild West Foundation Fundraiser/Dinner
• Presidential Inauguration & Reception



www.msma.org/annual-convention

Pre-Convention Meetings

Thursday, March 17

2:15 pm	MSMA Insurance Agency Board Meeting
3:30 pm	MSMA Executive Committee
3:30-6:30 pm	Convention Registration
3:30-6:30 pm	Exhibitor Setup & Registration
5:00 pm	**MSMA Council Meeting**
6:30 pm	Alliance Dutch Treat Dinner [Offsite]
6:30 pm	University of Missouri Awards Reception & Dinner [Offsite]
6:30 pm	**MSMA Council Reception & Dinner**

Convention Meetings

Friday, March 18

6:30 am-4:00 pm	Convention Registration
6:30 am	University of Missouri Breakfast
6:45 am	Moneta Breakfast
7:00 am	**Exhibit Hall Opens/Continental Breakfast for all Conferees**
8:00 am	**Opening Session MSMA House of Delegates**
8:30 am	Alliance Board Meeting
10:00 am	Alliance General Assembly - Session I
10:00 am	**Reference Committee A**
10:30 am	**Reference Committee B**
Noon	SLMMS Caucus & Luncheon
Noon	KCMS Caucus & Luncheon
Noon	"Spirit of the Alliance" Awards Luncheon
1:30 pm	**MSMA General Session**
2:00 pm	Missouri Million Hearts Meeting
2:45 pm	Alliance Past President's Reception
3:30 pm	**MSMA General Session**
5:00 pm	OMSS Business Meeting
5:30 pm	Medical School Alumni Receptions
7:00 pm	Alliance Foundation Fundraiser/Dinner "Wild, Wild West"

Saturday, March 19

6:30 am-4:00 pm	Convention Registration
7:00 am	**Exhibit Hall Opens/Continental Breakfast for all Conferees**
All Day	CME Programs, Lectures & Meal Functions
8:00 am	**MSMA General Session**
8:30 am	Alliance General Assembly - Session II
9:00 am	International Medical Graduate Section Meeting
10:00 am	**MSMA General Session**
10:00 am	MMPAC Meeting
10:00 am	Medical Student Section Meeting
10:30 am	Exhibit Hall Closes
Noon	Alliance Installation Luncheon
1:00 pm	AMA Issues
1:00 pm	Resident Fellow Section Meeting
1:00 pm	Young Physicians Section Program & Meeting
1:30 pm	**MSMA General Session**
2:00 pm	Missouri State Medical Foundation Meeting
2:30 pm	Alliance Board Meeting
3:00 pm	Component/Specialty Society Leaders Meeting
3:30 pm	OMSS Educational Session
5:15 pm	Reception: 50-Year Pin Recipients & MSMA Past Presidents
6:30 pm	**MSMA Presidential Inauguration**
7:30 pm	**MSMA Presidential Reception** *Entertainment, Hearty Hors d'oeuvres & Cash Bar*

Sunday, March 20

7:00 am	District Breakfasts & Caucuses
8:15 am	**Second MSMA House of Delegates**
Immediately Following Closure of the HOD	MSMA Council Meeting

Complete Program at www.msma.org/annual-convention

Subject to Change. Refer to Convention Official Program for times and meeting locations. All meetings held at the St. Louis Renaissance Airport Hotel unless otherwise noted. Updates on CME program, lectures, and meal functions at www.msma.org/annual-convention. For more information, contact MSMA's Benita Stennis, at 800-869-6762 or bstennis@msma.org.

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School of Medicine
University of Missouri Health

MU School of Medicine: Understanding the Importance of Inclusion, Diversity, and Civility in Education

by Patrice "Patrick" Delafontaine, MD

We are dedicated to saving lives – through medical research, education of tomorrow's physicians, and providing clinical care.

At the MU School of Medicine, the health of our patients is our first priority. By providing the highest quality health care, our providers create an environment for the highest quality education for future physicians. In this way, we fulfill our mission of improving the health of all people, especially Missourians.

During 2015, the University of Missouri has been faced with several controversies. Understandably, topics such as racism, freedom of speech, women's health and abortion have generated concern and comments from alumni and friends of the university on all sides of these issues. We recognize that these and other social issues historically have been the subject of passionate political activism and debate throughout our country and on college campuses. And rightly so, because freedom of speech and the right to express one's political opinions are inalienable rights upon which our country was founded.

At the MU School of Medicine, we understand the importance of inclusion, diversity and civility in education, and we have a longstanding commitment to providing a positive learning environment for all students. As medical professionals, it is our job to care for patients; moreover, as human beings it's our duty to respect others without exception. As physicians and educators, we are obligated to help students understand that respect is not a luxury reserved only for some – it's a fundamental value that serves as a cornerstone for us as physicians and educators.



The University of Missouri School of Medicine's new Patient-Centered Care Learning Center in Columbia is scheduled to open in 2017. The center, seen here in an artist's rendering, will connect the school to the larger MU campus through views of Jesse Hall and the older parts of campus.

In my opinion, an important point has been obscured amid the recent media coverage and political debates, and that is this: the University of Missouri School of Medicine is dedicated to saving lives – through medical research, education of tomorrow's physicians, and providing clinical care. That has been our mission for more than 165 years, and we deliver on it superbly every day. I can assure you that we remain focused on our mission and ways we can learn from these events and make improvements. The following are some examples of how we are carrying out our commitment to Missourians.



Nearly 100 medical students, including second-year medical student Molly Johnson, (MSMA member since 2014), showed their support for the School of Medicine expansion to a second campus in Springfield by participating in a groundbreaking ceremony in Columbia in July 2015

Education

The 2015 School of Medicine class excelled in multiple capacities. Our graduates scored nearly 10 points higher than the national average on the United States Medical Licensing Exam's Step 1 exam. Ninety-nine percent of our graduates were matched for residencies, and 31 percent of graduates chose MU for their residencies. Of the 104 students who began medical school this year, the average MCAT score was 30.3, and the average GPA was 3.79. For more than a decade, our students have outperformed their peers on licensing exams. They also take time from their demanding schedules to volunteer in the community with programs such as MedZou, our local student-run free clinic.



School of Medicine students Farrah Malik, Murphy Mastin and David Clarke (MSMA member since 2015) join Linda Headrick, MD, senior associate dean for education, at the construction site for the Patient-Centered Care Learning Center. When planning for the design of the center, project leaders sought the input of medical students in order to maximize the new space to meet students' needs.

Springfield Clinical Campus Expansion

The University of Missouri, CoxHealth, and Mercy Springfield are addressing a critical shortage of physicians in the state and nation by adding a second MU School of Medicine clinical campus in Springfield. As part of the expansion, MU recently broke ground on a $42.5 million Patient-Centered Care Learning Center in Columbia. These changes will make it possible for the MU School of Medicine to increase our medical school class size from 96 to 128 students. By 2020, a total of 64 third- and fourth-year medical students will be based in Springfield. The project will provide more than 300 additional physicians for Missouri, add more than $390 million annually to the state's economy and create 3,500 new jobs. When the Patient-Centered Care Learning Center opens in 2017, it will be more than just a new state-of-the-art facility: It will be a tangible symbol of the School of Medicine's mission to provide education that focuses on the patient in every aspect. You can find out more about this at http://medicine.missouri.edu/morephysicians.

Rural Track Training Programs

The School of Medicine's Area Health Education Center Rural Track Pipeline Program celebrated its 20th anniversary in 2015. The program, which is designed to address the critical shortage of physicians in rural areas, has helped produce 577 physicians since its inception in 1995. One of the four programs included in the pipeline is the Bryant Scholars Pre-Admissions Program. Through the program, eligible undergraduate college students

are pre-admitted to medical school at MU. The program recently expanded to all four-year universities and colleges in Missouri, allowing students from 24 additional universities to apply. Seventy-seven percent of Bryant Scholars now practice in Missouri, and 69 percent of that group practice in rural locations. Learn more about our Rural Track Program at http://medicine.missouri.edu/ahec.

Patient-Centered Education

The theme of patient-centered care is integrated throughout medical education at MU. Thanks to a $1.1 million grant from the Health Resources and Services Administration, the MU School of Medicine is piloting a new project that will help meet demand for primary care physicians, as well as provide patients expertise and knowledge from a team of health care providers, all in one visit.

The project, "Aligning Residency Education with Clinical Practice Transformation," will teach family medicine resident physicians how to provide comprehensive primary care to patients throughout their lifetimes, a practice known as a patient-centered medical home. In a medical home, physicians provide lifelong care anywhere the patient may be, whether that is in a clinic, a hospital, at home, in an assisted living facility or during hospice care.

The Legacy Teachers' Program that originated at the MU School of Medicine recently has been adopted by other medical schools across the nation. In this program, third-year medical students are asked to reflect on patients who have had a lasting impact on students' ability to provide patient-centered care. Students submit essays or artwork describing the patients' contributions to their lifelong development, as a way to thank and honor their Legacy Teachers for the powerful lessons they have taught medical students. For more information about Legacy Teachers, visit http://medicine.missouri.edu/legacy.



Patrice "Patrick" Delafontaine, MD, serves as the Hugh E. and Sarah D. Stephenson Dean of the University of Missouri School of Medicine.
Contact: delafontainep@health.missouri.edu

School of Medicine
University of Missouri Health

AT-A-GLANCE

People
- Medical students: 397
- PhD and master's degree students: 194
- Residents and fellows: 453
- Faculty: 687
- Staff: 1,509

Clinical Facilities
- University of Missouri Health Care
- Ellis Fischel Cancer Center
- Missouri Psychiatric Center
- Missouri Orthopaedic Institute
- Missouri Rehabilitation Center
- University Hospital
- Women's and Children's Hospital
- 57 outpatient clinics
  - Total staffed beds: 538
  - Major surgical operations: 23,472
  - Patient admissions: 25,749
  - Emergency and trauma center visits: 71,962
  - Clinic visits (all sites): 614,133

Social Media
- FACEBOOK: MissouriMedicine
- TWITTER: MUmedicine
- INSTAGRAM: MUHealth

Research

During fiscal year 2015, the School of Medicine received $16.8 million in grants from the National Institutes of Health. The medical school is fortunate to be located on the MU campus, in close proximity to the Harry S. Truman Veterans Administration Hospital, Sinclair School of Nursing, School of Health Professions, and the Colleges of Agriculture, Food and Natural Resources (CAFNR), Veterinary Medicine and Engineering. At MU, we have more than 1,000 life scientists — all on one campus — who are united in the goal of improving health by studying humans, animals, plants and the environment. Their efforts focus on the deadliest diseases, such as cancer and cardiovascular disease, and the most vulnerable populations, including children and the elderly. Visit http://medicine.missouri.edu/research for updates on the School of Medicine's latest research discoveries.

Clinical Care

In 2015, University of Missouri Health Care served 191,293 Missourians. MU Health Care, based in Columbia, Missouri, is a vital clinical partner in helping the MU School of Medicine achieve all of its missions. With expenditures of nearly $1.1 billion, MU's medical school, hospitals and clinics' combined annual economic impact totals of approximately $2.5 billion. MU Health Care consists of Ellis Fischel Cancer Center, the Missouri Orthopaedic Institute, the Missouri Psychiatric Center, University Hospital, and Women's and Children's Hospital – all based in Columbia. For more information on MU Health Care, please visit www.muhealth.org. **MM**

MU Ophthalmology Charts a Future of Growth

by Frederick W. Fraunfelder, MD

When I became chair of the MU Department of Ophthalmology in July 2014, I was given the reins to expand both the clinical and the vision science research programs. We have already added a glaucoma specialist, a neuro-ophthalmologist, an oculoplastic surgeon, a cornea and laser vision specialist, and a combination medical retina specialist, ocular oncologist, and ocular pathologist. During the next two years we will add a pediatric ophthalmologist and an additional retina specialist. To accommodate our growth in clinical services, we have opened a second clinic, called University Eye Institute East, in the eastern part of Columbia, where Women's and Children's Hospital and other MU Health Care clinics are located. As for the research side, in 2016 plans are to increase the number of research faculty to seven full-time PhD faculty and to expand the department's lab facilities to make room for additional postdoctoral fellows, undergraduate and graduate students, and laboratory technicians.

Our department has a long tradition of research, and four of the six articles in this issue are a glimpse of the clinical research that happens between faculty attendings and ophthalmology residents and medical students. An article on visual acuity outcomes when residents perform cataract surgery is the result of a research project by a resident, two medical students and Frank Rieger, MD, ophthalmology chief at the VA Hospital. An article on vitreoretinal surgery as a risk factor for complicated cataract surgery is from a research project by a resident, an undergraduate student, Dr. Rieger and Dean Hainsworth, MD, vitreoretinal surgeon, vice chair of the department and medical director of the Clinical Research Center of the MU Institute of Clinical and Translational Science. An article on vaccine-associated uveitis is written by a medical student and me, based on our analysis of reports of adverse ocular reactions to vaccines. An article on hyperbaric oxygen therapy for central retinal artery occlusion is by a 2015 graduate of our residency program and Kathy Lentz, MD, a comprehensive ophthalmologist on our clinical faculty.

The fifth article is by our residency director, Geetha Davis, MD, who is a comprehensive ophthalmologist. It traces the evolution of cataract surgery to the point where it has now become, for all intents and purposes, a refractive procedure. The sixth article is by our neuro-ophthalmolgist, Bokkwan Jun, MD, PhD, who describes the systematic approach to narrowing the diagnostic possibilities of transient vision loss.



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The strong research foundation in the Department of Ophthalmology was laid down in the 1980s, under the leadership of Robert Burns, MD, a retina specialist who served as chair from 1979 to 1991 and was instrumental in establishing our presence in lens and retina research. Dr. Burns orchestrated in 1982 the development of the Mason Eye Institute. The department's presence in cornea research was cultivated under the leadership of John Cowden, MD, a cornea specialist who served as department chair for 20 years, until his retirement in 2013.

Through the years the PhD research faculty in the department have garnered millions of dollars in grants from the NIH/National Eye Institute. Of the 16 clinical departments of the MU School of Medicine, ophthalmology ranks first in research funding from the National Institutes of Health. As such, ophthalmology is integral to MU's position among the 62 universities that comprise the Association of American Universities. AAU institutions are an elite group: nearly one-half of the doctoral degrees in the United States are awarded by AAU-designated universities, and 55 percent of those degrees are in the sciences and engineering. Expansion of both the clinical and research arms of the Department of Ophthalmology will help in the campuswide effort to boost MU's AAU standing.

The growth we have been experiencing during the past 18 months is but a beginning. We are now in the early planning stages of building a new center of excellence in eye care and vision research. We have set our sights on breaking ground for construction in two to three years. It's an exciting time for all of us in the MU Department of Ophthalmology. **MM**



Conceptual drawing of the proposed Missouri Eye and Ear Institute, having a building footprint of 100,000 square feet. Building plans include clinical, surgical, and research space for ophthalmology and otolaryngology. MEEI is will be a center of excellence within the MU Health Care system, serving patients throughout the Midwest.

Visual Acuity Outcomes of Toric Lens Implantation in Patients Undergoing Cataract Surgery at a Residency Training Program

by Meryl Sundy, MD, Dustin McKnight, MD, Craig Eck, MD & Frank Rieger, III, MD

Toric lenses provide the opportunity for reduced spectacle dependence following cataract surgery in a greater proportion of patients than was ever possible with a traditional intraocular lense.






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Abstract

Ophthalmology residents must become competent in the use of a variety of intraocular lenses (IOLs) and refractive technologies designed to reduce spectacle use after cataract surgery. Our study of visual acuity outcomes with toric IOLs at the Harry S. Truman Memorial Veterans' Hospital revealed that residents achieved an uncorrected visual acuity of 20/40 or better in 88% of the surgeries they performed, a rate comparable to that reported by other residency programs and by cataract surgeons.

Introduction

Cataract surgery offers a unique opportunity to improve vision in three ways: by exchanging a clouded, or opacified, lens with the replacement intraocular lens (IOL); by compensating for variability in size or shape of the patient's eye with a specific power of correction in the IOL, and by making adjustments in the curvature of the cornea to correct astigmatism. In some individuals the cornea's contribution to visual acuity is a regular spherical arc. However, in 22% to 28% of the population,[1] correction for astigmatism is also required when the cornea has more of a football shape, where the arc of curvature is steepest in one axis and shallowest in a perpendicular axis. Toric IOLs were introduced in 1998 to correct this issue and have steadily gained in popularity. The lenses themselves take a similar astigmatic shape and the ophthalmologist can use corneal topography to choose the appropriate lens and align the axis to maximize the patient's visual improvement. These lenses and other so-called "premium" lenses are becoming more available to patients and knowledge of their use may be helpful to primary care physicians who find themselves in the position of counseling their patients about cataract surgery.

In addition to toric IOLs to correct for astigmatism, there are techniques such as limbal relaxing incisions (LRI) or similar cuts in the cornea, called astigmatic keratotomy (AK), which are designed to flatten the cornea at designated axes in order to try to correct for astigmatism. For appropriate patients, LASIK (laser-assisted in situ keratomileusis) or photorefractive keratectomy (PRK) may be an appropriate therapy for correcting astigmatism at the time of cataract surgery. While these options offer certain advantages, they

also have drawbacks. The reliability and accuracy of LRI are dependent both on the skill of the surgeon and the healing properties of the tissue.[2] In addition, LASIK or PRK may be a cost barrier for some patients. By requiring a second procedure, each of these approaches introduces some amount of additional risk when added to cataract extraction and IOL placement. The toric lens offers the benefit of managing both cataract and astigmatism in a single effort.

Candidates for Toric Lenses to Correct Astigmatism

Generally, patients are considered to be good candidates for toric lenses if the preoperative evaluation highlights a mostly regular astigmatism that is expected to be visually significant in the postoperative course if a standard lens were implanted. Regularity of the astigmatism is defined as the presence of a single, definable axis of maximal and minimal arc along which a toric lens can be aligned. The level at which astigmatism becomes visually significant varies greatly among patients, but generally astigmatism less than 0.75D (diopters) is well tolerated by most patients. Many patients can tolerate 0.75D to 1.25D of astigmatism, whereas nearly all patients with uncorrected astigmatism greater than 1.25D experience visual deficit. Given these generalities, it is common practice to consider astigmatic correction for patients with greater than 1.0D of astigmatism.[3]

Toric lenses are only currently available in certain measurements so patients at the extremes of these values will not have satisfactory correction from the lens itself. In these cases, the addition of LRI is particularly useful. Most toric lenses will not correct presbyopia, thus patients will still require spectacles for reading. In the United States, there currently is one available accommodating toric lens (Trulign), but it is not approved for the correction of presbyopia. Multifocal toric lenses for the correction of both astigmatism and presbyopia are used internationally and await FDA approval for use in the United States.

Implantation of toric lenses adds a layer of complexity to surgical planning and is generally an increased cost compared to implantation of a standard IOL. Possible complications associated with toric lenses include incorrect lens selection from either incorrect measurement or calculations, improper lens placement from inaccurate surgical marking or implantation technique, and postoperative lens rotation resulting in inaccurate alignment.[4] As toric and other premium lenses become more widely used, it is a clear necessity that ophthalmology residents become competent in their use. The faculty physicians at the Harry S. Truman Memorial Veterans' Hospital (Truman VA Hospital), which is affiliated with the Department of Ophthalmology, Mason Eye Institute, at the University of Missouri, began working with both toric and presbyopia-correcting lenses several years ago for selected patients. In 2011, the Truman VA Hospital made toric lenses available to patients on a routine basis, leading to greater accessibility for patients and increased resident involvement in toric surgeries.

The standard preoperative evaluation for cataract surgery includes the measurements that identify candidates for toric IOLs. Important elements include the patient's attitude towards the surgery and their ability to undergo the procedure. The patient's visual acuity is assessed as well as the patient's response to glare and dim environments, as necessary. The refraction can be helpful to determine how much of the patient's visual impairment is from corneal aberration rather than cataract or retinal disease. The fundus of the eye is examined for evidence of macular disease that may limit the patient's visual potential. If the decision is made to proceed with plans for cataract surgery, then corneal topography is performed as well as manual and automated measurements of axes of astigmatism and axial length of the eye. At this point these measurements are used to calculate the strength of the IOL and, if appropriate, to select the proper toric model.

Multiple studies have been conducted to explore the accuracy of toric placement. A meta-analysis reviewing 11 studies of toric IOL placement by experienced surgeons found a collective improvement in uncorrected distance visual acuity (UDVA) and spectacle independence from 40% of patients requiring eyeglasses all of the time to 0% requiring eyeglasses all of the time. Although not all studies reported data on preoperative refractions, 7 of the 11 study populations achieved a mean UDVA of 20/40 or better and 10 of the 11 study populations achieved UDVA of 20/50 or better. With toric lenses, the proportion of patients never requiring spectacles increased from 15% to 85%.[5]

Corneal astigmatism is common in patients who are candidates for cataract surgery and IOL implantation. A prevalence study, in Germany, which included over 23,000 eyes, found that approximately 8% of people have at least 2.00D of corneal astigmatism and that 16% of all eyes are candidates for toric lenses based on a 1.50D threshold.[1] In a study of more than 4,500 patients preparing for cataract surgery, 34.8% were found to have at least 1.00D of astigmatism and more than 20% were toric candidates.[2]

Methods

To get a measure of our institution's competency in training ophthalmology residents to perform cataract surgery and toric lens implantation, we conducted a retrospective study of visual acuity outcomes of cataract surgery and toric lens implantation in patients undergoing cataract surgery during the early period in which toric lenses were offered at the Truman VA Hospital. We then compared the outcomes in our VA patients with those reported by other ophthalmology residency training programs and by experienced cataract surgeons. The study was approved by the Institutional Review Board of the University of Missouri and the Harry S. Truman Veteran' Memorial Hospital, Columbia, Mo. Patients were seen at the Eye Clinic of the Truman VA Hospital from July 2011 to September 2012, during the first year in which toric lenses were made available to patients at the Truman VA Hospital. Patients who met inclusion criterion of at least 1.00D astigmatism were offered implantation of the toric lens. AcrySof SN6AT3-SN6AT9 toric lenses (Alcon) were used.

The study population was comprised of 32 men (48 eyes), aged 54-96 years. Patients were not excluded because of ocular comorbidities such as glaucoma, hypertensive retinopathy, macular degeneration, and corneal scarring, with the exception of one patient who was excluded because of hypotonous maculopathy following a glaucoma surgery. For the purposes of data comparison, it is important to note that the aforementioned conditions likely cause a decreased overall visual potential and, for this reason, patients with such ocular conditions are typically excluded from IOL studies. However, we elected to include these patients, given our small sample size.

Preoperative consent was obtained and a full ophthalmologic examination was performed, including tonometry, visual acuity, refraction, keratometry, and dilated fundus examination. Preoperative cylinder was measured by various methods of quantifying corneal topography and used in preference of reliability; manual keratometry was chosen over IOL Master, which was chosen over Pentacam keratometry. Postoperative visual acuity was measured by manual refraction. Surgeries were performed by multiple second- and third-year ophthalmology residents of the Department of Ophthalmology, Mason Eye Institute, under the supervision of multiple attending cataract surgeons. Primary outcomes were UDVA (uncorrected distance visual acuity) and CDVA (corrected distance visual acuity). Secondary outcomes included reduction in cylinder (i.e., astigmatism). Outcomes were assessed in a retrospective fashion by chart review. Data were inputted into a standard database and statistical analyses were performed by the authors.

Results

Toric IOLs were implanted in 48 eyes of 32 patients. Data were analyzed from follow-up visits, typically occurring at one month and six months after surgery. It should be noted that initial postoperative data were recorded at variable visit intervals, ranging from 7 to 90 days after cataract surgery, with the majority of visits occurring at 30 days (32 of 48 eyes). These dates of the initial postoperative visit were analyzed together as the postoperative visit recorded that was closest to 30 days. Average preoperative cylinder was 2.04D (range: +1.00D to +4.75D). Average postoperative cylinder was 0.93D (range: +0D to 5.25D). The mean reduction in cylinder was 55%. Using the 30-day postoperative visit data, the average best-corrected visual acuity (BCVA) was 20/25 and the average uncorrected visual acuity (UCVA) was 20/30. At one month, UCVA of at least 20/25 was achieved in 50% of the eyes (24 of 48) and BCVA of 20/25 or better was achieved in 79% of the eyes (38 of 48 eyes). Regardless of the postoperative visit date, the overall rate of a UCVA of at least 20/40 was 88% (42 of 48 eyes).

Surgical complications were rare. Most pertinent to the evaluation of toric placement success, an increase in refractive cylinder following surgery occurred in two eyes, one of which was clinically significant. With regard to the surgery itself, two eyes had zonular dehiscence, and one patient was later noted to have a vitreous band to the surgical wound.

Discussion

We sought to evaluate outcomes of toric lens placement by ophthalmology residents and compare these outcomes to previously measured outcomes performed by experienced surgeons. The resident surgeons at the University of Missouri ophthalmology residency program achieved visual acuity outcomes in cataract surgery with toric IOL comparable to those reported by other teaching institutions evaluating such outcomes. An analysis of the VA population at the Bascom Palmer Eye Institute, University of Miami, found 80% of cases with final spherical refraction within 1.0D of target refraction, and ultimately 92% of cases achieved BCVA at least 20/50, with a 56% mean reduction in refractive cylinder (mean preoperative cylinder 2.4D; mean postoperative cylinder 1.1D).[6] The Dallas Parkland Health and Hospital population of 79 cases, studied by Roesch et al. (University of Texas Southwestern Residency Program), consistently had an 82% reduction in refractive cylinder (mean preoperative 2.13D; mean postoperative 0.38D), with 57% of eyes having a

postoperative UDVA of 20/25 or better and 90% having a UDVA of 20/40 or better. CDVA was 20/25 or better in 92% of eyes.[7] A third large VA population of 105 eyes (Brown University residency program) did not report mean pre- and postoperative values for refractive cylinder, but noted a mean discrete reduction of 1.13D, which appears comparable to other published studies.[8]

In comparison to accomplished surgeons, our residents were able to achieve a similar improvement in visual acuity. A meta-analysis of 11 studies evaluating toric placement found that toric lenses were universally associated with an improvement in visual acuity, but concluded that the lack of standardization of study methods and measurements and small sample sizes make direct comparisons of outcomes difficult. In addition, these studies had more extensive exclusion requirements than our own. The five studies that evaluated operative change in cylinder reported mean reductions ranging from 60% to78%.[4] A randomized parallel group study of toric IOL versus control IOL placement in 517 eyes, performed by experienced surgeons, demonstrated a reduction in the mean cylinder that ranged from 57.1% to 65.0%, depending on the choice of power. The data are again similar to our own findings. This study also found that 61% of patients with toric IOLs had spectacle-free distance vision at six months, as compared to 39% of patients who received the control IOL, made by the same manufacturer.[9]

Among the strengths of our study of visual outcomes with the toric lens is that the resident surgeons performing the cataract surgery were at different stages of ophthalmology residency training and were under the supervision of different attending surgeons, likely typifying the true practice of resident-performed surgeries. Another strength of our study is that we used the outcome of uncorrected visual acuity, which is an ideal target for the study of postoperative results, as uncorrected visual acuity highlights the most important outcome for both the patient and the surgeon: the patient is not subjected to the further burden of another procedure or of the need for constant spectacle use. Challenges to the study include the small sample size, all-male gender, the inability to exclude patients with pre-existing conditions with visual significance, and the fact that the procedures assessed were performed several years ago and surgical techniques have since evolved. Additionally, the retrospective nature of the study led to incomplete data collection. In future studies it would be helpful to include a larger, more diverse study population and to compare the standard IOL with the toric lens, each performed in association with further modifications such as LRI, PRK or LASIK. Studies of this nature pose obvious difficulties in standardization and control, which may preclude their development. Of note, one area that has not been frequently reported is the proportion of patients who are spectacle free following surgery and how this may affect quality of life. It would be equally helpful to examine the benefit-cost analysis of the "premium" toric lens versus the standard lens plus any additional procedure or spectacle costs to achieve BCVA.

Conclusion

Toric lenses provide the opportunity for reduced spectacle dependence following cataract surgery in a greater proportion of patients than was ever possible with a traditional IOL. The selection of appropriate patients, preoperative counseling, surgical planning, and operative technique for these lenses are important skills for residents to acquire and practice. The findings of our study show that our residents can execute the preparation and procedure for these "premium" lenses in a way that corrects vision at a level comparable to that achieved by other surgeons. Resident-performed cataract surgery with toric lens replacement appears to pose no additional risk to the patient than a standard surgery.

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Disclosure

None reported.

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Vitrectomy as a Risk Factor for Complicated Cataract Surgery

by Moss J. Fenberg, MD, Kenneth J. Hainsworth, Frank G. Rieger III, MD & Dean P. Hainsworth, MD

Our study underscores the importance of considering vitrectomy surgery as a risk factor for complications associated with subsequent cataract surgery.






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Abstract

A retrospective review of 98 cases of complicated cataract surgery and/or delayed intraocular lens (IOL) dislocation examined the relationship between vitrectomy and cataract surgery complications. Nine (9.2%) of the 98 patients had a history of vitrectomy, before or after cataract surgery, and each had complicated cataract surgery. Six patients who underwent vitrectomy before cataract surgery experienced intraoperative complications. Three patients in whom vitrectomy was performed after uneventful cataract surgery subsequently had delayed IOL dislocation.

Introduction

Among the most serious complications of cataract surgery are posterior capsular rupture, vitreous loss, retained lens fragments, and intraocular lens (IOL) dislocation. Studies have reported the incidence of capsular rupture to be 1.0-1.7% and IOL dislocation to be 0.2- 2.0%.[1-8] Lens/IOL dislocation may result in cystoid macular edema, rhegmatogenous retinal detachment, prolonged intraocular pressure elevation, phacoanaphylactic glaucoma, vitreous hemorrhage, pupillary synechiae, prolonged corneal edema, corneal decompensation, and endophthalmitis.[9-12]

Recognized conditions that increase the risk of complicated cataract surgery and IOL dislocation include pseudoexfoliation syndrome, facial/ophthalmic trauma, advanced age, chronic uveitis, high myopia, retinitis pigmentosa, and ectopia lentis.[13-16] As the number of patients undergoing vitrectomy surgery continues to grow, an increasing number of patients who require cataract surgery have a history of vitrectomy and an increasing number of patients who require vitrectomy have a history of uncomplicated cataract surgery and IOL replacement. These patients are at increased risk of experiencing either intraoperative or delayed complications as a result of vitrectomy surgery.[17-23]

We examined all cases of complicated cataract surgery and/or delayed IOL dislocation

over a 15-year period to assess the risk of complicated cataract surgery in patients with a previous or subsequent vitrectomy. We hypothesize that vitrectomy surgery alters the zonular strength and/or capsular bag stability, which may increase the risk of (1) complications in subsequent cataract surgery or (2) IOL dislocation in eyes with previous cataract surgery.

Methods

University of Missouri Institutional Review Board approval was obtained for this study. The medical records of all patients undergoing cataract surgery at one institution over a 15-year period were examined. Patients were included in the study if they had complicated cataract surgery, including lens subluxation, dislocation and retained lens fragments and/or IOL dislocation. Information gathered for each patient included the following: patient demographics, indication for vitrectomy surgery, other intraocular procedures associated with vitrectomy surgery, posterior chamber IOL lens type, intraoperative complications (if any) during cataract surgery, the interval between cataract surgery and IOL subluxation/dislocation, the interval between vitrectomy surgery and complicated cataract surgery, preoperative best-corrected visual acuity (BCVA), final BCVA, and management of the subluxed/dislocated IOL.

Patients were excluded if they had recognized risk factors for complicated cataract surgery or delayed IOL dislocation. These factors included pseudoexfoliation syndrome, retinitis pigmentosa, previous facial/ophthalmic trauma, advanced age (over 90 years at the time of surgery), chronic uveitis, high myopia, and ectopia lentis.

A single unmasked examiner reviewed the medical and surgical records of each patient. Patients were excluded if information was incomplete.

Results

A total of 5,831 patients underwent cataract surgery during the study period. There were 98 cases (1.7%) of complicated cataract surgery, including lens subluxation, dislocation, and retained lens fragments, or of IOL dislocation.

Nineteen of these 98 patients had known risk factors for capsular rupture, zonular dehiscence, or lens/IOL dislocation. Patients with known risk included seven patients with pseudoexfoliation (7.1%), five patients (5.1%) with retinitis pigmentosa, three patients (3.1%) with previous significant facial or ophthalmic trauma, two patients (2.1%) with advanced age, one patient (1.0%) with Marfan syndrome, and one patient (1.0%) with chronic uveitis. Seventy (71.4%) of the 98 patients had no known risk factors for complicated cataract surgery.

Nine (9.2%) of the 98 patients had associated vitrectomy surgery. Six of these nine patients had vitrectomy surgery before cataract surgery and then at a later date had subsequent complicated cataract surgery. Three of the nine patients had undergone uncomplicated cataract surgery before vitrectomy surgery at a later date, and in these patients vitrectomy surgery was followed by subsequent IOL dislocation. The nine patients who experienced lens complications associated with vitrectomy surgery are the focus of our study.

The average interval between prior vitrectomy and cataract surgery was 2.5 years (range: 0.2-10 years) in the six patients who had complicated cataract surgery after vitrectomy. Complications included capsular rupture in all six patients, intravitreal cavity lens fragments in five patients, and zonular weakness in two patients. Four of the six patients had adequate capsular support to place a sulcus-based posterior chamber intraocular lens. In two patients an anterior chamber IOL lens was placed because of inadequate capsular support. All six patients required repeat vitrectomy surgery to manage the complications of their cataract surgery.

The average interval between cataract surgery and vitrectomy surgery was 6.1 years (range: 5.5-6.7 years) in the three patients who underwent uneventful cataract surgery and then had vitrectomy surgery and IOL dislocation. The IOL type in all three patients was a 3-piece polymethyl methacrylate (PMMA) IOL. All three patients were managed by repeat vitrectomy surgery, with placement of a sutured posterior chamber IOL in the sulcus.

The average age of the overall group of nine patients with lens complications associated with vitrectomy and cataract surgery was 62.5 years (range: 45–80 years). Seven patients were male and two were female. Eight patients were Caucasian and one was Hispanic. Indications for vitrectomy surgery in the nine patients included proliferative diabetic retinopathy in four patients, retinal detachment in three patients, retinal detachment with a giant

retinal tear in one patient, and subretinal choroidal neovascular membrane removal in one patient.

Vitreoretinal procedures performed at the time of vitrectomy included endolaser (scatter or barrier) in five patients, scleral buckle in four patients, membrane peel in three patients, extended gas tamponade in three patients, exo-cryopexy in two patients, silicone oil tamponade in one patient, air tamponade in one patient, and retinotomy in one patient. One patient had no associated vitreoretinal procedures at the time of vitrectomy.

The mean BCVA for the nine patients was 20/135. The final BCVA was 20/120. The mean length of follow up following the last ocular procedure was 39 months (range: 3-102 months).

Discussion

Our study adds to the evidence that vitrectomy surgery is a risk factor for complicated cataract surgery and IOL dislocation. Cataract surgery is the most common ocular surgery performed worldwide. Because of improving vitreoretinal techniques, vitrectomy surgery is becoming increasingly common as its range of indications continues to expand. As a result, an increasing number of patients undergoing cataract surgery have had previous vitrectomy surgery. Additionally, many patients undergoing vitrectomy surgery have had previous cataract surgery. Our study suggests that vitrectomy before or after cataract surgery increases the risk of complications associated with cataract surgery.

Predisposing risk factors for complicated cataract surgery and IOL dislocation in our patients were similar to those previously reported, such as pseudoexfoliation, retinitis pigmentosa, facial or ophthalmic trauma, advanced age, Marfan syndrome, and chronic uveitis.[13-16] We found that vitrectomy surgery as a risk factor for lens complications in cataract surgery was as common as that previously reported. In our patients with complicated cataract surgery, 9.2% had associated vitrectomy surgery, as compared with a rate of complicated cataract surgery of 7.1% in association with pseudoexfoliation, 5.1% with retinitis pigmentosa, and 3.1% with facial/orbital trauma.

Other studies have examined outcomes of previously vitrectomized eyes,[17-21] with particular attention to the incidence of lens/IOL dislocation. In a study of 25 cases of "in-the-bag" posterior chamber IOL dislocation, contributing factors to IOL dislocation were zonular weakness, zonular dialysis, and contraction of the capsular bag.[22] No cases had associated vitrectomy surgery. Another study found "in-the-bag" dislocation occurred more commonly in patients with pseudoexfoliation, retinitis pigmentosa, trauma, and myopia.[23] Vitrectomy surgery had previously been performed in 5% of the patients in this study. "Out-of-the-bag" dislocation was seen with secondary implantation of an IOL into the sulcus and with mature cataract.

The mechanisms by which vitrectomy surgery leads to cataract surgery complications are unknown. Certainly, the mechanics of phacoemulsification are altered in eyes with previous vitrectomy, in which the anterior chamber is deeper and the lens is less stable. In eyes without previous vitrectomy surgery, the vitreous may serve as a "cushion" to stabilize the lens and decrease anterior and posterior movement during phacoemulsification. Additionally, it may be that the pupils of eyes with previous vitrectomy surgery do not dilate as widely, increasing the risk of capsular tear or rupture.

Zonular stability plays an important role in avoiding complications during cataract surgery as well as preventing IOL dislocation. Although the zonular adherence to the lens is well described, peripheral zonular adhesions are less well understood. Rohen[24] has described the zonules anchoring between the ciliary processes at a common point, whereas Farnsworth[25] has shown that some of the zonules pass through the ciliary processes to attach more posteriorly on the pars plana, near the ora serrata.

Vitrectomy surgery results in focal disruption of the vitreous base as instruments are passed in and out of the pars plana sclerotomies. Additionally, vitrectomy surgery may result in more diffuse vitreous-base disruption if the vitreous base is shaved over the peripheral retina and pars plana during aggressive vitreous removal. It is likely that some degree of zonule disruption occurs during

vitrectomy surgery, if Farnsworth's model of posterior zonule adherence is correct. Such zonular disruption would contribute to the increased incidence of lens complications associated with vitrectomy surgery observed in our study.

Conclusion

Our study underscores the importance of considering vitrectomy surgery as a risk factor for complications associated with subsequent cataract surgery. Additionally, previously stable IOLs may be at increased risk of dislocation after subsequent vitrectomy surgery. Eye surgeons must acknowledge these risks and provide informed consent when considering cataract surgery in patients with previous vitrectomy or when considering vitrectomy surgery in patients with previous cataract surgery.

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Disclosure

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Vaccine-Associated Uveitis

by Matthew Benage, BS & Frederick W. Fraunfelder, MD

While uveitis may be a rare adverse effect of vaccines, awareness of this potential reaction to vaccines is important, as is reporting such occurrences to adverse drug reaction registries.



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Abstract

All of the widely administered vaccines have been reported to cause uveitis. The ocular inflammation is usually temporary and resolves with topical ocular steroids. During a 26-year period, a total of 289 cases of vaccine-associated uveitis were reported to three adverse reaction reporting databases. Hepatitis B vaccine, either alone or administered with other vaccines, appears to be the leading offender. Clinicians are encouraged to report cases of vaccine- or drug-associated ocular adverse reactions to www.eyedrugregistry.com

Introduction

Millions of lives have been saved since Edward Jenner's pioneering work, in 1796, to create a smallpox vaccine.[1] Disease prevention by means of vaccination is one of public health's greatest successes.[2,3] But the benefits of vaccines also carry the potential for a wide variety of side effects. Cases of uveitis in association with vaccine administration have been reported with nearly all vaccines.[4,5] To examine the occurrence of vaccine-associated uveitis, we collected data on cases of vaccine-associated uveitis reported to three spontaneous reporting databases on adverse drug events.

Methods

Spontaneous reports of all cases of vaccine-associated uveitis, made from 1984 to 2014, were collected from the National Registry of Drug-Induced Ocular Side Effects (www.eyedrugregistry.com), the World Health Organization (WHO) Monitoring Centre (Uppsala, Sweden), and the FDA spontaneous reporting system (Bethesda, MD). In addition, a Medline literature search was performed using the keywords of uveitis, iritis, iridocyclitis, or vitritis, in combination with vaccines, hepatitis A, hepatitis B, HPV, BCG, brucella, DPT, herpes, influenza, measles, MMR, pneumococcal, smallpox, tetanus, typhoid, heine medin, varicella, yellow fever, and zoster vaccine.

Results

A total of 289 cases of vaccine-associated uveitis were reported between 1984 and 2014. A preponderance of cases occurred in females: 199 cases in females versus 77 in males. Gender was not reported in 13 cases. Mean age of uveitis cases was 30 years (age range: 2 months to 86 years). The median number of days between vaccination and onset of uveitis was 16 days (range: 1 day to 6 years; SD=362 days).

Table 1
Data on 289 Reported Cases of Vaccine-Associated Uveitis, 1984-2014

Vaccine	Number of cases	Average age (range)	Outcome
Bacille Calmette-Guerin	21 —11 F, 7 M, 3 unknown	60 years (13-85 years)	6 recovered, 3 unresolved, 12 unknown
Brucella	1 — unknown	Unknown	Unknown
DPT	1 —1 F	38 years	Unknown
Hepatitis A (alone)	5 — 4 F, 1 M	48 years (11-78 years)	3 recovered, 2 unknown
Hepatitis B (alone)	115 —74 F, 39 M, 1 unknown	29 years (<1mon to 58 years)	52 resolved, 9 unresolved, 54 unknown
Herpes zoster	1 — 1 M	59 years	Unknown
HPV	44 — 44 F	17 years (11-29 years)	10 recovered, 1 unresolved, 33 unknown
Influenza	28 —17 F, 8 M, 3 unknown	55 years (14-82 years)	9 recovered, 2 unrecovered, 1 sequelae, 16 unknown
Measles	1 —1 M	10 years	Unknown
MMR	13 — 8 F, 4 M, 1 unknown	7 years (<1-17 years)	1 recovered, 1 recovering, 2 unrecovered, 9 unknown
Pneumococcal	1 — 1 F	67 years	Unknown
Pox viral particles	1 — unknown	Unknown	Unknown
Smallpox	2 — 2 F	25 and 34 years	1 recovered; 1 unknown
Tetanus	1 — 1 F	50 years	1 recovered
Heine Medin	1 — unknown	Unknown	Unknown
Varicella	13 — 7 F, 6 M	27 years (4.8-86 years)	2 recovered, 11 unknown
Unknown vaccine	2 — 2 F	27 and 68 years	Unknown
SIMULTANEOUSLY ADMINISTERED VACCINES (SEE TABLE 2 FOR SPECIFIC VACCINE COMBINATIONS)			
DPT and vaccine(s) other than hepatitis B	3	Unknown	Unknown
Hepatitis A and B combined	10	Unknown	Unknown
Hepatitis A and vaccine(s) other than hepatitis B	4	Unknown	Unknown
Hepatitis B and vaccine(s) other than hepatitis A	11	Unknown	Unknown
HPV and other vaccine(s)	4	Unknown	Unknown
MMR and varicella	2	Unknown	Unknown
Typhoid and polio	1	Unknown	Unknown

F = female; M = male

Table 1 lists the vaccines associated with uveitis and the number of cases reported with each vaccine. Vaccines implicated in the case reports of uveitis included bacilli Calmette-Guerin (BCG), brucella, diphtheria-pertussis-tetanus (DPT), hepatitis A, hepatitis B, herpes zoster, human papillomavirus (HPV), influenza, measles, measles-mumps-rubella (MMR), pneumococcal, pox viral particles, smallpox, tetanus, Heine-Medin, and varicella. Thirty-five of the 289 cases of uveitis were associated with simultaneous administration of more than one vaccine (see Table 2 for the list of vaccine combinations and reported cases of uveitis).

Vaccines most commonly reported in association with uveitis were as follows, in descending order of frequency: hepatitis B vaccine, 115 cases; HPV vaccine, 44 cases; influenza vaccine, 28 cases; BCG vaccine, 21 cases; and MMR vaccine and varicella vaccine, 13 cases each. Information on which dose of a particular vaccine was associated with uveitis was not available in the reporting systems.

Hepatitis B Vaccine

The data point to hepatitis B vaccine as the leading offender for causing uveitis. A total of 115 cases (40%) of uveitis were reported in association with hepatitis B vaccine alone. Seventy-four cases were in females, 39 in males, and gender was not specified in 1 case. Mean age of was 29 years (age range: 1month to 58 years). The median interval between vaccine administration and onset of uveitis was 23 days (range: 1 day to 6 years). Resolution of uveitis was reported in 52 cases, no resolution in 9 cases, and the outcome was not reported in 54 cases. The median duration of uveitis was 346 days (range: 31-686 days).

Table 2
Breakdown of Reported Cases of Uveitis in Association with Simultaneously Administered Vaccines

Vaccine combination	Number of cases
DPT/Meningococcal	1
DPT/Pertussis	1
DPT/Pneumococcal	1
Hep A/Polio/Typhoid	1
Hep A/Varicella	1
Hep A/Hep B	10
Hep A/Typhoid	1
Hep A/Yellow Fever	1
Hep B/DPT	2
Hep B/DPT/polio	1
Hep B/Tetanus/Typhoid/Yellow Fever	1
Hep B/Tuberculin	1
Hep B/Typhoid	6
HPV/Tetanus	2
HPV/MMR/Varicella	2
MMR/Varicella	2
Typhoid/Polio	1

In contrast to the 115 cases of uveitis related hepatitis B vaccine, 5 cases were reported with hepatitis A vaccine. Four occurred in females and 1 in a male. Mean age was 48 years (range: 11-78 years). The median interval between vaccination and onset of uveitis was 5 days (range: 2-30 days). Recovery occurred in 3 cases, and resolution did not occur in 2 cases.

Human Papillomavirus Vaccine

Of the 289 reported cases of vaccine-associated uveitis, 44 (15%) were reported in association with HPV vaccine. All cases were female, with an average age of 17 years (age range: 11-29 years). The median time to onset of uveitis after vaccination was 30 days (range: 2-511 days). Recovery was reported in 10 cases, lack of recovery in 1 case, and the outcome was not reported in 33 cases.

Influenza Vaccine

A total of 28 cases of uveitis were reported following administration of the influenza vaccine. Cases occurred in 17 females and 8 males, and gender was not specified in 3 cases. The average age was 55 years (age range: 14-82 years). The median time to onset of uveitis was 1 day (range: 1-92 days). Nine cases were reported to have recovered, 1 case recovered with sequelae, 2 cases were unresolved, and in 16 cases the outcomes were unknown.

Bacille Calmette-Guerin Vaccine

Twenty-one cases of uveitis were reported following the administration of the BCG vaccine. Eleven of the cases occurred in females, 7 occurred in males, and gender was not reported in 3 cases. Mean age was 60 years (age range: 13-85 years). Data were insufficient to report median interval between BCG vaccination and onset of uveitis. The median duration of uveitis was 72 days (range: 35-514 days). Six patients were reported to have recovered, 3 patients were recovering, and outcome was not reported in 12 cases.

Measles-Mumps-Rubella Vaccine

Thirteen cases (8 females, 4 males, 1 unknown) of uveitis were reported following administration of MMR vaccine. The average age was 7 years (age range: 0.9-17 years). The median days to onset were 21 (range: 3-145 days). One patient was reported to have recovered, 1 patient is recovering, 2 have not recovered, and no outcome data were reported in 9 patients.

Varicella Vaccine

A total of 13 cases (7 females and 6 males) of uveitis were reported following varicella vaccination. The average age was 27 years (age range: 4.8-86 years). The median time to onset of uveitis was 2 days (range: 2-97 days). Two cases were reported as recovered and 12 cases did not include outcome data.

Simultaneous Administration of Multiple Vaccines

Of the 289 cases of vaccine-associated uveitis, 35 (8%) were reported to follow simultaneous administration of multiple vaccines (see Table 2 for the breakdown of the number of cases with each vaccine combination). The most common vaccine combination was hepatitis B and hepatitis A, reported in 10 of the 35 cases of uveitis in association with simultaneous administration of multiple vaccines. In 9 additional cases associated with hepatitis B vaccine, it was paired with DPT (2 cases), tuberculin (1 case) and typhoid (6 cases). Taken together, data on hepatitis B vaccine, given alone (115 cases) or in combination with other vaccines (21

cases), indicate it was associated in 136 (47%) of the 289 reported cases of uveitis.

Other vaccine combinations associated with uveitis included hepatitis A vaccine administered with polio and typhoid, with varicella, with typhoid , and with yellow fever, in 1 case each. Varicella vaccine was given simultaneously with MMR and HPV (all three at the same time) in 2 cases and with MMR in 2 cases. DPT vaccine was administered with meningococcal (1), pertussis (1), and pneumococcal (1) vaccines. HPV vaccine was paired with tetanus vaccine in 2 cases. One case of uveitis was reported in association with simultaneous administration of tetanus, diphtheria, polio, and MMR vaccines, and 1 case was reported with simultaneous administration of typhoid and polio vaccines.

Clinical Features of Uveitis

Uveitis can occur as an isolated disorder, which is likely the case in most vaccine-associated uveitis, or it can arise from numerous other diseases, including various autoimmune conditions, systemic infections, paraneoplastic syndromes and ocular trauma. In many cases of uveitis, an underlying etiology cannot be identified. Uveitis affects the middle layer of tissue in the eye and is classified by anatomic involvement: anterior uveitis, intermediate uveitis, posterior uveitis and panuveitis. Anterior uveitis, by far the most common, involves the iris. The ciliary body (vitreous) is involved in intermediate uveitis; the choroid, retina and optic disk are involved in posterior uveitis, and diffuse involvement of the eye characterizes panuveitis, which includes both the anterior and posterior chambers.

Uveitis is a vision-threatening inflammation and is considered an ophthalmic emergency. Patients typically describe eye redness, eye pain, blurred vision, decreased vision, light sensitivity, and the presence of floaters. Intermediate uveitis may be manifested symptomatically by a painless decrease in vision and noticeable floaters. The onset of symptoms can be sudden or gradual. Untreated, uveitis can lead to complications such as glaucoma, cataract, optic nerve damage, retinal detachment, and irreversible vision loss.

On ophthalmological examination, slit-lamp examination in anterior uveitis may reveal clumps of white blood cells on the inner corneal surface (keratic precipitates), cells and flare (a haze) in the anterior chamber, and posterior synechiae. With intermediate uveitis, examination may reveal the presence of inflammatory cells over the pars plana ("snowball" effect), evidence of cystoid macular edema and, in some cases, neovascularization of the retinal periphery. Funduscopic evidence of posterior uveitis includes cells in the vitreous humor and white or yellow-white lesions in the retina or underlying choroid, or both. Cystoid macular edema may be seen, as may evidence of optic disk edema, exudative retinal detachment, and retinal vasculitis.

Management of noninfectious uveitis primarily consists of intensive ocular steroid therapy to reduce the inflammation as quickly as possible. This approach would be used in most patients with vaccine-associated uveitis. Prednisolone acetate 1%, 1 drop every hour while the patient is awake, is typically given for several weeks. Systemic steroids, such as 1 to 2 mg/kg of prednisone once daily, may be initiated in severe or chronic uveitis. Other approaches include nonsteroidal immunosuppressive drug therapy for severe or refractory uveitis. Complications of uveitis such as glaucoma, retinal detachment or optic nerve damage, are treated accordingly.

Discussion

Spontaneous reports often give the first signal that a drug is causing an adverse reaction. They are, however, limited in providing consistent details on the clinical features, clinical course and outcome, and the existence of concomitant disease and other potential contributing factors. The interval between vaccination and the onset of uveitis had a wide range in the reported cases, from a few days to a number of years. Unfortunately, the number of days between vaccination and onset of uveitis was not often reported.

Various hypotheses have been suggested for vaccine-associated uveitis, including molecular mimicry secondary to a close resemblance between vaccine peptide fragments and uveal self-peptides, delayed-type hypersensitivity with deposition of immune complexes, and an immune reaction to vaccination adjuvants.[5,6] With hepatitis A vaccine,[6-8] aluminum-containing adjuvant used in the vaccine has been suggested as a cause of an inflammatory response and may be related to uveitis.[6-8] Our previous study of spontaneous reports of hepatitis B vaccine–associated uveitis found 32 cases reported between 1982 and 2009 to the National Registry of Drug-Induced Ocular Side Effects, the World Health Organization and the FDA adverse reactions reporting system, the same databases used in the current collection of cases.[5] (The 32 cases from 1982 to 2009 are included in the current data, since current data encompass the years 1982-2014.)

The explanation for the seemingly disproportionate increase in reported cases of hepatitis B vaccine–associated uveitis, from 32 cases reported in the years 1982-2009 to 136 cases reported in the years from 1982 to 2014, is unknown. Hepatitis B vaccine was approved for use in 1982, and since then hepatitis B prevention strategies have

evolved to include an increasing number of groups that are recommended to receive the vaccine. From the initial targeted populations that included health care workers and intravenous drug users, hepatitis B vaccine recommendations were expanded in 1991 to universal hepatitis B vaccination in infants, with the first dose administered soon after birth, before discharge from the hospital. Four years later, in 1995, the CDC Advisory Committee on Immunization Practices (ACIP) recommended routine vaccination of all adolescents 11 to 12 years of age who had not been previously vaccination. In 1999, the ACIP recommended that all unvaccinated children under 19 years of age be vaccinated. These strategies indeed reduced hepatitis B transmission in the United States: the incidence of acute hepatitis declined 75% from 1990 to 2004, with the greatest decline occurring among children and adolescents.[9]

Uveitis from influenza vaccine has been described in various case reports.[10,11] The mechanism leading to uveitis after influenza vaccination is postulated to be due to inflammation secondary to vaccine additive.[12] Varicella-associated uveitis has been documented previously, and the mechanism may relate to reactivation of varicella virus or may be due to inoculum with live attenuated varicella viral particles.[13]

Uveitis has been reported in association with intramuscular injection of live attenuated BCG vaccine for immunotherapy of malignant melanoma and with intravesicular BCG irrigation to treat bladder carcinoma.[14,15] The hypothesized mechanism for BCG-associated uveitis is molecular mimicry due to the amino acid sequence homology between proteins from BCG and retinal antigens.[15] Similarly, the mechanism for MMR-associated uveitis has been suggested to involve antigenic mimicry or even faulty preservation of the vaccine.[16,17]

Conclusion

While uveitis may be a rare adverse effect of vaccines, awareness of this potential reaction to vaccines is important, as is reporting such occurrences to adverse drug reaction registries. That hepatitis B vaccine accounted for a disproportionate number of cases certainly piques curiosity about contributing factors for uveitis in association with hepatitis B vaccine. In a similar vein, we are also left with the question of why a disproportionate number of cases of vaccine-associated uveitis occur in females (199 in females versus 77 in males in our data). Future studies of vaccine-associated uveitis could focus on active surveillance and rigorous clinical evaluation of patients presenting with uveitis temporally related to vaccination.

Dutiful reporting of suspected cases of vaccine- or drug-related reaction to registries that collect data on adverse events is a key to improving the quality of data tracking of potential adverse reactions from vaccines as well as from drugs and biologic agents. Clinicians who encounter patients with possible ocular side effects to vaccines (or other agents for that matter) are encouraged to report such cases to the National Registry of Drug-Induced Ocular Side Effects (www.eyedrugregistry.com).

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Disclosure

None reported.

MM

Central Retinal Artery Occlusion: A Literature Review and the Rationale for Hyperbaric Oxygen Therapy

by Evan A. Olson, MD & Kathy Lentz, MD

When patients present within 24 hours of the onset of central retinal artery occlusion symptoms, hyperbaric oxygen therapy is another possible intervention. It has the advantages of a relatively low-risk profile and can be attempted to help improve visual outcome.





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Abstract

Central retinal artery occlusion is visually devastating and has no proven treatments. The therapeutic interval between symptom onset and potentially sight-saving intervention is narrow. Traditional conservative approaches include digital massage, administration of systemic vasodilators and diuretics, and lowering of intraocular pressure. Systemic and targeted fibrinolytic therapy is under investigation but is associated with significant adverse reactions. We report a case in which hyperbaric oxygen therapy restored retinal perfusion, and the patient's vision was improved.

Introduction

One of the most devastating eye diseases that ophthalmologists face is central retinal artery occlusion (CRAO). Within minutes, vision can go from crystal clear 20/20 vision to seeing only hand motions. CRAO typically presents with painless, sudden, and profound unilateral vision loss. Animal models of CRAO suggest that the retina can make a full recovery when the occlusion lasts less than 90 minutes. Occlusions for longer than 100 minutes tend to leave varying degrees of retinal damage. When the blood flow is interrupted for longer than 4 hours, retinal damage is usually massive and vision loss is irreversible.[1] The tissue that is potentially salvageable before this stage is often referred to as the "ischemic penumbra."[2] Penumbral tissue has been described as hypoperfused tissue that is destined for infarction unless normal perfusion is promptly restored.

The retina is one of the most metabolically active tissues, consuming more oxygen per gram of tissue than many other tissues, including the brain.[3] The retina has a dual blood supply, with the inner layers nourished by the central retinal artery and the outer retinal layers supported by the choroidal circulation. Although the average diameter of the central retinal artery is only 0.16 mm,[4] few blood vessels have the sole responsibility of nourishing more important real estate. In contrast to the solitary central retinal artery that supplies the inner retinal layers, around 20 ciliary arteries work together (called the choroidal circulation) to nourish the outer layers of the retina. They also

supply the central fovea. It is the preservation of this blood supply that leads to the pathognomonic CRAO "cherry red spot" against the background of diffuse retinal whitening (see Figure 1).

In the vast majority of the population, the central retinal artery is the only artery that feeds the inner retina. Only 15-30% of the population have a cilioretinal artery that also feeds the inner retina, serving as a back-up blood supply that can provide adequate blood flow to the macula in the case of an acute CRAO. Patients with a cilioretinal artery have a much better visual prognosis than those with a central retinal artery only.[5] In the 70-85% of the population who do not have a cilioretinal artery, CRAO typically results in permanent vision loss in the range of light perception only to counting-fingers vision. Spontaneous visual recovery after CRAO is extremely rare. When a cilioretinal artery becomes occluded (see Figure 2), however, the visual prognosis depends on how much of the macular blood supply is dependent on this vessel.

The incidence of CRAO is around 1 in 10,000 to100,000.[6] Given the rarity of CRAO and the unlikely event that it is diagnosed within the first several hours of symptom onset, no well-established treatment guidelines have been developed. A variety of therapeutic modalities have been attempted but with relatively limited success. Although interventions have little proven benefit, most ophthalmologists and their patients with CRAO are willing and desperate to try anything that will do no harm in the hope that something might help. The reality is that most of the time such efforts end up being futile and the retina is declared "dead." Following CRAO, patients are typically monitored for long-term complications such as neovascular glaucoma.



Figure 1
Funduscopic appearance of the classic cherry red spot against the background of retinal whitening in central retinal artery occlusion.



Figure 2
Cilioretinal artery occlusion on funduscopy.

Risk factors for CRAO include giant cell arteritis, carotid artery atherosclerosis, cardiogenic emboli, hypertension, smoking, diabetes, and thromboembolic disease. The possibility of such etiologies is addressed in the work-up on an individualized basis. Systemic steroids are administered when giant cell arteritis is suspected clinically. Smoking cessation and blood pressure control are important in all patients. Patients with significant carotid disease are usually treated with carotid endarterectomy, and those with cardiogenic emboli are usually treated with long-term anticoagulation.

Conservative Therapies for CRAO

For many decades, ophthalmologists have held onto the hope that an intervention of some type would be identified to consistently improve the dire prognosis of CRAO. One of the most frequently attempted interventions is ocular massage, as it can be readily performed with no special equipment. Intermittent digital pressure is applied on the eye to help facilitate the outflow of aqueous fluid. The release of digital pressure, theoretically, causes a sudden lowering of the intraocular pressure, which should improve the retinal perfusion pressure.[7] This maneuver is not without risk, because it could theoretically cause a retinal embolus to go downstream.

Intraocular pressure can also be rapidly decreased by administering topical glaucoma drops, performing an anterior chamber paracentesis, or administering diuretics such as acetazolamide or mannitol.[8,9] A limitation of anterior chamber paracentesis is that it only takes 1-2 hours for a deflated anterior chamber to return to a normotensive range. Sometimes the central retinal artery is noted on funduscopy to open back up completely following anterior chamber paracentesis. However, the blockage has a tendency to recur as soon as the anterior chamber reinflates. A recent retrospective review of more than 50 patients who underwent anterior chamber paracentesis following CRAO showed that there was no added gain in visual acuity with this intervention.[10]

Others have postulated that administration of a potent vasodilator such as nitroglycerin or pentoxifylline can be used to improve ocular blood flow during the ischemic insult.[11] An alternative method is to have the patient breathe into a brown paper bag in order to cause a hypercapnic vasodilatory response.

Despite many anecdotal case series describing successful outcomes with any or all of the above measures, major review articles have concluded that there is not sufficient evidence from prospective trials to state that any intervention makes a statistical difference in clinical outcomes.[12,13]

Revascularization Through Fibrinolysis

Some authors have described the use of systemic or targeted administration of tissue plasminogen activator (t-PA) for CRAO, since CRAO is the ocular analogue of a cerebral stroke. The results have been mixed. It is more challenging to deliver the ideal concentration of t-PA to a smaller caliber vessel like the central retinal artery in comparison to a larger vessel that may be affected in acute ischemic stroke. As a result, the potential risk-benefit ratio with t-PA may be higher with CRAO than with stroke-related occlusion.

One multicenter (five centers) randomized trial compared local intra-arterial fibrinolysis with conservative treatment in 84 patients with nonarteritic CRAO.[14] This five-year study demonstrated identical visual outcomes in each treatment group. However, the study was stopped prematurely because adverse reactions were much more prevalent in the local intra-arterial fibrinolysis group: 37% versus 4% in the control group.

Additional prospective trials are underway. In the meantime, there is insufficient evidence to recommend the use of systemic or targeted fibrinolytics for CRAO. The use of thrombolytics should be limited to centers participating in ongoing clinical trials.

Laser or Surgical Arteriotomy

In the event that the offending clot or embolus is visible on the optic disc surface, some ophthalmologists have had successful outcomes with laser or surgical arteriotomy. The Nd-YAG laser is accessible in most ophthalmology clinics and has been used in selected cases of CRAO and branch retinal artery occlusion (BRAO).[15,16] The laser beam is focused directly on the clot in an attempt to dislodge or fragment it in order to revascularize the ischemic tissue.

A surgical technique has been described for physically removing the obstruction. During vitreoretinal surgery, a stylet is used to directly puncture and remove the offending embolus or clot.[17] As would be expected, vitreous hemorrhage is a common complication of both surgical and laser arteriotomy.

Hyperbaric Oxygen for CRAO

Hyperbaric oxygen (HBO) therapy may have a more favorable side effect profile than more invasive approaches like fibrinolysis or surgical arteriotomy.[18] The rationale behind HBO therapy lies in the aforementioned fact that the retina has a dual blood supply. If the oxygen levels in the choroidal circulation are increased to a sufficient degree, then enough oxygen can diffuse downstream to the inner retinal layers to allow them to maintain some degree of viability. This theory is supported by CRAO animal models in which preservation of the normal inner retinal layer architecture has been demonstrated when choroidal oxygen levels have been high enough to allow for diffusion to the inner layers.[19]

Numerous case series support the idea that hyperbaric oxygen can improve outcomes following CRAO.[20-25] Aisenbrey et al. reported a mean increase in visual acuity of 2 lines in a series of eight patients treated with HBO.[20] Beiran et al. found that over 80% of patients in their series reported subjective improvement in vision with HBO therapy compared to less than 30% in the control group.[21,22] In a series of 21 patients, 19 noted subjective improvement of vision, which was confirmed in 13 patients by visual acuity testing.[23] Cope et al. pooled data from their case series of 11 patients with data from two other case series of HBO therapy, giving a combined total of 51 patients, and found that more than half of patients experienced visual acuity improvement of greater than 2 lines with HBO therapy.[24] Menzel-Severing et al. compared the visual acuity outcome in 51 HBO-treated patients with that in a control group of 29 patients and found an average improvement of 3 lines of vision in the HBO group compared to only 1 line in the control group.[25]

While these studies vary in their selection criteria and treatment algorithms, the vast majority recruited only patients who presented within 24 hours of symptom onset. These studies show hope that early HBO may improve outcomes following CRAO. Prospective randomized trials are necessary to demonstrate a proven benefit. Hyperbaric centers that treat these patients should consider forming a central registry of standardized data to prospectively study the results of HBO therapy.[24]

Case Report

A 67-year-old African-American man presented to the ophthalmology clinic with complaints of sudden, painless loss of vision in his left eye. He had a history of hypertension, previous placement of two cardiac stents and a 50 pack-year history of tobacco abuse. More than 25 years prior to presentation, he lost the vision in his right eye from a central retinal vein occlusion (CRVO). As is not uncommon following a CRVO, he went on to develop neovascular glaucoma, with severely elevated intraocular pressures (IOPs) that reached up to the 50s (normal range: 10-22 mm Hg). Despite aggressive treatment with maximal glaucoma drops and multiple palliative laser procedures, his right eye became completely blind, with no light perception. He ultimately decided to undergo an enucleation procedure to remove the right eye because it had no visual potential and was causing intolerable pain.

The patient was quite frustrated with the sudden onset of vision loss in his remaining eye. Baseline visual acuity in this eye was 20/25. The evening prior to presentation, he noticed an abrupt onset of vision loss with a peculiar "kaleidoscope of colors" that developed over several minutes. He denied any weakness, slurred speech, balance issues, nausea/vomiting, or other neurologic symptoms. His blood pressure was 150/80 mm Hg. Although he had never had any episodes like this before, he went to bed hoping that his vision would be back to normal after a good night's rest.

His vision remained poor the following morning, which prompted a visit to the ophthalmology clinic. He was able to count fingers from 5 feet away but could not identify the 20/400 line of the Snellen eye chart. His intraocular pressure was within normal limits. Fluorescein angiography demonstrated delayed filling of the retinal circulation, consistent with acute CRAO.

The hyperbaric medicine team was consulted and expediently started HBO therapy, based on a 2012 treatment algorithm published in the *Journal of the Undersea and Hyperbaric Medical Society*.[18] The patient underwent a total of six treatments (one every 12 hours) over a 72-hour period. Each treatment consisted of three 30-minute sessions, with a 5-minute break between each session. The pressure level was set between 2.4 and 2.5 atmospheres. After each treatment, visual acuity was measured to assess for any interval changes. He tolerated the sessions without any adverse side effects.

Following the first hyperbaric treatment, the patient noticed an abrupt recovery in his sight. His vision improved to 20/70. After the second treatment, his vision improved an additional line, to 20/60. Over the next four

treatments, his vision continued to trend upward until it stabilized at 20/40. The following week, he underwent a second fluorescein angiography study. This time, there was no delay in the transit of the fluorescein dye into the retinal circulation. The previously obstructed central retinal artery had completely recanalized. After two years of follow-up, the patient's vision has remained stable at 20/40.

Conclusion

When it comes to CRAO, "time is vision." CRAO is a true ophthalmic emergency. If any intervention is capable of reversing or limiting the associated vision loss from CRAO, it must be done in a timely fashion while there is still hope to save the ischemic penumbra. When patients present longer than 24 hours after symptom onset, the damage has already been done and there is little hope for spontaneous visual improvement. The shorter the time between onset of symptoms and presentation, the more hope there is that intervention may be beneficial to some degree.

Because of the relative infrequency of CRAO in comparison to other ischemic events, it is challenging to perform large-scale randomized controlled trials. The few randomized trials that have been published have failed to demonstrate any proven intervention that is more likely to work better than doing nothing.[13] Well-designed prospective trials are still required to establish the most effective treatment for CRAO. Hopefully, future studies will demonstrate interventions that can improve the poor visual prognosis associated with CRAO. In the meantime, ophthalmologists will, within reason, continue to try anything and everything to improve oxygen delivery to the ischemic retina, with the hopes of salvaging as much vision as possible. When patients present within 24 hours of the onset of CRAO symptoms, HBO therapy is another possible intervention. It has the advantages of a relatively low-risk profile and can be attempted to help improve visual outcome.

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Disclosure

None reported.

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The Evolution of Cataract Surgery

by Geetha Davis, MD

Cataract surgery may be considered one of the most successful treatments in all of medicine.



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Abstract

Cataract surgery is one of the most common procedures performed worldwide. It is also one of the oldest. Alongside advancements in cataract surgical techniques have been improvements in intraocular lens replacement technology. Cataract surgery may be considered among the most successful treatments in all of medicine. This article discusses the fascinating evolution of cataract surgery, from the earliest approach of couching to modern day phacoemulsification and lens replacement.

Introduction

The normal crystalline lens of the eye is a clear structure suspended in its natural position by zonular fibers from the ciliary body (see Figure 1). The lens contains a capsule, lens epithelium, cortex, and nucleus. Functions of the lens include refracting light to focus a clear image on the retina and providing accommodation. A cataract is an opacification of the crystalline lens, leading to visual impairment. Many conditions can cause cataract formation. Aging, however, is the most common cause which is multifactorial in nature.[1] Avoidable risk factors for cataract include use of tobacco products and exposure to ultraviolet radiation.[2]

When a cataract becomes visually significant, cataract surgery is the only established method of treatment. The definition of "visually significant" has evolved over time, to its current meaning of a visual acuity of 20/40 or worse.[3] When cataract surgery was in its the infancy, a "visually significant" cataract was likely used to describe an advanced or mature cataract, with vision impairment approaching blindness (see Figure 2). Thanks to amazing advancements in surgical techniques and improved safety profiles, the indications and threshold for cataract surgery clearly have shifted to cataract removal at a much earlier stage of development.

Couching and Mature Cataract

The earliest known method of treating a cataract is couching, which dates back to the fifth century BC (see Figure 3).[4] The word "couching" comes from the French verb "coucher," which means "to put to bed." Couching was typically performed on mature cataracts. The cataract was not removed from the eye. Instead, the mature cataract was purposefully dislodged out of the visual axis with a needle. The cataract remained in the eye but was no longer blocking light, producing instantaneous improvement in vision. Indeed, in the very immediate postoperative period, couching was considered a success, but the retained cataractous lens and the lack of aseptic technique soon had deleterious effects on the eye, often resulting in blindness shortly after the procedure. Unfortunately, couching is still in practice in some developing countries.[5]

Extracapsular Cataract Extraction

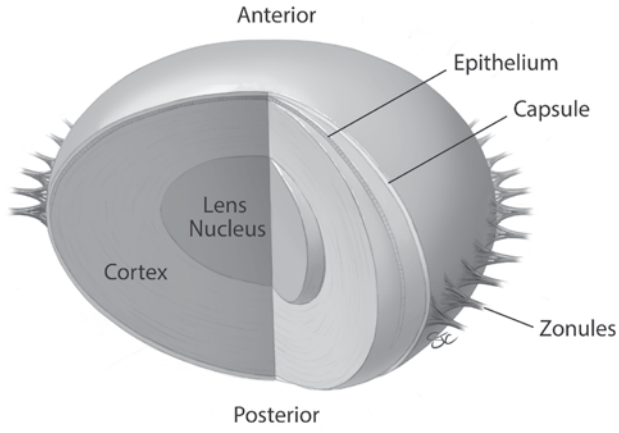
As knowledge of ocular anatomy and eye disease expanded, so did the approach to cataract surgery. While couching is generally thought to have been the predominant method of cataract treatment until the 18th century, ancient literature suggests that as early as 600 BC, an Indian surgeon, named Sushruta, may have been the first to perform some type of extracapsular cataract extraction (ECCE).[6] The procedure is termed "extracapsular" because the lens capsule is left in place. The first true cataract extraction was performed in 1747, in Paris, by the French surgeon Jacques Daviel. His procedure was more effective than couching, with an overall success rate of 50%.[7] Daviel's procedure basically involved making a large corneal incision (more than 10 mm), puncturing the lens capsule, expressing the nucleus, and then extracting the lens cortex by curettage. Although this procedure represented great progress compared to couching, postoperative complications were considerable, including poor wound healing, retained lens remnants, posterior capsular opacification, and infection.

Despite the risks of Daviel's procedure, it remained the accepted approach for cataract extraction for over 100 years, until the 19th century, when intracapsular cataract extraction (ICCE) became, for a time, the preferred method of cataract removal. However, improvements in operative methods and surgical tools eventually led to the reemergence, in the 1970s, of ECCE as the preferred approach over ICCE, which fell out of favor because of high rates of blinding complications. Modern day versions of ECCE and manual small incision cataract surgery (MSICS) are now used in many parts of the world, including the United States. Techniques for performing extracapsular cataract removal have dramatically improved over time, to the point where the overall success rate is now 90% to 95%.[8]

Intracapsular Cataract Extraction

In 1753, Samuel Sharp performed the first documented intracapsular cataract extraction (ICCE).[9] With ICCE, the entire lens, including the lens capsule, is removed through a large limbal incision. Samuel Sharp used his thumb to expel the cataract from the eye. Fracturing the zonular fibers that suspend the lens to the eye was a vital part of the ICCE procedure. The mechanism by which the zonules were broken has evolved from the early use of forceps to hold the lens capsule and manually disrupt the zonules. In 1957 Joaquin Barraquer was the first surgeon to utilize the enzyme alpha-chymotrypsin to dissolve the lens zonules.[10] Cryoextraction also proved to be a successful method for ICCE. With cryoextraction, a frozen probe is applied to the cataract, which adheres to the probe, and

Figure 1
Sectional view showing the layers of the lens.



the cataract is gently evacuated from the eye. The success of ICCE grew with the advent of modern anesthetic and sterilization techniques, but its popularity rapidly declined as improvements were made in ECCE techniques. The major drawbacks of ICCE are related to removing the lens and lens capsule in its entirety. The lens capsule serves as a wall between the anterior and posterior structures of the eye. Potentially blinding complications from ICCE, such as retinal detachment, macular edema, and corneal decompensation, are more likely to occur when this wall is not in place to prevent the vitreous from prolapsing forward. Furthermore, ICCE requires larger incisions to remove a cataract, leading to slow healing and a greater amount of surgically induced astigmatism. Despite the drawbacks of ICCE, it remained the primary approach for cataract extraction in the United States, well into the 1970s, and modern ICCE is still in practice in developing countries.

Modern Cataract Extraction and Phacoemulsification

As improvements in surgical techniques, anesthesia, and equipment evolved, ICCE fell out of favor and was supplanted by ECCE as the standard of care for cataract extraction. ECCE has proved to be an extremely effective method of cataract removal, with considerably better visual outcomes than with ICCE. The advent of an intraocular lens (IOL) to replace the cataractous lens has led to improved refractive results after surgery. The arrival in 1972 of ophthalmic viscosurgical devices (OVDs) improved the facility and safety of the operation as well. An OVD is a gel-like substance used during cataract surgery to maintain space in the eye, preventing deflation of the globe and protecting the structures inside the eye without interfering with the steps of the operation.

In 1967, an American ophthalmologist, Charles Kelman, revolutionized cataract surgery when he introduced phacoemulsification (often referred to as "phaco") as an alternative approach to ECCE.[11] With conventional ECCE, the entire nucleus of the lens is removed from the eye through a large (10 mm) incision. In phacoemulsification, an ultrasound-driven needle emulsifies and aspirates the lens through a considerably smaller (3 to 4 mm) incision. Phacoemulsification was initially met with resistance, but this procedure is now considered the safest and the preferred method of cataract surgery in the developed world. The smaller incision results in a more stable anterior chamber throughout surgery, shorter recovery time, and less surgically induced astigmatism.

The current phacoemulsification procedure is performed in the following manner. Pupillary dilation with topical medications usually takes place in the preoperative holding area. Topical anesthetic agents, introduced by Fischman in 1993,[12] are commonly administered before the procedure. In the operating room, after sterile preparation of the eye with povidone-iodine and draping, the eye is adequately exposed using a lid speculum, the surgical microscope is positioned, and the surgery begins. A paracentesis, or sideport incision (1 mm), is made in the cornea. Through this small incision, OVD is injected into the anterior chamber to protect the ocular structures as well as stabilize the globe in preparation for the main incision. The main incision is then made, which can range from 1.8 mm to 2.75 mm in size, depending on the instrument used. This wound is constructed in a multiplanar fashion to promote self-sealing at the conclusion of the procedure ("stitchless cataract surgery"). Next, a continuous circular opening is made in the anterior lens capsule (capsulorrhexis) to gain exposure of the contents of the lens. The phacoemulsification handpiece is then introduced into the eye to emulsify and aspirate the lens. After removal of all of the lens contents, all but the anterior portion of the lens capsule is then removed during capsulorrhexis. The anterior portion of the lens capsule, or capsular bag, remains intact and will serve to house the IOL. All of the lens contents are moved by phaco thorugh an opening made in the lens capsule (capsulorrhexis). All that remains after phaco is the lens capsule (minus the anterior portion that was removed during capsulorrhexis). The remaining lens capsule, or capsular gag, will serve to house the IOL.

Phacoemulsification techniques and technology continue to be refined. Precision is paramount. Cataract surgery in developed parts of the world has evolved into a refractive procedure, in which expectations of spectacle independence are commonplace. In the hands of

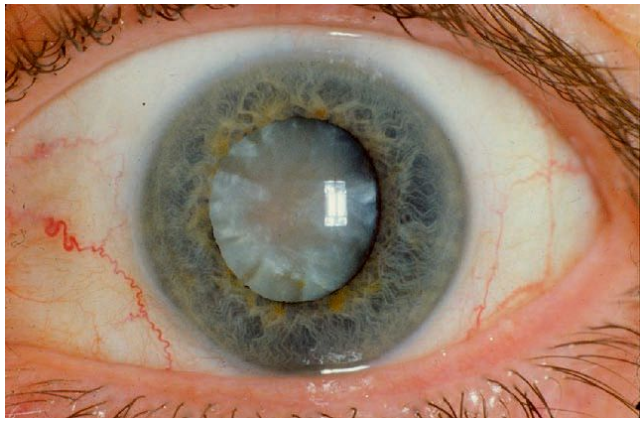


Figure 2
Hypermature age-related corticonuclear cataract with a brunescent (brown) nucleus.

experienced phaco surgeons, the above-outlined steps of cataract surgery are extremely controlled and consistent, so that surgical outcomes are predictable with a good degree of reliability. However, in medicine, there is always room for improvement. In 2001, femtosecond laser technology was applied to LASIK refractive surgery to create the corneal flap, resulting in a more precise LASIK flap. This technology was utilized in cataract surgery for the first time, in 2008, when the first femtosecond laser-assisted cataract surgery was performed in Budapest, Hungary.[13] The laser does not obviate the need for phacoemulsification. Instead, the laser performs many of the steps of the cataract procedure, including constructing the main wound, creating the capsulorrhexis, and fragmenting the lens. Limbal relaxing incisions to correct astigmatism are often also performed with the laser. With femtosecond laser technology, visual acuity outcomes are thought to be more precise, predictable, and reproducible compared to conventional cataract extraction. However, data do not demonstrate that femtosecond laser–assisted cataract surgery yields outcomes superior to those of manual phacoemulsification surgery. Thus far, the two approaches appear to be equally safe and effective.[14] Although many cataract surgeons worldwide have adopted femtosecond laser technology, there are still many phaco surgeons who do not believe this technology is beneficial or cost-effective.[15]

Intraocular Lenses

The incredible success of cataract surgery would not have been possible without the development of intraocular lenses (IOL). In 1949 Sir Harold Ridley, a British ophthalmologist, implanted the first IOL. Prior to the introduction of IOLs, patients were aphakic (without a lens) after cataract surgery. Postoperatively the aphakic

patient required high-powered hyperopic spectacles to be able to refract light and focus images on the retina. This meant that a patient who was losing vision due to a cloudy lens would have cataract surgery, only to find that, without correction, vision remained poor due to the absence of the lens. A medical student working with Ridley was reported to have asked, Why not replace the cataractous lens with a clear lens?[16] Sir Harold Ridley realized that wounded World War II pilots tolerated plastic pieces of shattered airplane windshields in their anterior chambers,[17] and this observation encouraged him to implant an IOL made of polymethyl methacrylate (PMMA), also known as acrylic glass. Initially Ridley's approach garnered little support, as there were considerable postoperative complications, including glaucoma, uveitis, and dislocation of implanted lens.

Remarkable innovations in IOL technology and design have occurred since Ridley's groundbreaking work. The goal of IOL implantation is to achieve the best refractive outcome while avoiding complications. IOLs can be implanted in various sites, including in the anterior chamber, tied to the iris, in the ciliary sulcus (the space between the anterior lens capsule and iris), and in the capsular bag. When IOL implantation was introduced, ICCE was the predominant method of cataract extraction, with removal of the entire lens, including the lens capsule, necessitating placement of the IOL in the anterior chamber or fixed to the iris. Early lens designs were not compatible with long-term safety in the eye. For example, anterior chamber IOLs often spun around in the anterior chamber and damaged the corneal endothelium. Iris-fixated lenses often led to pupillary distortion and uveitis-glaucoma-hyphema (UGH) syndrome.

When ICCE lost its popularity, IOLs were then designed with the intent of posterior chamber implantation. An American ophthalmologist, Steven Shearing, is credited with bringing IOL design into the modern era. In the 1970s he designed a lens that could center itself in the same position where the natural lens was positioned (behind the iris). As advances continued in cataract surgical techniques, a more structurally sound place for the IOL to reside was created: the capsular bag. In 1980 the first foldable lens arrived on the scene, which further improved outcomes. Foldable IOLs are made of flexible material (acrylic or silicone), allowing insertion into the eye through an even smaller incision. Since the 1970s, remarkable advances have occurred in IOL technology, design, and material. In 1992, astigmatism correction became possible when the first toric IOL was developed.[18] Since then, improvements in the toric IOL model have led to excellent results and increased freedom from spectacle correction.

Figure 3
Couching, the earliest known method of treating cataract.



The challenge of correcting presbyopia was taken on with the introduction of multifocal IOLs in the 1990s and of accommodating IOLs in 2000. A multifocal IOL acts like a bifocal inside the eye. It has multiple zones on the surface that will focus distance and near at all times. An accommodating IOL attempts to behave like the natural lens: when viewing an intermediate or near target, the lens is designed to flex forward to focus on the target.

Equally important as lens design is lens power. Just as glasses and contact lens powers need to be measured for each individual, so do IOL powers. When determining IOL power, multiple variables play a role, such as corneal refractive power, anterior chamber depth, length of the eye, and location of the lens when it is placed in the eye. Since IOL implantation became the standard of care in the 1970s, various mathematical formulas taking these variables into account have been utilized to calculate lens power. During the past 20 years, the developments in IOL calculation methods and measuring devices have been astonishing and have resulted in more precise postoperative refractive outcomes. Freedom from spectacles after cataract surgery is now more of an expectation than a mere possibility. Cataract surgeons are constantly evaluating postoperative data to personalize the lens calculation formulas in order to achieve better refractive results. In 2006, a United Kingdom study to establish benchmark standards for refractive outcomes after cataract surgery suggested that over 50% of patients

with normal eyes should be within 0.5D (diopter) of the desired target refraction and 85% should be within 1.0D of the desired target refraction.[19] Studies show that over 90% of cataract surgery refractive outcomes can be within 1.0D of predicted outcomes and over 70% can be within 0.5D of predicted outcome when a surgeon tailors his/her lens calculations using prior outcome data.[20,21]

Even with all of the remarkable technology and mathematical formulas, lens calculations are not perfect. Residual postoperative refractive error can be common. Typically such refractive error is not significant and is tolerated, and can be corrected with glasses or contact lenses if needed. When the refractive error is significant or intolerable to the patient, an IOL exchange may be required. Although an IOL exchange is a safe procedure in the hands of an experienced surgeon, it still subjects the patient to the risks associated with a second intraocular procedure, such as macular edema, vitreous loss, corneal edema, infection, wound leak, and prolonged inflammation. Unlike spectacle and contact lens correction, an IOL cannot easily be "trialed" and exchanged if it is not the correct power. Intraoperative aberrometry is an innovative technology that provides additional data about the eye during the cataract procedure to help in the selection of IOL power and to correct astigmatism. Currently, aberrometry has been found to be most beneficial in achieving the precise alignment of a toric IOL along the axis of astigmatism.[22]

Another exciting development on the horizon is adjustable lens technology, in which the implanted lens power can be adjusted postoperatively with a secondary noninvasive or invasive procedure. There are many adjustable IOL technologies under development, including light-adjustable IOLs, multicomponent IOLs, mechanically adjustable IOLs, and magnetically adjustable IOLs.[23] This technology will lead to a higher level of precision in cataract surgery.

Conclusion

Cataract surgery may be considered one of the most successful treatments in all of medicine. With continued advancements in techniques and technology, cataract surgery has evolved into a refractive procedure rather than simply a surgical treatment of cataract. Yet despite the worldwide availability of multiple IOL brands, materials, and models, not all lenses are suitable for every patient (and not all lenses are covered by health insurance companies). While modern cataract surgery has significantly improved the lives of many people throughout the world, perfection seems to be an elusive, moving target. There remains room for improvement, but the future of cataract surgery will be incredible as advances continue to evolve.

Acknowledgment

Figure 1 by Stacy Turpin Cheavens, MS, CMI, Medical Illustrator, University of Missouri School of Medicine. Figure 2 from National Eye Institute, National Institutes of Health. Figure 3 from Wellcome Library, London.

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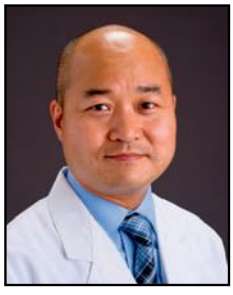
Disclosure

None reported. **MM**

Diagnostic Considerations in Patients Presenting with Transient Vision Loss

by Bokkwan Jun, MD

No standard classification system and no guidelines exist for the diagnosis and management of transient vision loss.



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Abstract

A complete history is essential for determining whether the underlying etiology of transient vision loss is from an ischemic or a nonischemic condition that originates in the eye or elsewhere. Ischemic transient vision loss constitutes a transient ischemic attack and requires a full work-up for ischemic stroke. If carotid artery stenosis is found, early intervention may improve the clinical outcome. This article highlights the diagnostic considerations in the evaluation of patients with transient vision loss.

Introduction

Transient vision loss is clinically challenging for ophthalmologists and debilitating, frustrating and worrisome for patients. Most of the time patients are asymptomatic when they present to an ophthalmology clinic because of episodic transient vision loss, and clinical evaluation during the visit may be unremarkable. Therefore, clinical judgment for further investigation and management is often based on the patient's history alone, underscoring the importance of asking the patient probing questions to elicit a thorough and complete history. How do the symptoms develop? How do they go away? How often does the vision loss occur and how long does it last? Do the symptoms occur with any activity, any particular position or at a specific time of the day? Do other symptoms occur before, after or during the visual disturbance? Does the visual disturbance affect one eye or both eyes? Ask questions to get a sense of whether the visual symptoms are positive or negative visual phenomena. Not only is it important to obtain a thorough history of the features of the episodes of transient vision loss, it is also important to obtain a complete personal, social, family and medication history, which can uncover pertinent information such as the recent start of a new medication, the presence of cardiovascular risk factors, or a history of migraine or motion sickness in the past or in family members.

Obtaining a detailed and extended history is the first step in the diagnostic approach of transient vision loss. Why is an extended history important clinically in ophthalmology? Because patients with ischemic transient vision loss are at risk of irreversible loss of vision. Moreover, transient loss of vision can be followed by an ischemic stroke. An ischemic cause of transient vision loss should not be missed and needs to be managed properly to prevent permanent vision loss or ischemic stroke.

Table 1. Ophthalmic and Nonophthalmic Conditions That May Cause Transient Vision Loss

	Ischemic	Nonischemic
Ophthalmic conditions	Retinal ischemia Temporal arteritis Vasospastic vision loss Carotid dissection Postprandial transient vision loss Light-induced transient vision loss Ocular thrombosis	Tear film abnormalities Corneal endothelial dysfunction Anterior chamber abnormalities Transient elevation of intraocular pressure Vitreous abnormalities Optic nerve anomaly Papilledema Orbital mass
Nonophthalmic conditions	Transient cortical ischemia Cardiac and carotid thromboemboli to the retina Vasculitis Hypercoagulable disorders	Migraine Transient cortical blindness (posterior lobe epilepsy) Uhthoff phenomenon in demyelinating diseases Fluctuating blood glucose

Illustrative Case

A 70-year-old woman with a medical history of hypertension and hyperlipidemia presented to the emergency department because of episodic vision loss in her left eye. She described the episodic vision loss as sudden, painless and associated with a growing white spot that covered the visual field. The episodes lasted for 3 minutes, followed by gradual recovery of vision. The initial neuro-ophthalmologic evaluation showed signs of optic neuropathy in the left eye, with poor visual acuity (light perception), dyschromatopsia (0/4 gross color) and a relative afferent pupillary defect. Interestingly, about 40 minutes after the initial examination, the patient stated that she could see the outline of images, and repeat examination indeed showed slight improvement of visual acuity and color vision, with finger counting at 6 feet and 3/4 gross color.

Magnetic resonance imaging (MRI) of the brain and magnetic resonance angiogram (MRA) of the head and neck were unremarkable for ischemic stroke and carotid artery stenosis. Given the fluctuation of the neuro-ophthalmologic evaluation, vasospastic ischemic optic neuropathy was a concern, and the decision was made to begin calcium channel blocker therapy with amlodipine and increase her aspirin dose.

Two days later, repeat neuro-ophthalmologic examination showed significant improvement of the visual sensory function in the left eye. Visual acuity was 20/15 and color vision was 10/10 on Hardy Rand and Rittler color plate testing. The patient concurred that there was about a 20% reduction of light and red desaturation in the left eye. Humphrey automated visual field testing showed cecocentral scotomas in the left eye, with 25 decibel (dB) fovea threshold and –6.96 dB mean deviation (MD), compared to the right eye, which exhibited a 34 dB fovea threshold and –3.2 dB MD. The patient had several more episodes while she was receiving 5 mg of amlodipine daily. Amlodipine was increased to 10 mg and her transient visual disturbance has not recurred.

Ischemia as a Cause of Transient Vision Loss

The various causes of transient vision loss are summarized in Table 1. Transient vision loss due to ischemia is also known as amaurosis fugax. Embolic lesions from the heart and carotid arteries, atherosclerotic thrombotic lesions involving ophthalmic, central retinal or short posterior ciliary arteries, vasculitis, hypercoagulable disorders, and vasospasm can all cause monocular or binocular transient vision loss.

Amaurosis fugax, or fleeting blindness, usually lasts for a few minutes, followed by gradual recovery within 24 hours. Vision loss caused by ischemia is characterized by sudden, painless darkening of vision in association with partial or complete visual field defects. Most of the visual disturbances are negative phenomena, such as diffuse loss of vision, a curtain coming down (altitudinal field defect), nasal or temporal vision loss, constriction of the visual field, and dark spots, but the rare patient with transient vision loss from ischemia describes positive phenomena, such as flashing light and scintillating scotomas.[1,2] Patients usually are aware of the time of onset, frequency and duration of the episodes.

In terms of the pathology of ischemia, thromboembolic

causes include cardiac thromboemboli (atrial fibrillation, valvular disease), carotid thromboemboli (atherosclerosis, dissection), aortic arch emboli, and hypercoagulability. Hemodynamic causes include postural hypotension, malignant hypertension, and high blood viscosity. Vascular causes of transient vision loss due to ischemia include vasculitis, vasospasm, arteriovenous fistula and vertebrobasilar insufficiency.

Ophthalmic Causes of Transient Vision Loss Due to Ischemia

Retinal Ischemia

Retinal hypoxia, or ocular ischemia, is signaled by the onset of amaurosis fugax in 15% of patients, and 74% of patients with ocular ischemia have severe carotid artery stenosis.[3] Cardiac and carotid emboli to the retinal vasculature may cause retinal hypoxia and transient vision loss. Sources of cardiac emboli include valvular disease, mural thrombus and atrial myxomas. On funduscopic examination, calcific or cholesterol emboli (Hollenhorst plaque) may be observed. Carotid ultrasound and echocardiogram should be considered.

The treatment of a retinal transient ischemic attack is the same as that for a cerebral transient ischemic attack. The risk of ischemic stroke and death is increased in patients who have had a retinal transient ischemic attack. The short-term risk of ischemic stroke after a transient ischemic attack is 3% to 10% at two days and 9% to 17% at 90 days after the episode.[4] Patients with retinal transient ischemic attack need a work-up for stroke, including brain MRI with diffusion-weighted imaging, electrocardiogram, echocardiogram and vascular imaging by means of computed tomographic angiogram (CTA) and MRA. Brain infarction is demonstrated on MRI in 25% of patients with acute retinal ischemia[5] and in 18% of patients with a retinal transient ischemic attack.[6]

Temporal Arteritis

Temporal arteritis should always be considered in patients over 60 years of age who present with transient vision loss. Therefore, during history taking in this age group of patients, questions should be asked about the presence of constitutional symptoms, such as weight loss, fever, cough, myalgia and fatigue, and other associated symptoms, such as new headache, scalp tenderness and jaw claudication. Episodic vision loss during position changes, such as bending over or getting up from a supine position, may be associated with temporal arteritis. An elevated erythrocyte sedimentation rate, C-reactive protein and platelet count may be helpful in clinical decision-making. These tests should be ordered in all patients with transient monocular vision loss, even in patients who have no other symptoms of temporal arteritis. Up to 20% of patients with temporal arteritis and ocular symptoms have otherwise occult disease.[7] If clinical suspicion of temporal arteritis exists and a temporal artery biopsy for tissue diagnosis is under consideration, systemic corticosteroid therapy should be initiated without delay.

Vasospastic Vision Loss

As shown in the illustrative case, patients with vasospastic vision loss may show a dramatic change in clinical findings in a short period of time. Visual acuity can change from light perception to 20/20 or vice versa during a couple of hours of the clinic visit. Vascular imaging should be performed to exclude stenosis, thrombosis or dissection, but imaging studies are unremarkable in many patients. Diagnostic conventional cerebral angiography could be considered but a calcium channel blocker trial, such as nifedipine or amlodipine, also could be considered for both diagnostic and treatment purposes.

Carotid Artery Dissection

Although a rare cause of transient vision loss, extracranial internal carotid artery dissection may be manifested by transient monocular vision loss. One study showed that 28% of patients with extracranial internal carotid artery dissection had transient monocular visual loss, frequently in association with painful Horner syndrome ipsilaterally.[8]

Postprandial Transient Vision Loss

Postprandial transient vision loss may be associated with severe carotid artery occlusion. Relative hypoperfusion of the retinal and choroidal circulation by increased blood flow to the intestines after eating may be a mechanism for this condition.

Light-Induced Transient Vision Loss

Bright light signal may compromise the regeneration of retinal pigment and induce episodes of transient vision loss in patients with severe carotid artery stenosis.

Transient Cortical Blindness - Ischemic

Patients with cortical transient ischemic attacks may present with episodic transient vision loss. It could be caused by posterior or anterior cerebral circulation insufficiency. This condition needs to be considered in older patients who have cardiovascular risk factors. Vertebrobasilar insufficiency may cause unilateral or bilateral vision loss, and the vision

loss can be isolated or combined with other neurologic symptoms, such as ataxia, dysarthria and/or vertigo. A work-up for ischemic stroke must be done as soon as possible.

Ophthalmic Causes of Transient Vision Loss Not Related to Ischemia

Patients with transient vision loss from nonischemic ophthalmic causes usually have a longstanding history of fluctuating symptoms that have been gradually worsening. They may not know the exact time the symptoms started. Patients may experience fluctuation of symptoms during the day, depending on the time of day and on the direction of gazes, and they may have other symptoms, such as ocular irritation, red eye and headache. Patients with diabetes may have a history of poorly controlled blood glucose levels.

Tear Film Abnormalities

Tear film abnormalities as a result of dry eye syndrome or blepharitis are common causes of transient visual disturbance. In particular, patients using contact lenses and older patients with a history of neurodegenerative disorders such as Parkinson's disease may experience ocular foreign body sensation and conjunctival injection with transient visual disturbance. The duration of episodes may be variable, from several minutes to several hours. Patients may state that blinking or lubricating eye drops help relieve the symptoms. Ophthalmic evaluation with slit lamp may show inflammation along the lid margins, abnormal tear film break up time, superficial punctate keratitis and conjunctival congestion.

Corneal Endothelial Dysfunction

Patients with corneal endothelial dysfunction may develop corneal edema and visual disturbance. The visual disturbance from the edematous cornea is often worse in the morning and improves throughout the day. Patients may experience visual disturbance before the corneal edema becomes noticeable on the slit lamp examination.

Anterior Chamber Abnormalities and Transient Elevation of Intraocular Pressure

Anterior chamber abnormalities that can cause transient vision disturbance include uveitis, hyphema and intermittent angle-closure glaucoma. Patients who have transient visual disturbance and ocular discomfort need prompt ophthalmologic evaluation to rule out intraocular inflammation or elevated intraocular pressure. Patients with uveitis or intraocular inflammation (infectious, noninfectious) may also experience ocular pain and photophobia. Ophthalmologic evaluation with slit lamp may reveal conjunctival or episcleral injection and inflammatory reaction in the anterior chamber and vitreous. Intermittent angle-closure glaucoma may also cause vision loss and ocular pain as well as associated systemic symptoms such as headache, nausea and vomiting. Ophthalmologic evaluation with the slit lamp and gonioscopy may demonstrate a shallow anterior chamber and angle.

Vitreous Abnormalities

Patients who experience transient episodes of vision loss may report that they see floaters, especially on a monotonous background such as a white wall. Vitreous floaters may be a consideration in patients with high-refractive errors or a history of ocular injury or diabetic retinopathy. Floaters may be visualized on slit lamp examination and fundoscopy. Generally, a sudden worsening of floaters and flashing light may portend vitreoretinal traction or retinal detachment. Recently, transient vision loss after intravitreal injection of ocriplasmin was reported.

Optic Nerve Abnormalities

Transient visual obscurations are commonly associated with papilledema from elevated intracranial pressure. Patients with increased intracranial pressure may experience transient vision loss with positional changes and Valsalva maneuver, and may also experience headache in the morning and positional headache. Transient visual obscuration from papilledema can be monocular or binocular, typically lasting for seconds only, and can be described as a gray, black or white out of vision.

Transient visual obscurations are also associated with optic disc anomalies, such as optic disc drusen, Fuchs coloboma and optic nerve sheath meningioma.[9] These conditions may be associated with transient elevation of intraocular pressure, which needs to be considered and monitored.

Orbital Mass

Patients with an orbital mass may experience vision loss in a particular direction of gaze, called gaze-evoked amaurosis. The vision loss only lasts for seconds and baseline vision returns on straight-ahead gaze. Orbital meningiomas, optic nerve gliomas, cavernous hemangiomas, orbital osteoma and orbital fractures have been reported to cause gaze-evoked amaurosis.[10] Interference of axoplasmic flow by direct compression of the optic nerve and transient ischemia by compression of the vascular supply to optic nerve may be underlying mechanisms for gaze-evoked amaurosis caused by an orbital mass. In addition to orbital computed tomography and MRI imaging, real-time color Doppler studies of

the optic nerve vasculature may be useful in revealing a reduction of blood flow on eccentric gaze when the patient is symptomatic.[11]

Nonophthalmic Causes of Transient Vision Loss Not Related to Ischemia

Fluctuating Blood Glucose

Patients with diabetes mellitus and fluctuating blood glucose levels may experience transient visual disturbance from osmotic change in the crystalline lens and from myopic shift by increased thickness of the lens. The visual disturbance may last from several minutes to several hours. On ophthalmologic examination, visual acuity may improve on pinhole testing.

Uhthoff Phenomenon in Demyelinating Conditions

Patients with demyelinating conditions may experience Uhthoff phenomenon, a transient vision loss associated with elevation of the body temperature after exercise or a hot shower. Typically the visual disturbance lasts until the body temperature normalizes.

Epilepsy and Transient Cortical Blindness - Nonischemic

Transient vision loss has been reported in patients with occipital lobe epilepsy. The vision loss occurs during ictal and postictal periods and improves with antiepileptic medications.[12]

Migraine

Migraine-associated visual aura may be characterized by positive visual symptoms, such as photophobia, scintillating scotomas, zigzag lines and flickering colorful lights, and by negative symptoms, such as dimming, focal scotoma and vision loss. Most transient forms of hemianopic vision loss in younger patients with no cardiovascular risk factors are likely the result of migraine. In migraine-associated vision disturbance, positive visual phenomena usually precede negative visual phenomena. Migraine-related transient vision loss develops gradually over several minutes and usually lasts from 30 minutes to several hours. The vision loss in migraine can be followed by headache but also may occur without headache. The patient may have a history of migraine or motion sickness or a family history of migraine. Avoidance of migrainous triggers and a migraine prophylaxis regimen may help reduce and treat the transient vision loss, but it's important to exclude other causes of transient vision loss before attributing the vision disturbance to migraine.

Conclusion

No standard classification system and no guidelines exist for the diagnosis and management of transient vision loss, but a systematic process of differential diagnoses and management can be facilitated by determining initially whether the vision loss stems from an ischemic or a nonischemic condition. The patient often does not know whether the episode of vision loss was monocular or binocular, therefore, the initial work-up should basically proceed in the same manner for monocular and binocular transient vision loss. If ischemic transient vision loss is a concern, the patient should undergo a work-up for ischemic stroke, including brain MRI, carotid imaging with Doppler, CTA and MRA of the head and neck, echocardiogram and a lipid panel. Ischemic transient vision loss can precede stroke in about 18% to 25% of patients.[5,6] If carotid artery stenosis is discovered during the work-up, early intervention with carotid endarterectomy may be considered for asymptomatic or symptomatic severe stenosis (over 70%) and symptomatic moderate stenosis (50% to 69%).[13] If vasospastic transient vision loss is a concern, a calcium channel blocker can be tried for diagnosis and management, as in the illustrative case in the article.

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Disclosure

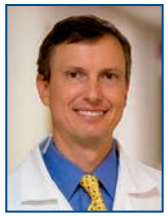
None reported. **MM**

Turn on the Music: Cochlear Implants

by Zachary W. Bear, MD & Anthony A. Mikulec, MD

Today, a child born without hearing can be implanted young enough to develop excellent speech and oral communication. An adult who loses his hearing in his 80s can have his hearing restored.





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Introduction

"Watch as a girl hears her dad's voice for the first time." As little as 60 years ago, these words would have elicited skepticism from even the most prominent otologist and audiologist. Today, many otologists have witnessed a patient hearing for the first time because of a cochlear implant. The emotion felt by a patient after the initial activation of a cochlear implant is pure joy. When activated, acoustic stimulation is converted to an electric signal, carried to the auditory cortex, and stimulation of previously unused neuroconnections occurs and like magic to the patient, they can hear the world around them. The medical, technological, and engineering evolution of cochlear implants has been prodigious.

Timeline of Cochlear Implantation

Not long ago the medical community could offer little to a patient with severe to profound bilateral sensorineural hearing loss. An adult with presbycusis (age-related hearing loss) in the 1950s was prescribed various forms of amplification until the hearing loss was severe enough they depended on lip reading, sign language, and other non-verbal communication. A newborn stricken with congenital cytomegalovirus who developed severe hearing loss would live their entire lives never hearing. In 2013, Graeme Clark, Ingeborg Hochmair, and Blake Wilson, shared the prestigious Lasker-DeBakey Clinical Medical Research Award for their work in the development of the modern cochlear implant. Their contributions, along with others, set the world on a path to make deafness an ailment of the past.

The discovery that electricity could stimulate the cochlear predates the cochlea implant. Benjamin Wilson, inventor of the first electrical capacitor called the Leyden jar, placed the electrodes of his device on the temples of a deaf woman in 1748.[1] A recollection of the experiment states, "there ensued a small explosion. She was much surprised . . . she felt a small warmth from ear to ear."[2] Alessandro Volta, credited with inventing the battery, wrote a paper in 1800 expounding on the "sensible effects" of his battery. "The hearing will be strongly affected by introducing into the ears two probes . . . it was a kind of jerky crackling as though some paste or tenacious matter was boiling."[2] These early observations occurred prior to the scientific community being equipped to discuss a solution for deafness, but they did reveal that electricity could stimulate hearing.

In the 1930s, researchers, Ernest Wever and Charles Bray described the cochlear microphonic in cats.[3] Alterations of this potential in the cochlea began to describe how acoustic (sound) energy is converted into electrical energy for transmission to the cochlear nerve. Their understanding of this concept led Gursun and Volokhov, to document how an electrically stimulated cochlea can produce hearing.[4]

A major breakthrough occurred in 1957 in a patient with a history of bilateral extensive cholesteatomas requiring temporal bone resections. The left and right temporal bone resections, performed years apart, left the patient with bilateral profound hearing loss and facial nerve paralysis. Otologist Charles Eyries, was consulted to consider a facial nerve graft, but the remaining nerves were too small for a local graft. However, a chance meeting with Andre Djourno, a physics professor also interested in implanting an electrode for hearing, resulted in the collaboration to perform the facial nerve graft and placing a single electrode in the remaining stump of the right cochlear nerve (which is intimately associated with the facial nerve as it leaves the central nervous system). The patient was able to hear sounds.[5] Interestingly, the patient's bilateral cochleas had been removed during the procedure and therefore, this event actually represents the first central nervous system implant for hearing rather than the first true cochlear implant.

In 1961, Georg von Bekesy won a Nobel Prize for his traveling wave theory that described the tonographic mapping of the cochlea with high frequencies represented at the base and low frequencies at the apex (See Figure 1). This same year, arguably the most prominent otologist in history, William House, was reading a newspaper clipping of the Eyries and Djourno surgery. He and neurosurgeon John Doyle performed two implants on patients with bilateral profound hearing loss, inserting the electrode in the cochlea after a hole was drilled adjacent to the round window. These procedures represented the first true cochlear implants.[6] Initially, details of the implantations were not widely published; it was years before the accounts received notable attention. House and his team detailed their experiments changing the pulse frequency and amplitude of the stimulator that resulted in patients' ability to hear sounds and improved lip reading.

Timeline of Cochlear Implantation

1748	**Benjamin Wilson stimulates hearing in deaf woman with Leyden jar**
1800	**Alexander Volta uses his newly invented battery to stimulate hearing**
1930s	**Ernest Wever and Charles Bray discover the cochlear microphonic, Gursun and Volokhov document how electric can stimulate hearing in the cochlea**
1957	**Charles Eyries and Andre Djourno performed first implant to restore hearing**
1961	**Georg von Bekesy wins Nobel Prize for traveling wave theory**
1961	**William House and John Doyle perform first true cochlear implants**
1964	**Blair Simmons, John Epley and Robert White first to perform a multichannel cochlear implant; Simmons coins term "cochlear implant"**
1967	**William House and Jack Urban develop induction coil that fit beneath the skin**
1974	**Graeme Clark host a telethon in Melbourne to raise money for his cochlear implant research; develops "variable stiffness" electrode**
1975	**Ervin Hochmair and Ingeborg Desoyer receive funding for cochlear implant research**
1976-77	**NIH releases Bilger report stating that cochlear implants are safe and beneficial**
1984	**Led by William House, FDA approves the 3M Corporation's single channel electrode for adults**
1988	**Blake Wilson develops continuous interleaved sampling**
1989	**FDA approves cochlear implant for children over 2**
1990	**Hochmair's group founds MED-EL corporation**
2000	**FDA approves cochlear implant for children over 12 months**

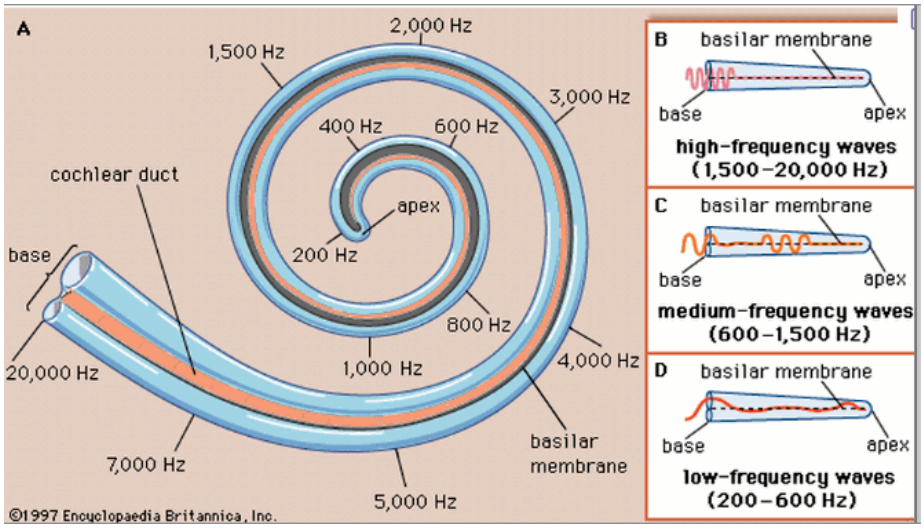


Figure 1
Tonographic Mapping of the cochlea.
Source: http://teddysratlab.blogspot.com

House's original implants were single channel, meaning they lacked the ability to take full advantage of the tonographic mapping of the human cochlea. In 1964, otologist Blair Simmons, John Epley, and engineer Robert White were the first to implant a multichannel electrode, placing electrodes at different locations along the cochlea to stimulate different frequencies. Multiple electrodes allowed the implant to take advantage of the tonographic mapping of the cochlea. Simmons reportedly coined the term "cochlear implant," using it as the title of his presentation at a workshop on microsurgery of the ear.[4,7]

House collaborated with electrical engineer Jack Urban to develop an induction coil that fit beneath the skin in 1967. He implanted three patients between 1969 and 1970 using this technology along with a single channel electrode. Claude Chouard, a colleague of Charles Eyries, developed cochlear implants with multiple electrodes that each had to be inserted through a separate hole made in the cochlea.[8]

In the mid-1970s, cochlear implants were still thought to be dangerous and not worth the risk, despite growing interest and advances in technology. In 1976-1977, the National Institute of Health commissioned a study led by Robert Bilger to independently evaluate all 13 U.S. patients with cochlear implants. They concluded that the procedure was well tolerated and patients had increased scores when tested for lip reading and recognition of environmental sounds.[1] The Bilger Report was instrumental in the future development of the cochlear implant because it provided evidence that the implants were a benefit to patients.

While playing with turban-shells and grass on the beach, Australian Graeme Clark was inspired to create an electrode of variable stiffness for assistance in insertion into the cochlea.[9] Clark obtained funding from a telethon in Melbourne in 1974 and subsequently implanted his first multi-electrode cochlear implant in 1978. The "variable stiffness" of Clark's electrode permitted deeper insertion into the spiraling cochlea (see Figure 2). This allowed for stimulation of a wider range of the sensory organ and took advantage of the known frequency mapping described earlier. Clark's cochlear implant became the first commercially successful multi-channel electrode with the Cochlear/Nucleus cooperation.

In Vienna in 1975, Ervin Hochmair and Ingeborg Desoyer received funding for cochlear implant research. They teamed with the 3M Corporation to market William House's single channel broadband analog implant. This was the first implant to gain FDA approval in 1984. Although Clark's multi-channel electrode eventually became standard of care, the single channel electrode created by House was the first commercially successful cochlear implant. In 1990, the Hochmair group formed MED-EL, an industry leader in implantable hearing solutions. Ingeborg Hochmair (formerly Ingeborg Desoyer) left her academic career to head the privately held MED-EL.[4]

Similar to most technology of the time, the physical hardware (cochlear implant), preceded the software required to optimize its function. In 1988, a Duke University engineer, Blake Wilson, developed continuous interleaved sampling, a method of mapping the wide dynamic range of environmental sound into the smaller range of electrically evoked hearing. His algorithm exponentially improved hearing quality with cochlear implants and is the basis for speech processors in modern cochlear implants.

The programming of cochlear implants requires more commitment from a patient and family than the surgery itself. The implant will be activated around 3 weeks following surgery by the audiologist. A "map" will be made using that minimal electrical stimulus a patient can perceive

and the level of stimulus required for comfortable hearing. This represents the dynamic range of the cochlear implant. From this point, much of the software used in hearing aids can be applied to cochlear implants. Modern users have multiple settings based on their environment (noisy, outdoors, quiet, etc) with the implant itself able to switch between settings on its' own. Patient's must continue to follow up routinely to have the programming optimized.

The rapid progress of cochlear implant technology may indicate endless possibilities for the future treatment of the deaf. The FDA approved cochlear implants for adults in 1984 and children over 2 years of age in 1989, lowered to children age 12 months in 2000. For the past several years, there has been a trend for bilateral cochlear implantation. This gives deaf children binaural hearing and improves both localization of sound and speech perception. Because of new designs doctors can take advantage of electroacoustic simulation which allows patients to use the cochlear implant and any residual hearing simultaneously. The use of cochlear implantation for single sided deafness is also being researched.

Engineers are also developing a way to use light to stimulate the cochlea instead of electricity. This increases the specificity that the cochlear nerve can be stimulated, resulting in a more dynamic sound perception.[10] Scientists developed auditory brainstem implants for patients who cannot receive a cochlear implant, such as patients born without a cochlea. It is difficult to imagine a future where hearing is not an option for any patient.

Without experiencing deafness oneself, comprehension of the totality hearing loss has on one's life is difficult, but the benefit of a cochlear implant is profound in a patient's life. Cochlear implantation in adults who lose their hearing is shown to correlate directly with increased income, possibly slow or even improve dementia in the elderly and improve the quality in all areas of life measurements.[11,12] Children with cochlear implants have demonstrated improved cognitive function, social communication and motor skills and increased hearing and language performance comparable to normal hearing children.[13,14]

At the end of 2012, approximately 324,000 people had received cochlear implants worldwide thus hundreds of thousands of people have been impacted with technology that did not exist in any form 60 years ago.[10] Today, a child born without hearing can be implanted young enough to develop excellent speech and oral communication. An adult who loses his hearing in his 80s can have his hearing restored. Great minds like Clark, Hochmair and Wilson have literally turned on the music.



Figure 2
Schematic of electrode in scala tympani of cochlea.
Source: http://med.stanford.edu/ohns/earinstitute/otology-neurotology/resources/cochlear_implant.html

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Disclosure

None reported. **MM**

Is It Painful to Manage Chronic Pain?
A Cross-Sectional Study of Physicians In-Training in a University Program

by Hariharan Regunath, MD, Kelly Cochran, Pharm D, Kasey Cornell, MD, James Shortridge, DO, Daniel Kim, MD, Syed Akbar, MD, Barbara Boshard, RN, Rebecca Chitima-Matsiga, MPH, Jyotsna Reddy, MD, Steven Keithahn, MD & James P. Koller, MD

Structured and focused curriculum on a recurring basis, targeting chronic pain management and safe prescription of opioids may help to alleviate physician fear of inappropriate prescription and misuse of opioids as well as improve patient care.



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Abstract

Background

Prescribing opioids for chronic non-cancer pain (CNCP) is a challenge due to associated risks from abuse, addiction and adverse effects. We surveyed resident physicians on their knowledge, attitude and practices in opioid prescription practices in the ambulatory setting and conducted an educational module to address their knowledge gaps.

Methods

A phase 1 survey assessed knowledge, attitudes and practices of residents in the out-patient management of CNCP with opioids. Demographics, numbers of patients seen, those with concerns for risky behaviors, adverse effects and the reasons for concern were also recorded. In Phase 2, an educational module in the form of didactics and case based discussions addressed the perceived deficiencies noted from results of phase 1 survey. Pre and post module surveys assessed the effectiveness of the educational module.

Results

In the phase 1 study (45/49, 92% response rate, M:F=30:15) 33.3%(15/45) were in Post-Graduate Year (PGY) 1, 35.6% (16/45) PGY2s and 31.1% (14/45) PGY3s; 80% (36/45) saw more than one patient with CNCP in the previous 3 months; 62.2% (28/45) had at least one patient with concerns for misuse and addiction; 77.8% (35/45) and 86.7% (39/45) reported a lack of training and consistent documentation respectively, and 82.2% (37/45) were uncomfortable to refill for other provider's patients. All (100%, 45/45) consulted the clinical pharmacist; 86.7% (39/45) believed that either focused education would be beneficial. In the phase 2 study (44/49, 89.7% response rate, M: F = 29: 15), the pre- and post-module responses showed that > 90% of the residents perceived improvement in knowledge and confidence in management of CNCP with opioids after the educational module.

Conclusions

Internal medicine residents perceived deficits in their ability to manage CNCP. Following a focused educational training, residents' knowledge and confidence in prescription of opioids improved,

demonstrating the need to include management of CNCP with opioids into their curriculum.

Introduction

Chronic non-cancer pain (CNCP) is defined as pain that lasts beyond three months of onset, an arbitrary period beyond which the underlying healing process is expectedly complete.[1] CNCP has a tendency to worsen over time affecting all aspects of a person's life and often requires comprehensive approaches for management and prevention.[2] The Institute of Medicine (IOM) reported that 100 million Americans suffer from pain at an estimated loss of $ 635 billion every year for treatment and loss of productivity. While the role of opioids in acute pain and cancer related chronic pain is well established, opioids place in therapy for CNCP is controversial. Chronic opioid therapy (COT) is defined as scheduled opioid medications daily or at least near-daily for 90 days or more.[3] Prescribing opioids for CNCP is a challenge for physicians in an ambulatory setting due to the need for balancing the risks and benefits of COT, the lack of evidence-based benefit and the potential for abuse, misuse and addiction.[4-7] Increased efforts to adequately control pain has resulted in a several hundred fold increase in the prescription of opioids since 1998, but has undoubtedly contributed to the increase in the number of deaths from opioid overdose, emergency room visits and drug abuse.[7-9]We conducted a cross-sectional survey of internal medicine residents to assess their current knowledge, attitude and practices in regards to opioid prescription in the ambulatory care setting. Based on the results of this survey, an educational module was designed and delivered. Surveys conducted pre and post module assessed whether the residents perceived improvement in knowledge and hence confidence in prescription of opioids for CNCP.

Methods

The structured ambulatory care experience for each cohort of University of Missouri Internal Medicine residents occurs for one full week in every five weeks. During this time, a cohort of 9 -11 categorical Internal Medicine residents attend quality improvement didactic sessions, and there were 5 such cohorts. This study was conducted in two phases as survey research questionnaires. Both phases of the study were approved by University of Missouri Institutional Review Board. The questionnaires were developed by the authors and reviewed by Internal Medicine faculty for face validity and suggested modifications were incorporated. Informed consent was obtained from every participating resident.

For the phase 1 study, the survey was administered at the weekly didactic sessions for five weeks in April and May 2012. The survey was printed as a hard copy and every resident participant manually completed it. Along with resident physician demographics, the survey collected descriptive data about their ambulatory practice in chronic pain management. The survey had open ended questions for resident physicians to quantify their patients on COT, quantify patients causing concern for high risk behavior, and describe the reasons for concern. The 12 Likert-style (seven scaled – strongly agree to strongly disagree) questions assessed resident physician self-reported knowledge of prescribing opioids for CNCP, as well as attitudes toward opioid prescribing in this population and practices towards prescribing opioids for CNCP. All data from the collected surveys were entered in tabular form in an Excel sheet. The data was later exported into SPSS version 20. Demographic data with continuous variables were expressed as mean ± standard deviation (SD) and responses to the Likert scale questions were summed as either agree, neutral or disagree responses and their percentages were deduced. The Cronbach's alpha for the Likert scale questions of this phase 1 study was 0.67.

Based on the results of the initial survey, phase 2 of the study was designed. This contained an educational module designed by the study investigators with the aim of improving deficiency in the knowledge and confidence in prescribing opioids for CNCP, as observed from the results of the phase 1 study. The specific topics focused by this educational module are mentioned in Table 1. The entire educational module comprised of a didactic

Table 1
Objectives of focus for the educational module for resident physicians

- *Describe the principles of effective evaluation of CNCP in ambulatory care setting*
- *Discuss the indications for opioid use for CNCP*
- *Diagnose and identify the adverse effects of opioid therapy*
- *Identify high risk co-morbidities for concurrent opioid therapy*
- *Selecting appropriate starting doses of common opioids*
- *Identify overdose, tolerance , misuse or addiction*
- *Apply opioid conversion calculations to patient case scenarios*
- *Develop an effective opioid treatment agreement*
- *Formulate an effective individualized long term plan*

presentation divided into the following interactive sections:

Overview: National burden of CNCP, costs, challenges and common obstacles to patients and providers in management of chronic pain and the unintended consequences of national strategies to achieve pain control.

Evaluation of CNCP: Comprehensive history, specific principles that are needed in evaluation of CNCP e.g. non-judgemental reflective listening, spending adequate time, etc. and psychosocial evaluation

Opioid Pharmacology: Evidence based indications for opioids and its use in CNCP, pharmacologic classes of opioids, schedules based on controlled subtances act, opioid dosing in naïve patients, long versus short acting opioids, methadone, adverse effects with conditions that pose high risk for adverse effects, counselling, short-term and long term follow up (assessment of 4As – analgesic efficacy, adverse effects, aberrant behavior and activities of daily living) and opioid equi-analgesic dose conversion with case scenarios.

Risk stratification: Definitions of risk terms (abuse, addiction, aberrant drug related behavior, physical dependence, tolerance, etc.), factors conferring high risk, risk assessment tools (Opioid risk assessment tool [ORT], Screener and opioid assessment for patients in pain [SOAPP], etc.) and urine drug screening [UDS] (when and why to use UDS, drugs screened, evidence behind use of UDS, pros and cons, etc.).

Treatment agreement: Components of physician-patient treatment agreement, Informed consent, documentation of plan of care and creating a treatment plan

The module was delivered to the same residents who completed the phase 1 survey during the weekly didactic sessions in the respective ambulatory week for every cohort between April and May 2013. The educational module included a pre-module survey followed by didactic presentation encompassing the various educational objectives of focus (Table 1) and exercised on opioid conversion, calculations and patient case scenarios, and a post-module survey to determine if this educational module helped them to perceive improvement in knowledge and confidence in prescription of opioids for CNCP. The phase 2 surveys (pre- and post-module) developed by the authors were also structured in the same way as the survey in phase 1, with demographic details and 15 – Likert-scale questions targeting the objectives of focus in the educational module. The Cronbach's alpha for pre- and post-survey were both > 0.90

Results

Phase 1

Forty-nine residents out of 54 categorical residents completed the survey, of which four were excluded due to grossly incomplete data [45/49, 92% response rate, M: F = 30(66.67%): 15(33.33%)]. The baseline and demographic characteristics are listed in Table 1. The numbers of participants in each of PGY 1 through PGY3 years were comparable [PGY1 =15(33.3%), PGY2=16(35.6%), PGY3=14(31.1%)]. Our residency program is diverse in that 31/45 (68.9%) of residents had graduated from institutions outside of the United States (US).

Resident physician demographics describing prior medical practice before starting at the University of Missouri Internal Medicine Residency program were available in 33/45 participants and of those, 23/33 (69.7%) had practiced medicine outside of the US prior to starting residency. Of the 43 residents who had provided data regarding experience prescribing narcotics 25/43 (58.1%) had not prescribed narcotics in their previous practice, including 48% of residents (12/25) with previous medical experience outside of the US. The rest (18/43, 41.9%) had prior experience with use of opioids and all of them had graduated from Non-US medical schools with all of their prior use of opioids in non-US settings (India, Jordan, UK, Russia, Syria and Pakistan).

Thirty-six (80%) residents reported ambulatory clinic encounters for more than one patient with CNCP in the previous three months, of which 6 (13%) had encountered 6-10 patients and 6 (13%) had cared for 11 or more patients in the same time period (Table 2). Twenty eight (62.2%) reported seeing at least one patient causing concern for opioid prescribing. Among the perceived reasons for concern, misuse (71.1%) and addiction (68.9%) were the predominant reasons (Table 3). All (45/45, 100%) consulted the clinical pharmacist for either dosage adjustment, opioid conversion or patient education.

As evidenced by resident responses to Likert scale items (See Figure 1), 73.3%(33/45) reported lack of access to pain specialist; 77.8% (35/45) reported a lack of training in the management of CNCP [88% (22/25) of residents with no prior work experience and 72.2%

Figure 1
Residents responses to Likert scale items in Phase 1 study.

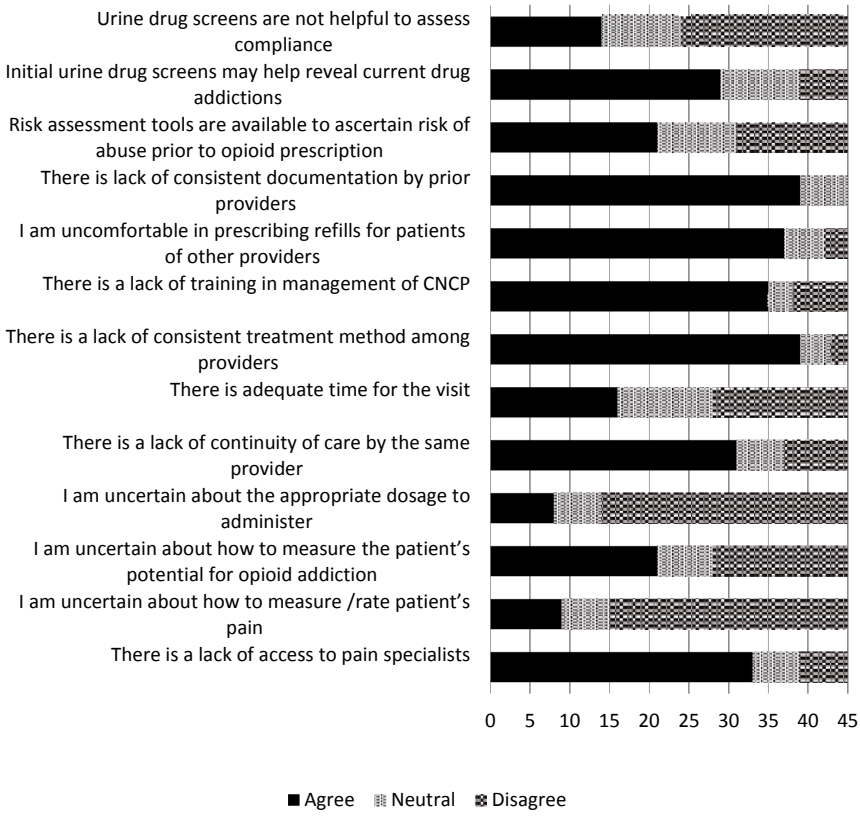


Table 2
Baseline and demographic characteristics from phase 1 (*N= 45, except for ¶ N=33 and ¥ N=43)

Baseline Characteristics		N* = 45
Age (Mean ± SD)		29.82 ± 2.93
Gender [N (%)]	Male	30 (66.7%)
	Female	15 (33.3%)
Level of training [N (%)]	PGY1	15 (33.3%)
	PGY2	16 (35.6%)
	PGY3	14 (31.1%)
Years since graduation (Mean ± SD)		4.80 ± 3.31
Country of graduation [N (%)]	USA	14 (31.1%)
	Other countries	31 (68.9%)
Prior practice [N (%)]¶	Yes	23 (69.7%)
	No	10 (30.3%)
Narcotic prescribing prior practice [N (%)]¥	Yes	18 (41.9%)
	No	25 (58.1%)

(13/18) of residents with prior work experience] ; 86.7% (39/45) reported a lack of consistent documentation and treatment method among different providers and 82.2% (37/45) were uncomfortable in prescribing opioid refills for patients of other providers. Sixty-four percent agreed that urine drug testing was helpful at the initial visit and 46.7% agreed that it was a useful tool to assess compliance. Thirty-nine respondents (86.7%) agreed that continuing medical education would benefit them with preference to either in-service presentation or case based discussion.

Phase 2

Of the surveys completed pre- and post-module from the same 49 residents, 5 (in each of pre- and post-surveys) needed to be excluded due to grossly incomplete data. Demographics were grossly unchanged except that response rate was 44/49 [Response rate 89.7%, M:F = 29(65.9%) : 15 (34.1%)].

The responses of the residents to the Likert scale questions, pre and post module are depicted in Figure 2 and Figure 3 respectively. From these figures it is evident that the educational tool developed and implemented, helped to improve current knowledge about safe and confident opioid prescription practices in our university ambulatory care setting among internal medicine residents.

Discussion

Our study demonstrates that prescribing opioids for CNCP poses a challenge for internal medicine residents. Our results support those of other surveys of residents from other programs [10-12]. Several deficiencies were reported by residents, notably 77.8% clearly indicated that there is lack of adequate training in chronic pain management. Residents as primary care physicians often

Figure 2
Pre-educational module survey responses to Likert scale questions in Phase 2 study .

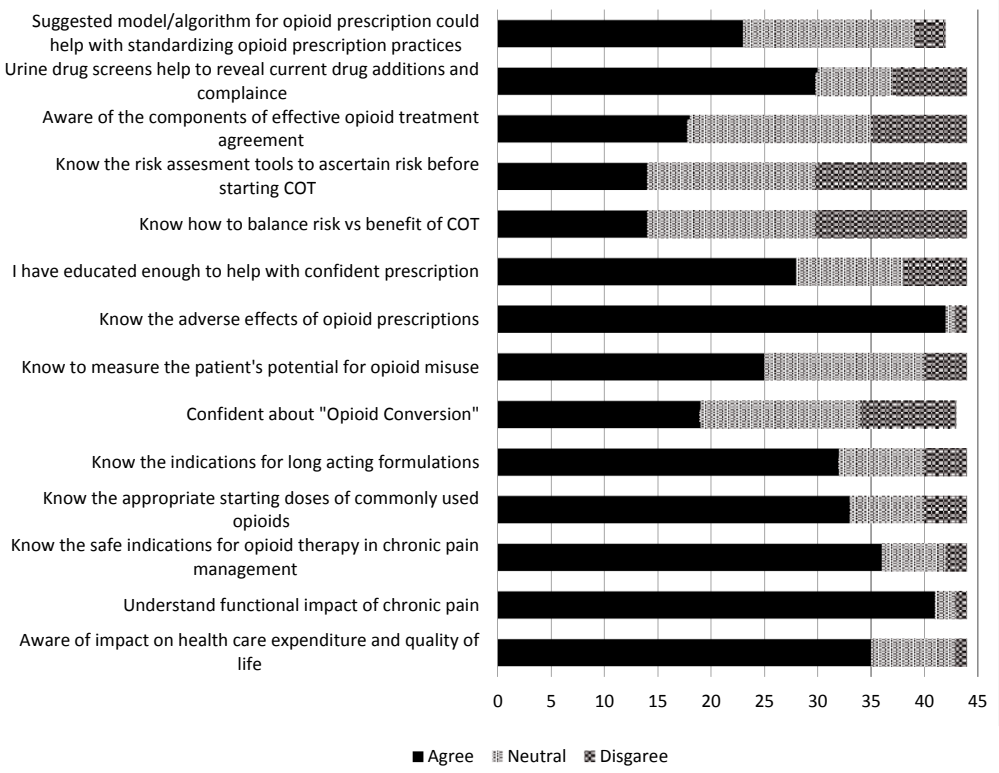


Table 3
Number of ambulatory patients causing concern for opioid prescribing, per resident, in previous 3 months and resident perception for concern.

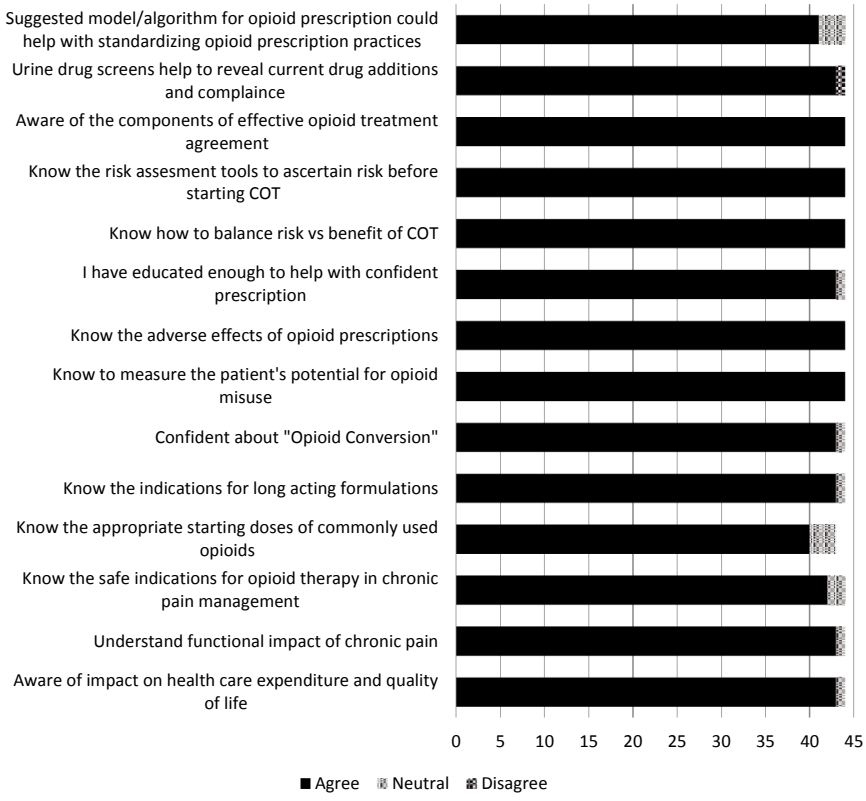
Number of patients causing concern [N (%)]	**N=45**
None	9 (20%)
<5	20 (44.4%)
6-10	9 (20%)
11-20	3 (6.7%)
Reasons for concern [N (%)]	
Misuse	32 (71.1%)
Addiction	31 (68.9%)
Diversion	4 (8.9%)
Adverse effects	13 (28.9%)
Intolerance	1 (2.2%)
Uncontrolled pain	4 (8.9%)

inherit patients who have been on chronic opioid therapy or encounter a new patient with chronic pain who is opioid naive. Prescribing of opioids not only requires clinical decision-making, but also consideration and discernment of social and behavioral patterns. During the first clinic visit it is often difficult to identify patients with a history of opioid misuse or to predict which patients will be problematic users of prescribed opioids. The fine balance between confident prescribing and fear of problematic use can be bridged by reviewing previous health records, performing a thorough interview and physical assessment as well as obtaining knowledge about patient history of chronic pain.

In our study cohort, 68.9% (31/45) residents had graduated from non – US medical schools. Of this 58.1% (18/31) had prior experience with use of opioids in Non-US settings (India, Jordan, UK, Russia, Syria and Pakistan). As we did not gather data regarding the reasons for the use of opioids in their prior practice, we could not derive any conclusions. Nevertheless, irrespective of country of graduation (U.S. and non U.S. countries), a majority perceived a lack of training [88% (22/25) of residents with no prior work experience and 72.2% (13/18) of residents with prior work experience] in management of CNCP with opioids.

Improved documentation of risk factors, compliance, response to therapy and adverse effects are important factors in safe and vigilant opioid prescribing due to its potential for significant adverse outcomes.[13,14] In our study, 86.7% reported a lack of consistent documentation by different clinic providers. This likely resulted in a majority of respondents (82.2%) reporting that they were

Figure 3
Post - educational module survey responses to Likert Scale Questions in Phase 2 study.



uncomfortable prescribing opioids for other providers' patients in the clinic.

While evidence to support periodic urine drug screening (UDS) in the context of COT for CNCP is lacking, many chronic pain management experts recommend UDS at the initial evaluation and randomly during follow-up of new patients especially those with high risk behavior. [4,15,16] While 64% believed that an initial UDS will help to identify current illicit drug use, only 46.7% were aware of its use as a tool for assessing compliance. In each of these categories 22.2% of the respondents were unsure about the usefulness of UDS. While a large proportion of residents recognized the utility of UDS, only 46.7% believed in its usefulness in predicting high risk behaviors, 22.2% were neutral and 31.1% did not find these tools to be available. We anecdotally suspect that among those residents who were aware of available risk assessment tools, they did not implement them nor document such use in their clinic records. This is similar to findings in another recent study that reported limited use of risk reduction strategies by primary care physicians. [17]

In the phase 1 study, 39(86.7%) respondents reported a lack of consistent treatment methods among different providers. We suspect that this variability in pain management likely results from a combination of factors including: individual clinical judgment, personal preference, fear of legal implications from use in patients with high risk behavior as well as limited and outmoded knowledge and attitudes about opioid prescribing for CNCP. [18] As part of an educational institution, resident physicians and their supervising attending physicians rotate periodically in clinics, providing a milieu for variable knowledge, practice patterns and patient care. The results of our phase 2 study demonstrates a clear improvement in knowledge and confidence in prescribing opioids after implementing an educational module addressing the deficiencies perceived by practicing providers in training. Such focused educational approach to improve competence and confidence in pain management among trainees may translate into not only improved clinical outcomes, but also help develop future providers equipped with essential skills for individual practice.[19]

The results of phase 2 study clearly showed that residents perceived improved knowledge and confidence in prescribing opioids for CNCP after the educational module and these results are consistent with previous other studies done in resident populations.[20] Even at this time, medical education in chronic pain management is still not a mandatory Accrediting Council of Graduate Medical Education (ACGME) component, alternatively it is often and only optionally available through various workshops, lectures and Continuing Medical Education (CME) venues. This lack of uniformity or standardization results in an education that is fragmented and diverse.[21]

We recommend that the ACGME re-evaluate the requirements for residency education in the area of opioid prescribing, particularly for CNCP, to increase

resident physician confidence in prescribing this highly regulated class of medications. Educational content reviewing opioid pharmacology, toxicology and pharmacokinetics/dynamics, as well as incorporation of risk assessment tools and risk reduction methods into pain management practice would fulfill this unmet need. There is a paucity of objective evidence-based benefit of opioid therapy. However, true benefit can be achieved from opioids in selected patients with CNCP. Given these things, and coupled with the structured, yet dynamic rotation schedule of a residency training program, an algorithmic approach for management of CNCP and opioid prescribing could provide a backbone for consistency in management of CNCP. Such an approach would alleviate the fear of associated risk and also institutionally standardize pain management care. A vigilant and transparent relationship has to be established between the primary care physician and the patient with CNCP, sharing the challenges and responsibilities.

Although the results are purely descriptive, they have revealed an important chasm in the medical education. Other limitations in the phase 2 study include that the post-module survey was done soon after the delivery of the educational module and exercises, as thus may not translate into meaningful benefit in the consistent clinical practice over the long run. Also, the study was not designed to see or measure a true change in the prescription practices of resident providers in their respective ambulatory care setting.

Conclusion

Our survey demonstrated that internal medicine residents do perceive deficits in their ability to manage patients with CNCP. Structured and focused curriculum on a recurring basis, targeting chronic pain management and safe prescription of opioids may help to alleviate physician fear of inappropriate prescription and misuse of opioids as well as improve patient care. The resident curriculum should incorporate chronic pain management in the ambulatory care setting as a mandatory requirement, without which the noted deficiencies in knowledge, attitude and practices will continue to persist. A standardized and institutionalized algorithmic approach for risk assessment, opioid prescription, and consistent documentation may all help improve opioid prescription practices.

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Disclosure

None reported. **MM**

Health Management and Informatics

Hospital Personnel Attitude Toward Utilization of Depth Imaging Technology in Hospital Rooms

by Rebbecca Fenton, MHA, Mihail Popescu, PhD & David Moxley, MLIS

This video surveillance technology, while slightly controversial among providers due to privacy concerns, has produced positive effects in the care of patients within the challenging environment we know as the patient room.



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Abstract

Research supports that the use of alarm intervention technology alone does not conclusively reduce fall incidents. In an effort to address the need for broader use of intervention technology, a study was conducted at a large Missouri hospital. The purpose of the study was to determine hospital personnel perceptions toward the utilization of depth imaging technology in hospital rooms and to explore expanded use of video surveillance systems in the patient room.

Introduction

Patient falls in the acute care setting continue to be of critical concern. Falls sustained while receiving care within a hospital result in multiple devastating effects including increased healthcare costs, increased length of stays, over-use of hospital resources and further injury to patients.[1] To place the issue into somber perspective, it has been stated that patient falls are among the most common and yet one of the most preventable negative events that can be experienced during a hospital stay.[2] In 2008, the Centers for Medicare and Medicaid Services eliminated reimbursement to hospitals for costs associated with adverse events related to falls. According to an analysis in the New England Journal of Medicine, on average, one fall can raise treatment costs by more than $4,000 per patient.[3] Consider that in the year 2000, the CDC reported that the medical cost of fall injuries totaled $179 million dollars and that hospitalization falls accounted for approximately two-thirds of these falls.[4] In 2012, the CDC went on to report that falls among older adults cost the U.S. health care system $30 billion in direct medical costs.[5] It is not surprising hospitals are turning their attention toward identifying ways to reduce these costs.

In response to these issues and in an effort to improve patient outcomes, hospitals nationwide are examining issues related to patient safety by exploring improved fall prevention programs. In an effort to eliminate or identify the cause of falls and to avoid or minimize associated negative effects, multiple strategies are employed. Current focus revolves around reducing patient falls through implementation of fall safety protocols. One common and

highly employed fall prevention strategy is the use of alarm technology as a way to provide early detection and warning to staff.

The Literature Review

A systematic review of the literature reveals that use of alarm systems, as the primary source of fall reduction, is inconclusive and often conflicting at best. After reviewing the data it was predominantly determined that exit-alarm usage is not in itself a key factor in fall reduction. The literature suggests that increased use of alarm systems had no statistically significant effect on numbers of falls. [6] Dr. Ron Shorr, a professor of epidemiology, states, "The idea that hospitals can magically eliminate the problem of falls by investing a lot of money and effort into bed alarms is not well-founded. Does that mean bed alarms should never be used in hospitals? No, I think that alarms may have a use within the context of a well-developed fall prevention program."[6]

It can be concluded that the complexity of alarm systems can present greater challenges to staff when paired with the unpredictable behavior of high-risk patients. False alarms are often the consequence of poorly utilized equipment or underestimation of the patient involved. As a result, staff may become "ambivalent" with the adoption and use of such equipment, creating an environment of erratic compliance.[7] In short, bed and chair alarms do not prevent falls they merely warn staff of patient's movements, often when it is too late.

Where Do We Go From Here?

Failure to adequately address the fall phenomenon has incited innovative research. Necessity, more than curiosity, compelled researchers to focus their attention beyond audible alarms as the primary fall prevention strategy, instead shifting focus towards integration of surveillance detection devices with video feedback. Video surveillance detection improves knowledge beyond the fall event by identifying ways to not only detect not only additional variables associated with falls, but also to identify additional factors of interest to staff and leadership within patient care settings. Researcher Marylin Rantz identified areas of need to include the ability to monitor illness progression, assess environmental issues and identity of staff related matters.[8]

The Research

Research conducted at the University of Missouri confirmed that early illness detection among older adults could reveal many issues before they occur. In addition, preliminary data derived from a feasibility study conducted within a hospital setting determined that the Kinect system, when utilized as a video surveillance device, can provide improved fall detection capability, assist with determination of fall risk, and enhance quality improvement strategies within real hospital settings. It was determined that these positive outcomes can be obtained inconspicuously with respect to patient privacy. [9]

The Study Purpose and Objective

The purpose of the study was to assess hospital personnel attitudes toward utilization of depth imaging in the patient room. The objective of the study further expanded upon the MU project by addressing stakeholder perceptions and exploring additional clinical relevant use of the Kinect fall detection project.[10]

The Study Design

A qualitative study was completed at a large Missouri hospital. Information was obtained via unstructured focus group interviews and written surveys. In addition to group discussion, participants completed a written survey. The paper survey contained both closed and open-ended questions to identify demographic data and subjective information. The surveys' purpose was to measure attitude, knowledge and personal belief regarding video surveillance technology in the patient room.[11]

A total of four groups were organized, each group comprised of stakeholders from four departments: physicians, nurses, occupational and physical therapists, and leadership staff. Groups contained five to ten members and sessions lasted approximately 40-60 minutes in length.

Participants were introduced to content which focused on use of the Kinect gaming system as a depth image video surveillance system in patient rooms. The subjects reviewed current fall alarm technology

Figure 1
Kinect Video Image, before and after.

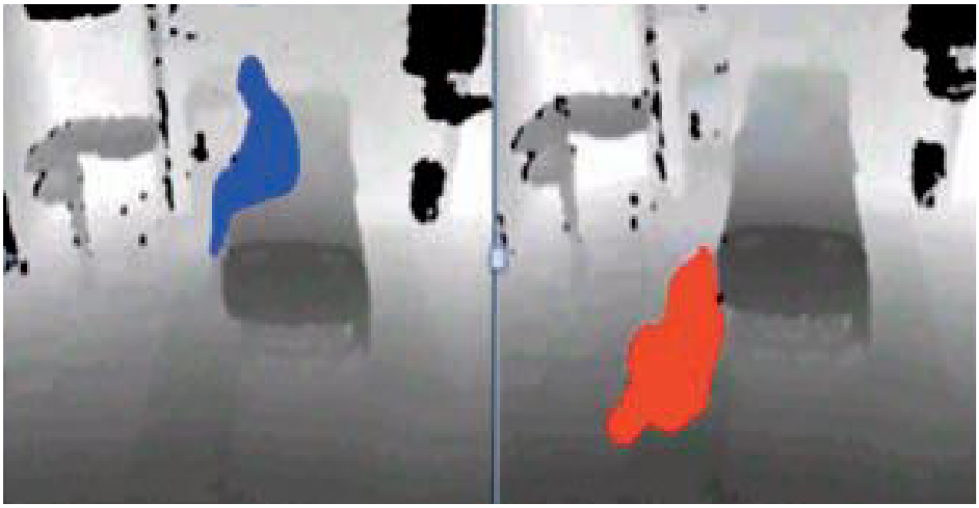


Table 1
Study Demographics, Q1-Q4

Stakeholders		Participants		Group Distribution	
Group A: Leadership		6		20.7%	
Group B: Physicians		6		20.7%	
Group C: Nursing		9		31.0%	
Group D: Therapists		8		27.6%	
Age	**%**	**Sex**	**%**	**Experience**	**%**
25-34	34.5%	Male	28.6%	<5 years	27.6%
35-44	34.5%	Female	71.4%	5-10 years	10.3%
45-64	24.1%			>10 years	62.1%

utilized within their setting, specifically the use of bed alarms and chair alarms. Participants were able to draw comparisons between the two types of fall prevention techniques: audible alarm technology versus video surveillance technology. Short videos were utilized to provide visual instruction of the Kinect. (See Figure 1.)

Study Results

Over a four-day period, from July 21–24, 2014, four interviews were conducted with a total of 29 participants. Participant ages ranged from 25-64, and were predominantly female. The stakeholders identified themselves as one of four occupations or specialties with >62% having worked in their identified specialty for longer than ten years. See Table 1.

Survey and PowerPoint questions were utilized within each focus group to stimulate dialogue and thought. Data was analyzed from the perspective of each specialty and as a whole.

Paper Survey Opinion Questionnaire, Q5-Q12

Q5. Would you consider fall detection useful? If yes, please provide a short description.

Q6. Can you see other uses for a depth imaging system in hospital rooms? If yes, please provide a short description.

Q7. As a hospital employee, do you think that a depth imaging based system might be intrusive?

Q8. Do you think that the review interface is useful? If yes please provide a short description.

Q9. Do you think it may impact clinician behavior? If yes please provide a short description.

Q10. Do you think it may impact patient behavior? If yes please provide a short description.

Q11. As a patient, do you think the system would be intrusive?

Q12. On a scale of 1-5, with one being little to no impact and five being highly impactful to patient care, how would you rate possible positive impacts on your ability to care for the patient?

PowerPoint comprised of 18 slides contained from the following seven questions:

Q1. How might proposed image-based fall detection systems differ from current technology in use at your facility?

Q2. What features of the review system could be clinically or professionally useful to your specialty or position?

Q3. What fall outcomes do you want measured?

Q4. What other patient activity would you like to monitor?

Q5. How might the proposed image-based fall detection systems impact the behavior of patients, clinicians and others?

Q6. How might this historical review system be useful to management, administration or leadership?

Q7. Are there any other activities you would like to monitor or study?

Group A: Leadership

The Leadership Group was composed primarily of females between the ages of 35-44, with 75% reporting greater than ten years' experience in their position. Individual responses regarding use of fall detection devices within the hospital setting were overwhelmingly positive.

Review of leadership stakeholders' written comments and audio recordings, revealed a more optimistic thought process than apprehensive. Focus within the leadership/management group centered on financial impact, liability, risk-to-reward ratio, educational opportunities, process improvement, training capability, auditing and monitoring capability, compliance improvement among staff and patients, and as a mechanism to improve work injury programs. While concerns were raised regarding privacy, initial investment cost, and staff buy-in, these issues did not eclipse the possibilities of use within the hospital setting.

Group B: Physicians

The Physician Group was predominantly male between the ages of 25-64, with an even split of participants reporting between the category of less than ten years and greater than ten years' experience.

Review of written comments and transcribed audio revealed that physicians demonstrated more hesitancy in their opinion, choosing a more moderate position. While 83.3% agreed that fall detection in the form of video surveillance could be useful, prevailing opinion regarding specific use was evenly split, with a negligible 0.01% voting more favorable.

Physicians expressed the most concern regarding privacy issues, with 83.3% feeling that this system would be intrusive to both the employee and patient. Physician privacy concerns were higher than the other focus groups.

Group C: Nursing

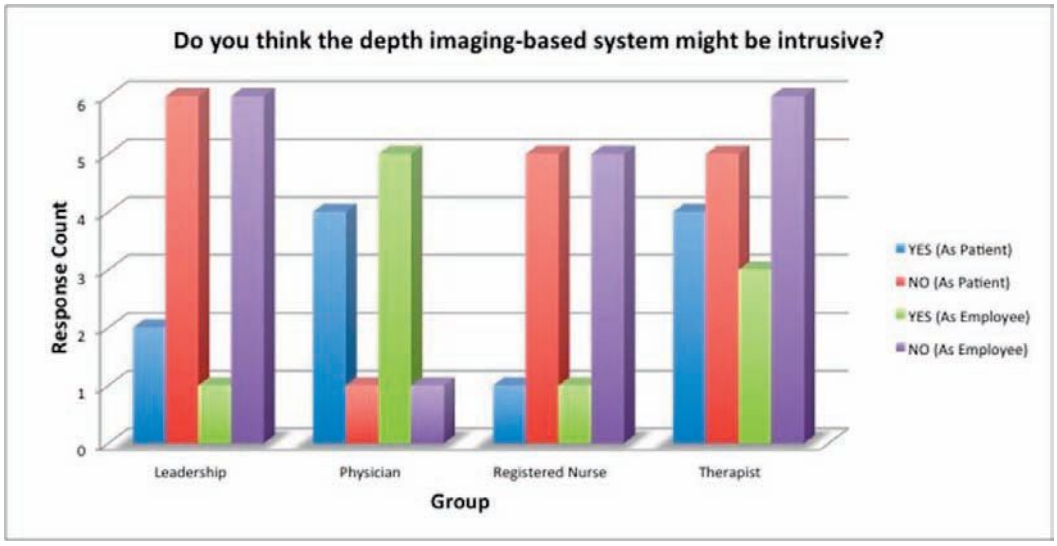
The Nursing Group was 100% female between the ages of 25-64, with an even split of participants reporting between the less than ten years and greater than ten years' experience categories. Individual nursing responses regarding use of fall detection devices within the hospital setting were overwhelmingly positive.

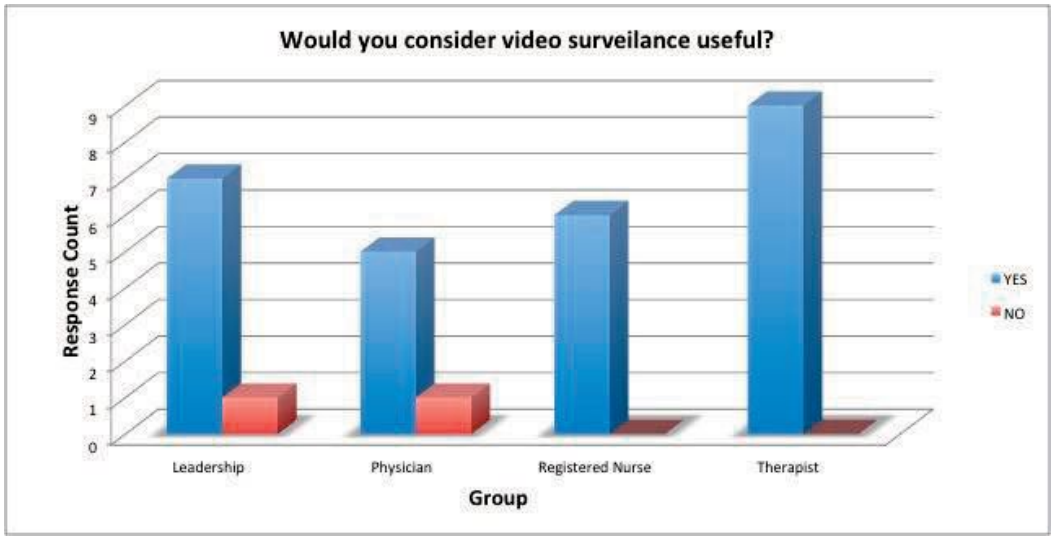
Upon review of the written comments and transcribed audio it is clear that RN's deemed use of Kinect within patient rooms as a positive addition for both improvements in patient care and safety. Nurses were in full agreement on four of the seven questions queried regarding usefulness. The variances in opinion were associated with privacy concerns regarding potential intrusiveness and behavior modifications.

Group D: Therapists

The Therapist Group was predominantly female at 87.5%, with 88.9% between the ages of 25-44. Experience among the participants was mostly split between the two categories, less than ten years and greater than ten years' experience. Individual therapist responses regarding use of fall detection devices within the hospital setting were positive, with moderate hesitancy noted regarding privacy and intrusiveness.

Upon review of the written comments and transcribed audio it is clear that therapists within the hospital setting would deem use of Kinect within patient rooms as a positive addition for both improvements in patient care and safety. While it was agreed that the ability to utilize knowledge regarding patient changes in behavior could be beneficial with





plan of care development, therapists were concerned regarding impact on personal productivity and privacy invasion.

Group Results

Several themes remained constant within the groups. All groups rated potential positive impact on the higher end of the spectrum. On a scale of 1-5 the average rating was 3.4 -- moderate. The issue of privacy, financial burden and ease of use were common concerns. Ultimately the overall consensus is overwhelmingly positive.

Completion of the interview process within the acute care setting at this Missouri hospital revealed that while this particular group of stakeholders had no direct experience with this setup, they were open to the idea of implementation. While guarded regarding the issue of privacy, perception among this group was predominantly positive.

It was determined that in addition to the obvious aspect of enhancing a fall alert system with the provision of REWIND[1] capability, it would be beneficial to utlize this technology in additional practical methods. Staff identified the following additional uses outside of fall prevention:

- Improve training and educational processes (lifting classes, nursing procedure)
- Improve staff and patient compliance by impacting behaviors
- Potentially impact financial costs associated with work-related injuries associated with patient care

- Monitoring of family and friends interaction, primarily to reduce distribution of unapproved medications or drugs to patients
- Improving diagnosis of patient illness
- Improve patient outcomes and discharge planning
- Monitoring stations with real time surveillance capability at nursing stations so that staff can receive immediate footage of patient activity

Limitations identified among interviewed staff followed a relatively common thread. The issue of maintaining both patient and employee privacy was a frequent theme. Staff concerns were lessened upon view of the depth image, with consensus stating it was an acceptable format to maintain personal privacy. Other potential negative identifiers involved issues of liability, litigation and ease of use.

Recommendations

It is recommended, based on the feedback from this study, that further research be pursued in regard to the development of improved real-time use. Additional research with focus on creation of improved capability to monitor patients via a live feed within nursing units was identified by staff as an innovative way to improve patient care and positively impact patient outcomes, primarily fall reduction. In addition, physicians identified use of such live feeds as a potentially useful patient observation resource to better judge the patient's current level of illness and to improve discharge planning. Overall, consensus supported the prospect of a pilot program of this technology within their setting.

Summary

We find ourselves in an interesting era of change and challenge for health care. The challenge faced by health care entities regarding the issue of patient falls and the un-reimbursed costs associated with such adverse events is of chief concern. While limited in scope, the Kinect fall detection research offers the most promising avenue for the next step in development of improved fall prevention strategies within the acute care setting. This video surveillance technology, while slightly controversial among providers due to privacy concerns, has produced positive effects in the care of patients within the challenging environment we know as the patient room.

While it is acknowledged that integration of such devices within the patient room carries a small fear factor due to variables associated with ease of use and integration, the possibilities are exciting. The study revealed an overall perception that having the ability to "see" what happens in a patient room will not only positively impact patient care and staff behaviors, but could also reduce the financial obligations associated with non-reimbursed costs related to falls.

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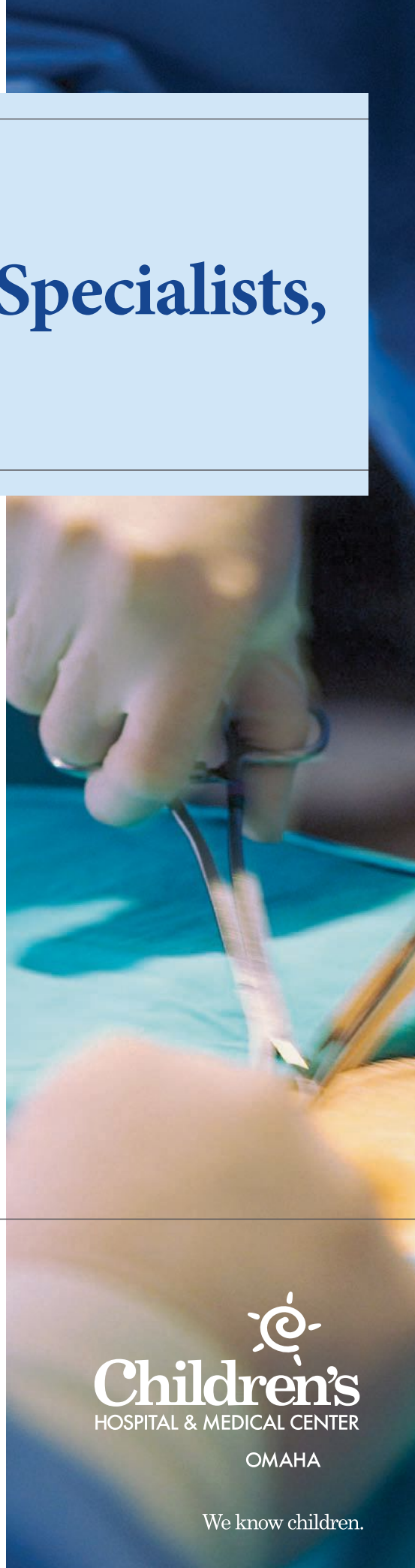
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Disclosure

None reported.

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