

Medicine  Health  
RHODE ISLAND

---



# Isn't it time you got your own second opinion?



The Rhode Island Medical Society has partnered with Butler & Messier Insurance to provide an exclusive **CONCIERGE PROGRAM** for all your insurance needs. Everyone in the Rhode Island medical community is eligible for the best rates for your home and auto insurance, as well as your office policies.

**For your own FREE – NO OBLIGATION – SECOND OPINION call  
John Divver at 401.728.3200**



[www.ButlerandMessier.com](http://www.ButlerandMessier.com)



UNDER THE JOINT  
SPONSORSHIP OF:

The Warren Alpert Medical School of  
Brown University  
Edward J. Wing, MD, Dean of Medicine  
& Biological Science

Rhode Island Medical Society  
Alyn L. Adrain, MD, President

EDITORIAL STAFF

Joseph H. Friedman, MD  
Editor-in-Chief

Sun Ho Abn, MD  
Associate Editor

John Teehan  
Managing Editor

Stanley M. Aronson, MD, MPH  
Editor Emeritus

EDITORIAL BOARD

Stanley M. Aronson, MD, MPH

John J. Cronan, MD

James P. Crowley, MD

Edward R. Feller, MD

John P. Fulton, PhD

Peter A. Hollmann, MD

Anthony E. Mega, MD

Marguerite A. Neill, MD

Frank J. Schaberg, Jr., MD

Lawrence W. Vernaglia, JD, MPH

Newell E. Warde, PhD

OFFICERS

Alyn L. Adrain, MD  
President

Elaine C. Jones, MD  
President-Elect

Peter Karczmar, MD  
Vice President

Elizabeth B. Lange, MD  
Secretary

Jerry Fingerut, MD  
Treasurer

Nitin S. Damle, MD  
Immediate Past President

DISTRICT & COUNTY PRESIDENTS

Geoffrey R. Hamilton, MD  
Bristol County Medical Society

Robert G. Dinwoodie, DO  
Kent County Medical Society

Rafael E. Padilla, MD  
Pawtucket Medical Association

Patrick J. Sweeney, MD, MPH, PhD  
Providence Medical Association

Nitin S. Damle, MD  
Washington County Medical Society

Cover: "Wine Bottles and a Peach," composition study with oil on canvas, Rhonda Melucci. Rhonda Melucci is a North Providence-based artist whose work has been appeared at several major art festivals in Rhode Island. She has most recently exhibited at the Bailey Art Gallery in Wickford. Her artwork and contact information can be found at <http://artid.com/members/rhondamelucci>.

# Medicine & Health RHODE ISLAND

VOLUME 95 No. 11 November 2012

PUBLICATION OF THE RHODE ISLAND MEDICAL SOCIETY

COMMENTARIES

338 Failing Marks In Optimism  
*Joseph H. Friedman, MD*

339 For Whom Does the Cricket Sing?  
*Stanley M. Aronson, MD*

CONTRIBUTIONS

340 Sex Differences In Door To Electrocardiogram and Balloon Times In Patients With ST Segment Elevation Myocardial Infarction  
*Nathan Spence, MD, Janice Muratori, RN, Steven Reinert, MS, Barry L. Sharaf, MD, and J. Dawn Abbott, MD*

342 Lumbar Spinal Stenosis: Evaluation of Information On the Internet  
*Ross J Feller, MD, Ariel Cohen, BA, Mark A Palumbo, MD, and Alan H Daniels, MD*

345 A Novel Preclinical Course in Ophthalmology and Ophthalmic Virtual Surgery  
*Jennifer J. Yong, BS, Michael E. Migliori, MD, and Paul B. Greenberg, MD*

349 Cubital Tunnel Syndrome: Diagnosis and Management  
*Samir K. Trehan, MD, John R. Parziale, MD, and Edward Akelman, MD*

358 Eligibility For Financial Incentives and Electronic Medical Record Use Among Physicians  
*Chang Liu, MA, Rosa Baier, MPH, Rebekah Gardner, MD, and Amal Trivedi, MD, MPH*

363 Staying Healthy During Hard Times: The Impact of Economic Distress On Accessing Care and Chronic Disease Management  
*Thomas P. O'Toole, MD, Lauren Buckel, MPH, Stephen Redihan, BS, Stacey DeOrsey, MSW, and Daniel Sullivan, MSW*

COLUMNS

367 HEALTH BY NUMBERS: Hospital Emergency Department Visits For Non-Traumatic Oral Health Conditions Among Rhode Island Adults Age 21–64 Years, 2006–2010  
*Junhie Oh, BDS, MPH and Laurie Leonard, MS*

371 PHYSICIAN'S LEXICON: A Proliferation of Pro- Words  
*Stanley M. Aronson, MD*

371 VITAL STATISTICS

372 NOVEMBER HERITAGE

*Medicine and Health/Rhode Island* (USPS 464-820), a monthly publication, is owned and published by the Rhode Island Medical Society, 235 Promenade St., Suite 500, Providence, RI 02908, Phone: (401) 331-3207. Single copies \$5.00, individual subscriptions \$50.00 per year, and \$100 per year for institutional subscriptions. Published articles represent opinions of the authors and do not necessarily reflect the official policy of the Rhode Island Medical Society, unless clearly specified. Advertisements do not imply sponsorship or endorsement by the Rhode Island Medical Society. Periodicals postage paid at Providence, Rhode Island. ISSN 1086-5462. POSTMASTER: Send address changes to *Medicine and Health/Rhode Island*, 235 Promenade St., Suite 500, Providence, RI 02908. Classified Information: Cheryl Turcotte/Rhode Island Medical Society, phone: (401) 331-3207, fax: (401) 751-8050, e-mail: [cturcotte@rimed.org](mailto:cturcotte@rimed.org). Information on permissions and reprints available from [jteehean@rimed.org](mailto:jteehean@rimed.org).

Note: *Medicine & Health/Rhode Island* appears on [www.rimed.org](http://www.rimed.org), under Publications.



## Commentaries

### Failing Marks In Optimism



**I LIKE TO THINK OF MYSELF AS A PERSON WITH** a reasonably accurate perception of the future, neither unrealistically optimistic or pessimistic: expect the worst and hope for the best, probably like most people. I've been accused of being overly optimistic because I plan for the future, assuming that current trends will continue, in contrast to my friend who always assumes and plans for the worst, with excess insurance coverage and multiple contingency plans for disasters most people don't dream about. "You can call me Cassandra, if you want. We can't count on luck."

Which brings me to the current state of clinical neuroscience. A recent lecture by a distinguished researcher in **Alzheimer's disease (AD)** started his talk by noting that five years ago researchers were very optimistic. There were a number of trials planned to test exciting new approaches to treating AD, with vaccines, drugs to reduce pathology and drugs to enhance cognition. The situation looks much worse now, he opined. Progress in treatment has not been made and then popular theories were being abandoned or modified.

My best friend's website for his university physics lab uses the motto, "Experimental physics: where theories come to die." This, of course, extends as well to clinical trials for therapeutics. It sounds like a good thing to reduce amyloid plaque to decrease the pathological burden in AD, and there's undoubtedly an important insight to be learned from a drug that does indeed reduce the amyloid plaque load but which sadly makes the dementia worse, but what that insight yields remains murky. Mitochondria are dysfunctional in Parkinson's disease and drugs that "enhance" their function should help the disease; but, although CoQ10 "works" in animals, it does not in Parkinson's disease.

In a cartoon caption, one scientist turning to another, "What's the opposite of, 'Eureka?'"

I think of the study of neurological disorders being akin to fractals: the closer you look, the more complicated they become. Twenty years ago the gene for **Huntington's disease (HD)** was discovered. Not only was this a breakthrough for HD, but it also was the unearthing of an unknown mechanism for genetic diseases, the "excess triplet repeat disorders." This led to the discovery of many other excess-repeat disorders, doublets, triplets, quadruplets, with different constellations of base-pair sequences. But Huntington's disease is no better treated than it was 20 years ago, or maybe 100 years ago. In fact, as with other late-onset neurodegenerative disorders, we still can't even determine when it begins.

Patrick Kennedy has been trying to focus the attention of politicians, the business community and the general public on the public health problems due to brain diseases. He does this partly by discussing not only the devastating effects that these disorders have on the individuals affected, and their families, but also their economic consequences. The economic effects of the dementias are gigantic, and escalating rapidly. He points out the obvious importance of investing now and investing heavily, very heavily, in heading off a problem that will become ever more devastating as our elderly population increases and our younger population decreases. The economics, he argues, are very clear. There is a greater economic reward to be had by *investing* in understanding neurodegenerative disorders, than there is in oil recovery from the oil sands in the Midwest.

Recently, at a major Washington, DC Alzheimer meeting, the Department of Health and Human Services announced a large push to better treat Alzheimer's disease, by funding some new, novel trials. I am skeptical that this is a wise investment. Of course I think it's wiser than building bridges to nowhere, or paying for nuclear weapons, but testing

drugs in human trials when we don't have reliable ideas about how the disease starts or advances is a benign waste of money. We need the public to understand that spending money on research is, in fact, an investment, both in human capital and in financial capital. And we need to start by investing primarily in understanding disease processes, and not in splashy studies with a thin rationale.

The Michael J. Fox Foundation is investing heavily in a study that follows newly diagnosed Parkinson's disease patients, measuring as much as possible, in the hope that biomarkers will be found that will help us monitor disease progression in a way that is more accurate than our current approach of eyeballing the patient with a few physical and mental exercises to which we apply numerical scores. This is a no-loss proposition, accruing information that will be useful in clinical trials, unlike the drug trials for slowing disease which either work or don't. But it's not going to solve Parkinson's disease.

The focus should be on causality and to do this requires larger investments in genetics, molecular biology and the development of animal models and if this reduces the amounts invested in clinical trials because of tight budgets and congressional earmarks then we will suffer the consequences, as we are right now.

— JOSEPH H. FRIEDMAN, MD

#### Disclosure of Financial Interests

Lectures: Teva, General Electric, UCB

Consulting: Teva; Addex Pharm; UCB; Lundbeck

Research: MJFox; NIH: EMD Serono; Teva; Acadia; Schering Plough

Royalties: Demos Press

#### CORRESPONDENCE

e-mail: joseph\_friedman@brown.edu

# For Whom Does the Cricket Sing?

**CITY CHILDREN ARE FAMILIAR WITH THE SIGHTS AND SOUNDS OF** mechanical contrivances such as vacuum cleaners; but unless they live close to a park, they may never experience the sounds of breezes rustling through the trees, the morning songs of birds or even the chirping of the crickets at twilight. Indeed, many a Providence youngster has never heard a cricket's song; and further, doesn't know whether a cricket is a sport or a bug.

For centuries, cricket sounds have enchanted people, soothed the distressed and inspired the poets. The most garrulous speaker will be reduced to silence when the evening cricket begins its song. There is something about the cricket repertoire, beyond its awesome rhythmicity, beyond its fidelity to but one tone, beyond even its tenacity that captivates the listener. And whether from the meadow or from the cottage hearth, it brings to the listener a sense of equanimity; truly, it is nature's congenial anodyne.

Surely the male cricket's song was not fashioned solely to confer a sense of peace upon humans at eventide. Nature is rarely so bounteous or considerate. Entomologists have lately devoted much research to the cricket, its biology, the sounds it generates and even its sex life; and as a result clarifying the dynamics of the cricket chirp.

The common cricket (*Gryllus assimilis*)—closely related to the katydid, the grasshopper and its migratory kin called the locust—has about 900 species, each with its characteristic cricket chirp. Crickets are nocturnal creatures; and their chirpings (generated only by males) are produced by the rubbing together of their dorsal wings, each wing endowed with a linear ridge containing a series of small rasp-like teeth. And thus, when the wings are alternately extended and retracted, the clicking (called stridulation) is generated by the rubbing together of these abrasive ridges. The chirpings, a sequence of sound impulses, are rapid (about 60 per second), the rate and tone distinctive to each species.

The commonest of the cricket songs is a sequence of clicks generated by the male to summon the female cricket, the sounds guiding the sexually receptive female to the male cricket's burrow. (Utter chaos would develop were it not for the fact that each species has its characteristic calling song and to which only females of the same species will respond.)



Once the couples are in the same vicinity, a second song is issued, called the courting song, a sort of prenuptial-agreement melody. And following the transfer of sperm, yet another sound is issued, a post-copulatory song. And finally, minutes later, a final group of clicks declaring fulfillment. The courtship scene is not a totally idyllic encounter since males will be obliged to fight other males to maintain their partnership; and thus this final song, called by biologists a song of triumph, is generated only by the victors.

The distinctive chirping patterns, with audible messages of critical communicative importance, are not learned; rather they are genetically determined and encoded in each cricket's genes. And thus, a cricket maturing in total isolation will still possess the neural instructions needed to create the sundry calls typical of his species.

The sounds of the crickets, biologists now tell us, are not rapturous expressions or songs of yearning, but rather the audible translation of some encoded genetic instruction to facilitate nature's fecund purposes.

The cricket is endowed with clusters of nerve cells scattered as discrete ganglia along its interior. There is no central registry of nerves—a brain—to exert ultimate control. And so, much of the cricket's actions and missions are automatic, a series of pre-programmed, indeed robotic, responses to a limited number of external stimuli. Biologists tell us that the mature cricket has inherited all of its actions, leaving nothing to chance or learning.

Robotic perhaps; yet in a world drowning in ambiguity and subtle nuance, it is refreshing to witness the directness and clarity of the cricket's audible messages. Other crickets, male or female, never have to speculate: "What did he mean by that series of chirps? What was the deeper, existential, significance to his earnest message?"

As emotion-laden humans rather than robotic insects, we humans are moved by things more complex than hereditary molecules. But sometimes, amidst the cacophony of our lives, we dream of and pine for the plainness, the precision, the transparency of the cricket songs.

— STANLEY M. ARONSON, MD

*Stanley M. Aronson, MD is dean of medicine emeritus, Brown University.*

## Disclosure of Financial Interests

The author and his spouse/significant other have no financial interests to disclose.

## CORRESPONDENCE

e-mail: SMAMD@cox.net

# Sex Differences In Door To Electrocardiogram and Balloon Times In Patients With ST Segment Elevation Myocardial Infarction

Nathan Spence, MD, Janice Muratori, RN, Steven E. Reinert, MS, Barry L. Sharaf, MD, and J. Dawn Abbott, MD

**APPROXIMATELY 500,000 ST-ELEVATION myocardial infarctions (STEMI)** occur each year in the US. The American College of Cardiology/American Heart Association guidelines recommend that a 12-lead electrocardiogram (ECG) be obtained in the Emergency Department (ED) within ten minutes of arrival for all patients presenting with chest pain or symptoms suggestive of acute coronary syndrome (ACS).<sup>1</sup> The ten minute door-to-ECG (DTE) standard is of particular importance in STEMI patients, as delays beyond this interval are associated with prolonged time to reperfusion and an increased mortality.<sup>2,3</sup>

Prior studies have reported sex-based disparities in cardiac care, including delays in obtaining ECGs and initiating treatment, in the setting of chest pain and ACS.<sup>2,4,7</sup> Delays observed in women have been attributed to the frequency of atypical clinical presentations and physician bias among other theories. The primary purpose of our study, therefore, was to examine the relationship between sex and DTE times in the highest risk subset of ACS patients, those with STEMI, and secondarily to assess DTB times.

## METHODS

### Study design and setting

This was a retrospective study of consecutive patients admitted through the ED at Rhode Island Hospital, an urban Level I trauma and tertiary care center in Providence, RI. The ED has a census of approximately 100,000 adult visits annually. The hospital has a 24-hour primary PCI program with a catheterization laboratory in the ED. Care is documented in an electronic medical record system. A database is maintained for all patients diagnosed with STEMI. The dataset includes the following times: triage, ECG, catheterization lab activation, lab staff availability, patient in lab, and reperfusion. In addition, it is recorded whether the patient was transferred in from another institution, had a pre-hospital ECG transmitted, had ST elevation present on the initial ECG, and had shock or cardiac arrest. A research coordinator verified all

data by independent review of the medical record. Medical history, presenting symptoms, and mode of arrival were obtained from chart review. The Institutional Review Board approved the protocol.

### Study Population

All patients presenting with a diagnosis of STEMI who were taken to the cardiac catheterization lab January 1st, 2008 through December 31st, 2010 were included. The initial sample consisted of 440 males and 142 females. Patients were excluded if they met the following criteria: they were transferred from an outside medical facility, had a pre-hospital ECG showing ST elevations, initial ECG time was unavailable, the initial ECG did not show ST elevation, or mode of transportation was not documented. The final patient population was 197 patients (150 male, 47 female).

### Statistical Analysis

The primary outcome measure was DTE, calculated from the triage time and first ECG time. The secondary outcome measure was DTB time, determined by subtracting time of arrival from the first intra-coronary device time. Baseline

variables and outcomes were analyzed according to sex using the independent-samples t-test (with adjustment for unequal variance where appropriate). We used the Pearson correlation coefficient for gauging the strength of the relationship among time variables, age, and DTB. We used an alpha probability of 0.05 as the threshold for statistical significance in two-tailed comparisons. Means are presented with standard deviations throughout. All statistics were performed with Stata v.10 (Stata Corp., College Station, TX).

## RESULTS

### Baseline characteristics

197 patients met study eligibility criteria. Baseline characteristics according to sex are displayed in Table 1. Women were older; more often diabetes, and were less likely to have prior CAD. Presence of chest pain and mode of arrival were similar.

### Diagnosis and treatment times

The mean DTE time was similar in women and men (eight minutes versus seven minutes,  $p=0.25$ ). 81% of women and 79% of men had DTE within the ten minute guideline recommendation

Table 1. Baseline characteristics according to sex

	Female		Male		p-value
	n	%	n	%	
Mean age (yrs) (SD)	66 (14)		58 (13)		0.0002
Chest pain as chief complaint	41	87	139	93	0.25
Presence of associated symptoms (i.e., nausea, vomiting, dyspnea, diaphoresis, radiation)	37	90	125	90	0.95
<u>Past Medical History</u>					
Hypertension	30	64	80	53	0.21
Diabetes mellitus	12	26	12	8	0.001
Current or former smoker	35	75	96	64	0.19
Family history of premature CAD	20	43	49	33	0.22
Hyperlipidemia	23	49	68	45	0.67
Previous MI or CAD	8	17	51	34	0.03
Congestive heart failure history	1	2	2	1	0.70
<u>Mode of Arrival</u>					
Emergency medical services	40	85	121	81	0.50

CAD – coronary artery disease, MI – myocardial infarction

( $p=0.75$ ). When adjusted for the presence of chest pain, associated symptoms, or past medical history, no statistically significant difference was found between the groups. Though it did not reach statistical significance ( $p=0.10$ ), males with chest pain did receive an initial ECG five minutes sooner than those who did not have chest pain (seven versus 12 minutes). Females with chest pain, in turn, only received an ECG one minute sooner than those who did not have chest pain (eight vs. nine minutes).

DTB times were non-significantly shorter in men compared to women (68 minutes vs. 76 minutes,  $p=.08$ ), however, 85% of women and 89% of men had a DTB within 90 minutes ( $p=0.43$ ). When adjusted for time intervals between DTE and DTB times, no difference was found between the groups.

## DISCUSSION

In this study we observed that DTE and DTB times were similar in women and men, consistent with a lack of sex-based disparity in the diagnosis and treatment of STEMI in our institution. This is an important finding since the ECG is required for appropriate diagnosis of STEMI, and time to primary PCI is strongly associated with mortality risk.<sup>3</sup>

Our findings differ from others that reported sex-based differences in ECG time with delays reported for women.<sup>2, 8, 9</sup> This likely reflects the inclusion of only STEMI patients as opposed to all non-traumatic chest pain or ACS, where clinical presentations are more variable. In our cohort, the clinical presentation in women and men was similar with the majority of patients presenting with chest pain as the chief complaint and arriving to the ED by ambulance. Interestingly, those who did not present with chest pain as their chief complaint did not have statistically significant delays in acquisition of ECGs. This may be because STEMI patients, appear more ill than non-STEMI ACS and low risk chest pain patients, and are more likely to arrive by ambulance, which leads to a more rapid triage process. In support of this concept, a prior study showed that only 33% of patients with non-STEMI had an initial ECG obtained within 10 minutes of ED arrival compared to 80% in our study.<sup>2</sup> Additionally, a retrospective cross sectional analysis of patients presenting to our institution found that fewer than 25%

of patients with atypical symptoms of ACS received a timely ECG and patients arriving by ambulance had significantly shorter ECG times than walk-ins.<sup>8</sup>

While it did not reach statistical significance, the sex difference in DTB of almost nine minutes we observed between women and men may be clinically important. The study, however, was not powered to assess clinical outcomes. Previous studies have reported delays in time to reperfusion in women with STEMI with higher adjusted mortality compared to men.<sup>10</sup> Our study suggests that the difference in DTB time is not related to a delay in diagnosis and further investigation into factors that may delay reperfusion such as obtaining arterial access or angiography are warranted and may identify additional targets to further improve care in STEMI patients.

## LIMITATIONS

Our study is limited by it being a single site at an academic urban medical center and results may not be generalizable to other institutions. Our hospital has a multidisciplinary DTB time quality improvement team comprised of representatives from the ED, interventional cardiology, cath lab, and hospital. An internal monitoring system to track DTB times has been in place since 2005 and all cases that fall outside the guideline times are reviewed. The results, therefore, may not be observed in hospitals with less organized or successful primary PCI programs. The presence of the cath lab in the ED also facilitates rapid DTB times. An additional limitation is the relatively small sample size. It is possible that statistically significant differences would be found in a larger patient population.

## CONCLUSIONS

In a primary PCI program where the majority of patients receive guideline recommended care we did not observe differences in the diagnosis or treatment of STEMI according to sex. This suggests that ED and hospital protocols for evaluating high-risk ACS patients work effectively in both women and men.

## REFERENCES

1. Anderson JL, Adams CD, Antman EM, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-Elevation myocardial infarction. *J Am Coll Cardiol*. 2007;50:e1-e157.
2. Diercks DB, Peacock WF, Hiestand BC, et al. Frequency and consequences of recording an electro-

cardiogram >10 minutes after arrival in an emergency room in non-ST-segment elevation acute coronary syndromes. *Am J Cardiol*. 2006;97:437-42.

3. McNamara RL, Wang Y, Herrin J, et al. Effect of door-to-balloon time on mortality in patients with ST-segment elevation myocardial infarction. *J Am Coll Cardiol*. 2006;47:2180-6.
4. Heston TF, Lewis LM. Gender bias in the evaluation and management of acute nontraumatic chest pain. *Fam Pract Res J*. 1992;12:383-9.
5. Jackson RE, Anderson W, Peacock WFT, Vaught L, Carley RS, Wilson AG. Effect of a patient's sex on the timing of thrombolytic therapy. *An Emerg Med*. 1996;27:8-15.
6. Takakuwa KM, Shofer FS, Hollander JE. The influence of race and gender on time to initial electrocardiogram for patients with chest pain. *Acad Emerg Med*. 2006;13:867-72.
7. Vaccarino V, Rathore SS, Wenger NK, et al. Sex and racial differences in the management of acute myocardial infarction, 1994 through 2002. *New Engl J Med*. 2005;353:671-82.
8. McGregor A, Madsen T, Napoli A, Weinstock B, Machan J, Becker B. Evidence that Gender Effects on Time-to-ECG may be attributable to differences in Atypical Presentations. *Emerg Med*. 1:102. doi:10.4172/egm.1000102.
9. Zegre-Hemsey J, Sommargren CE, Drew BJ. Initial ECG acquisition within 10 minutes of arrival at the emergency department in persons with chest pain: time and gender differences. *J Emerg Nurs*. 2011;37:109-12.
10. Jneid H, Fonarow GC, Cannon CP, et al. Sex differences in medical care and early death after acute myocardial infarction. *Circulation*. 2008;118:2803-10.

*Nathan Spence, MD, is an Internal Medicine Resident, Department of Medicine, Rhode Island Hospital.*

*Janice Muratori, RN, is a Research Coordinator in the Cardiac Project Office at Rhode Island Hospital.*

*Steven E. Reinert, MS, is a Research Analyst, Department of Information Services, Lifespan.*

*Barry L. Sharaf, MD, is Director of the Cardiac Catheterization Laboratory, Associate Professor, Department of Medicine, Rhode Island Hospital.*

*J. Dawn Abbott, MD, is Director of the Interventional Fellowship, Associate Professor, Department of Medicine, Rhode Island Hospital.*

## Disclosure of Financial Interests

The authors and/or their spouses/significant others have no financial interests to disclose.

## CORRESPONDENCE

J. Dawn Abbott, MD  
Rhode Island Hospital  
814 APC, 593 Eddy St.  
Providence, RI 02903  
phone: (401) 444-4581  
fax: (401) 444-8158  
e-mail: jabbott@lifespan.org

# Lumbar Spinal Stenosis: Evaluation of Information On the Internet

Ross J. Feller, MD, Ariel Cohen, BA, Mark A. Palumbo, MD, and Alan H. Daniels, MD

**THE EXPLOSION OF HEALTH CARE INFORMATION** on the Internet mirrors the continued rapid expansion of electronic communication and related Internet industries. The supply is composed of a wide range of resources, from academic and evidence-based to personal and anecdotal. It is decentralized in nature: any individual with an Internet connection can now contribute to and retrieve online health information as demonstrated by blogs, testimonials and open forum.<sup>1</sup> Although this makes for a dynamic model of knowledge dispersion, there are no guidelines for evaluation of accuracy, currency, readability and scope of information. On the demand side, broadband/wireless connection in particular has allowed rapid, minute-to-minute access of information in a way never before experienced. It is reported that 80% of people with access to the Internet have performed health-related searches in the last month, and 81% of searches are performed through a search engine.<sup>1</sup> On a daily basis, 6 million Americans are seeking answers to healthcare queries on the Internet.<sup>2</sup>

It has been suggested in several studies that this rapid evolution of supply and demand has not necessarily been matched by an equal increase in quality. Several orthopaedic topics, including cervical and lumbar disc herniation, carpal tunnel syndrome, back pain, and scoliosis have been examined to identify trends in the breadth and depth of information available.<sup>1, 3-7</sup> Most investigations have shown the available content to be of incredibly varied quality.

Chronic orthopaedic conditions are ideal topics of study in this forum. Unlike acute musculoskeletal trauma which typically leads to early presentation to an emergency care facility or physician office, people with long-standing orthopedic disease will often engage in their first "consultation" online. In a recent patient survey, 55% of respondents stated that during the past twelve months they had consulted a physician for a health-related issue while 59% stated they had accessed the Internet for this information.<sup>9</sup> In addition, many

will continue to research topics on the Internet even after establishing direct care with a physician; only one third of these patients disclose that they are gathering information from the Web.<sup>8</sup>

**Lumbar spinal stenosis (LSS)** is a common cause of back pain and neurogenic claudication in elderly individuals. The presentation of LSS is variable, and it can be confused with pathology affecting other organ systems (e.g. peripheral vascular disease). As such, LSS is a commonly searched topic on the Internet. The goal of this study was to assess the overall quality of online information regarding LSS. The degree of correlation between authorship and website quality score was examined. We also sought to identify deficiencies and/or strengths in the body of knowledge on LSS available to the standard Internet user.

## METHODS

The phrase "lumbar spinal stenosis" was entered as a search item using the popular search engine [www.google.com](http://www.google.com) during the month of July, 2011. A disease-based search rather than a symptom-based search was employed in order to more easily isolate the body of information specific to one disease process. This search method was employed instead of using a search term that produces a "differential diagnosis" of web listings related by a common symptom (ex. lower back pain or sciatica). The first 50 web sites listed were classified according to authorship and individually analyzed using a 25-point scale (Informational Quality Score, IQS) based on "Disease Summary", "Treatment Options", "Pathogenesis", and "Complications/Results" (Table 1).<sup>3</sup> Points were awarded in the category if the web site

**Table 1: Information Quality Score (IQS) Tabulation Sheet**

### I. Disease Summary

1. Neural/disc/vertebral anatomy \_\_\_\_\_
2. Risk factors (at least 2 mentioned) \_\_\_\_\_
3. Symptoms: leg weakness \_\_\_\_\_
4. Symptoms: leg discomfort \_\_\_\_\_
5. Symptoms: leg numbness/tingling/decreased sensation \_\_\_\_\_
6. Signs: bowel/bladder dysfunction \_\_\_\_\_
7. Signs: sensation or motor deficit \_\_\_\_\_
8. Dx studies (MRI, CT myelo, or EMG/NCS) \_\_\_\_\_

### II. Treatment Options

9. Bed rest/activity modification \_\_\_\_\_
10. Exercise therapy/physical therapy \_\_\_\_\_
11. Pharmacologic Rx \_\_\_\_\_
12. Other modalities (ice/heat/e-stim, etc) \_\_\_\_\_
13. Corticosteroid epidural injection \_\_\_\_\_
14. Physical treatments (chiro, trxn, acupuncture) \_\_\_\_\_
15. Surgery: decompression \_\_\_\_\_
16. Surgery: fusion \_\_\_\_\_
17. Surgery: other \_\_\_\_\_

### III. Pathogenesis

18. Disc herniation \_\_\_\_\_
19. Spondylosis/disc degeneration \_\_\_\_\_
20. Neural compression \_\_\_\_\_
21. Central/lateral recess/foraminal stenosis \_\_\_\_\_

### IV. Complications/Results

22. Results: non-operative Rx \_\_\_\_\_
23. Results: operative Rx \_\_\_\_\_
24. Complications: non-operative Rx \_\_\_\_\_
25. Complications: operative Rx \_\_\_\_\_

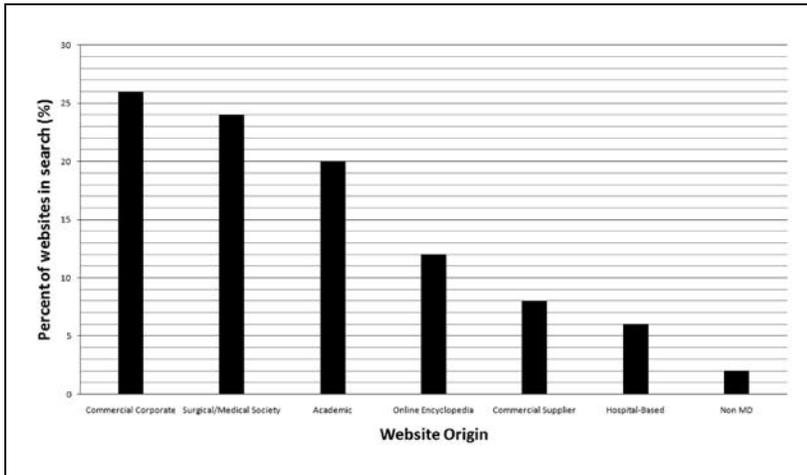


Figure 1. Website Origin classification results.

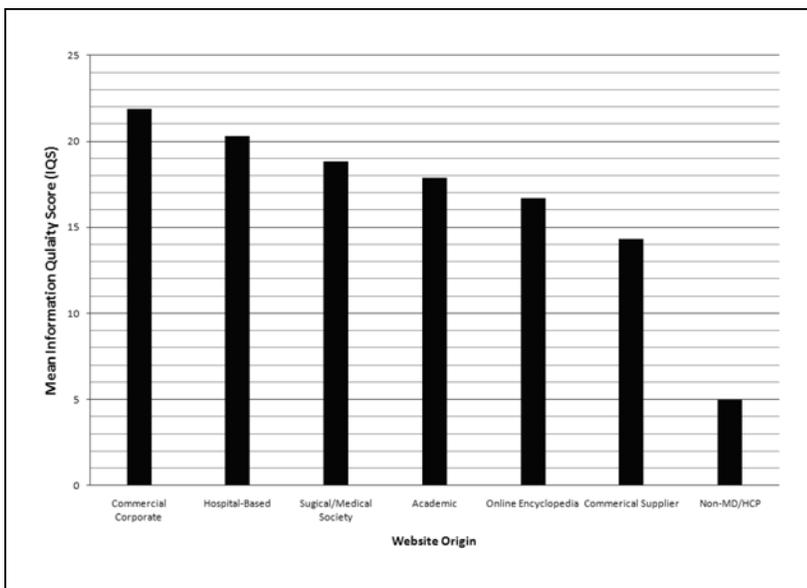


Figure 2. Mean Information Quality Score (IQS) based on website classification.

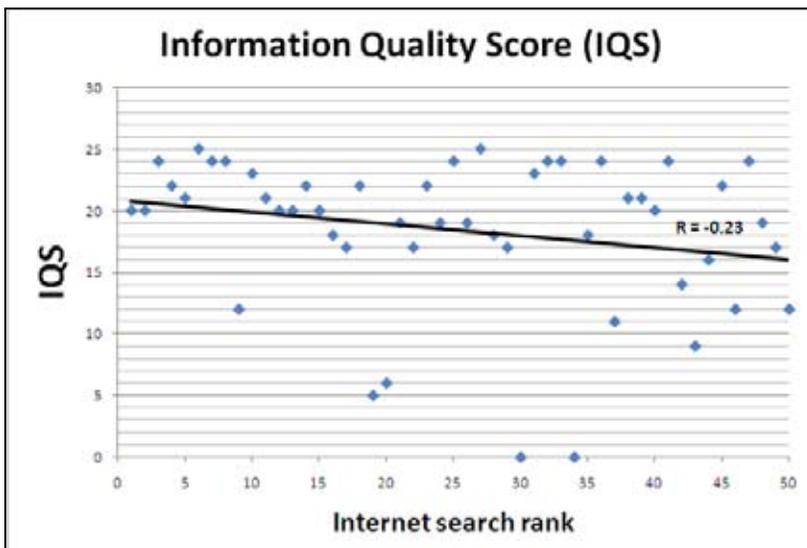


Figure 3. Information Quality Score as related to Internet search rank.

of interest covered the topic. An IQS of greater than 20 was used to denote information of “high quality”. The presence of advertising and marketing were also noted. Two independent observers scored each website utilizing the IQS datasheet. Statistical analysis was performed to evaluate the effect of website origin, search rank, and presence of advertising on IQS.

## RESULTS

Of the 50 web sites evaluated, six (12%) were online encyclopedias, three (6%) were hospital sponsored, 12 (24%) were surgical/medical society, ten (20%) were academic, 13 (26%) were commercial corporate and four (8%) were commercial supplier; only one website (2%) was identified as individual/non-healthcare provider (Figure 1). In addition to the 8% of commercial supplier sites marketing their own product for secondary commercial gain, 42% of websites were involved in advertising.

The mean IQS among all sites analyzed was 18.4. The authorship category associated with the highest mean IQS was commercial corporate (21.9), followed by hospital (20.3), surgical/medical society (18.8), academic (17.9), online encyclopedia (16.7), commercial supplier (14.3), and non-healthcare provider (5) (Figure 2). Only 22 (44%) of websites had an IQS >20, reflecting “high quality” medical information. The Pearson correlation coefficient of IQS to Internet search rank was  $R = -0.23$ , signifying a skew towards lower IQS for the websites further down the Internet search list (Figure 3). The IQS did not vary significantly between sites that advertised and those that did not (18.05 vs. 18.69,  $p = 0.72$ ). The websites with IQS of 23 or greater in the initial 25 search results are listed in Table 2.

## DISCUSSION

This study suggests that the quality of on-line health information related to LSS is highly variable. Only 44% of the identified websites were of “high quality”. These results mirror prior studies that reported low overall quality of health information available to the Internet user. It is notable that our study results indicate a higher overall quality of content (average IQS of 18.4) compared to previous investigations. In 2005 Greene and colleagues calculated an average IQS of 9 out of 25 for **online health information (OHI)** related to lumbar disc herniation.<sup>3</sup> Similar to the current study, commercial websites demonstrated a higher mean IQS than any other category. Using a symptom-based search design, Butler found the quality of information regarding “low back pain” to be limited.<sup>6</sup> Similarly,

**Table 2: Websites amongst the top 25 Internet search results with an IQS of 23 or greater:**

<http://www.lumbarstenosis.com/>  
<http://www.webmd.com/back-pain/tc/lumbar-spinal-stenosis-topic-overview>  
<http://www.mayoclinic.com/health/spinal-stenosis/DS00515>  
<http://www.aafp.org/afp/980415ap/alvarez.html>  
<http://www.spinalstenosis.org/lumbar.php>

Morr et al generated a mean quality score of 10.9 out of a possible 28 for websites related to cervical disc herniation.<sup>4</sup>

Although different search engines and evaluation systems have been utilized in these studies, it is clear that the body of health-related literature currently available on the Internet is variable. It is also noteworthy that the previous studies available for comparison use data from as many as five to ten years ago. This point highlights the rapid turnover and expansion of information on the Internet. Thus, some suggest that the real problem may relate to an overload of information rather than to a dearth of it. The data utilized in this study was gathered in 2011 and represents a more current snapshot of online information regarding a specific orthopaedic condition. Whether our higher overall quality score represents a true advance in online health information is unclear and will need to be supported by other up-to-date investigations.

The physician-patient relationship is also important in directing an individual to relevant, high quality information. Of patients that do present to a physician's office, 70% would like a website recommendation but only 4% receive such information.<sup>9</sup> Healthcare providers must realize this shifting paradigm in the distribution of healthcare information and modify their practice accordingly. As Sechrest suggests, the "information component" of practice is "important and demands competency and skill, just as diagnosis and treatment do".<sup>10</sup> The data provided by this study may help physicians in guiding their patients towards reliable information on LSS.

There are several limitations to our study. The search engine Google was the single portal employed to assess the body of online information on LSS. It was decided that using a single search engine would closely approximate search behavior on the part of the patient. In addition, the website evaluators utilized in this study (two Orthopaedic Surgery residents) have a

very different knowledge base than that of a typical patient. This study did not examine the readability of information provided, which includes whether the information is presented in a way that enables swift and easy website navigation. A recent study suggested that less than 2.5% of spine-related patient education websites used a reading level at or below the sixth grade, the recommended readability level for adult patients in the US.<sup>11</sup> Even if information is improving, it must be coupled with an attention to the characteristics of the audience being provided information.

## CONCLUSION

The quality of Internet information on lumbar spinal stenosis is variable. Less than 50% of relevant web sites were determined to be of high quality. More than one-half of the websites sought secondary commercial gain. The higher overall scores generated in this study may reflect a trend towards improvement in online health information. The list of high quality sites generated from our study should prove useful to both patients and physicians who wish to utilize online health information pertaining to lumbar spinal stenosis.

It is without doubt that information on the Internet *can* help to empower patients and reduce healthcare costs. Patients now have access to information on symptom recognition and diagnosis, chronic disease management, and the latest available treatments and their associated complications. The major goal now needs to be identifying ways to organize quality information so that it can be rapidly accessed, evaluated and comprehended by the general population.

## REFERENCES

1. Beredjickian PK, Bozentka DJ, Steinberg DR, Bernstein J. Evaluating the source and content of orthopaedic information on the Internet. The case of carpal tunnel syndrome. *J Bone Joint Surg Am.* 2000 Nov;82-A(11):1540-3.
2. Lorence DP, Greenberg L. The zeitgeist of online health search. Implications for a consumer-centric health system. *J Gen Intern Med.* 2006

Feb;21(2):134-9. Epub 2005 Dec 7.

3. Greene DL, Appel AJ, Reinert SE, Palumbo MA. Lumbar disc herniation: evaluation of information on the internet. *Spine (Phila Pa 1976).* 2005 Apr 1;30(7):826-9.
4. Morr S, Shanti N, Carrer A, Kubeck J, Gerling MC. Quality of information concerning cervical disc herniation on the Internet. *Spine J.* 2010 Apr;10(4):350-4.
5. Mathur S, Shanti N, Brkaric M, Sood V, Kubeck J, Paulino C, Merola AA. Surfing for scoliosis: the quality of information available on the Internet. *Spine (Phila Pa 1976).* 2005 Dec 1;30(23):2695-700.
6. Butler L, Foster NE. Back pain online: a cross-sectional survey of the quality of web-based information on low back pain. *Spine (Phila Pa 1976).* 2003 Feb 15;28(4):395-401.
7. Qureshi SA, Koehler SM, Lin JD, Bird J, Garcia RM, Hecht AC. An evaluation of information on the internet about a new device: the cervical artificial disc replacement. *Spine (Phila Pa 1976).* 2012 May 1;37(10):881-3.
8. Greenberg L, D'Andrea G, Lorence D. Setting the public agenda for online health search: a white paper and action agenda. *J Med Internet Res.* 2004 Jun 8;6(2):e18.
9. Ullrich PF Jr, Vaccaro AR. Patient education on the internet: opportunities and pitfalls. *Spine (Phila Pa 1976).* 2002 Apr 1;27(7):E185-8.
10. Sechrest RC. The internet and the physician-patient relationship. *Clin Orthop Relat Res.* 2010 Oct;468(10):2566-71. Review.
11. Vives M, Young L, Sabharwal S. Readability of spine-related patient education materials from subspecialty organization and spine practitioner websites. *Spine (Phila Pa 1976).* 2009 Dec 1;34(25):2826-31.

*Ross J. Feller, MD, is a Resident in the Department of Orthopaedic at the Warren Alpert Medical School of Brown University.*

*Ariel Cohen, BA, is a Resident in the Department of Emergency Medicine, at Metro-Health Medical Center in Cleveland Ohio.*

*Mark A. Palumbo, MD, is an Associate Professor and Chief of the Division of Spine Surgery in the Department of Orthopaedic Surgery at the Warren Alpert Medical School of Brown University.*

*Alan H. Daniels, MD, is Chief Resident in the Department of Orthopaedic Surgery at the Warren Alpert Medical School of Brown University.*

## Disclosure of Financial Interests

The authors and/or their spouses/significant others have no financial interests to disclose.

## CORRESPONDENCE

Alan H. Daniels, MD  
Department of Orthopaedic Surgery  
Warren Alpert Medical School of Brown University  
2 Dudley Street, Suite 200  
Providence, Rhode Island 02905

# A Novel Preclinical Course in Ophthalmology and Ophthalmic Virtual Surgery

Jennifer J. Yong, BS, Michael E. Migliori, MD, and Paul B. Greenberg, MD

**THE LIASON COMMITTEE ON MEDICAL** Education provides guidelines for medical school curricula, but these guidelines lack requirements for teaching ophthalmology.<sup>1</sup> Due to the vast amount of information taught to preclinical medical students, more time is devoted to fundamental subjects and less on specialties like ophthalmology.<sup>2</sup> There has been a significant decline in the number of schools requiring an official clinical rotation in ophthalmology.<sup>3</sup> In addition, although the number of hours of undergraduate ophthalmology instruction may meet the International Council of Ophthalmology Task Force recommendations, data indicates that residents in primary care are uncomfortable in assessing and managing common ophthalmic conditions.<sup>4</sup> These studies highlight the need for improved ophthalmic instruction in medical school to avoid overlooking eye conditions that may result in irreversible damage if left untreated.

Ophthalmology is of interest to medical students for several reasons: it is disproportionately concerned with the care of the fastest growing segment of the United States population, the elderly; it is connected to many important systemic diseases; it has a major impact on daily functioning and quality of life; finally, it provides insight into an unusual specialty that is strongly linked to both medicine and surgery. To this end, we designed a preclinical elective course in ophthalmology at the Alpert Medical School of Brown University.

Taking a previous Alpert Medical School preclinical elective on cataract surgery as our starting point,<sup>5</sup> our course, titled *Adventures in*

*Ophthalmology and Virtual Surgery*, introduces preclinical medical students to ophthalmology through multiple diverse approaches.<sup>6</sup> The course's multifaceted method of instruction is innovative because it accommodates different learning styles, allows flexibility of schedule, and helps students to learn interactively with virtual surgery technology to consolidate concepts of anatomy, pathology, and treatment of the eye.

## METHODS

### Course Design and Implementation

The elective was designed in three parts: (1) independent study of web-based didactics; (2) participation in conducting a vision screening; and (3) training with a virtual eye surgery simulator.

The first section of the course was designed as a web-based curriculum to be completed independently. This portion was divided into five learning blocks, one for each of the eye conditions examined: cataracts, open-angle glaucoma, age-related macular degeneration, diabetic retinopathy, and thyroid eye disease. These specific eye conditions were chosen to provide students with a well-rounded understanding of how disease can impact key components of the eye.

The first learning block (cataracts) was taken from the predecessor course offered at Alpert Medical School in 2009-2010.<sup>5</sup> The remaining four learning blocks were created specifically for this initiative. Each learning block is composed of a didactic curriculum, a supplementary video, and a short quiz. The didactic curriculum consists of three PowerPoint slide modules, focusing on topics of epidemiology, pathophysiology, and treatment for the particular eye condition. The learning objectives for this curriculum were based on the American Academy of Ophthalmology guidelines.<sup>8-11</sup> A web-link was included in each block, directing to a digital video on the surgical treatment of the particular disease. A ten-question, investigator-generated multiple-choice quiz was created for each learning block; each quiz was administered before starting and after completing each block to assess the students' progress. Course materials were uploaded onto our institution's online course management system.

The second section of the course was designed to bring the didactic portion of the course to life in a clinical setting. Arrangements were made for pairs of students to participate in a three-hour glaucoma screening session at the Rhode

**Table 1. Selected results from the pre-course survey**

Statement (n=17)	Average Rating	Standard Deviation	Question Style
Is the ophthalmology content provided in your medical school classes limited?	3.67	0.94	Likert
Does the multifaceted nature of the course (online learning, clinic screening, virtual surgery) interest you?	4.18	0.51	Likert
Did the online nature of the didactic modules attract you to enroll in the course?	3.65	1.03	Likert
Are you interested in ophthalmology as a possible career choice?	3.76	1.00	Likert
Do you have experience working with virtual surgery simulators?	No (16 of 17)		Yes/No
Do you have experience using ophthalmic diagnostic equipment?	No (12 of 17)		Yes/No

Average Rating was calculated by assigning a numeric value to each response (Strongly disagree=1, Disagree=2, Neither agree nor disagree=3, Agree=4, Strongly agree=5), and obtaining a weighted average of all the responses.

**Table 2. Selected results from the post-course survey**

Statement (n=17)	Average Rating	Standard Deviation	Question Style
Course content was at a level of difficulty appropriate to first and second year med students.	4.69	0.46	Likert
The virtual surgery simulator helped me in understanding ocular anatomy.	4.00	0.79	Likert
I would be interested in more experience with the virtual surgery simulator.	4.56	0.61	Likert
I feel more comfortable with using ophthalmic diagnostic equipment.	4.19	0.53	Likert
Participating in the glaucoma screening session helped me understand the importance of early diagnosis for glaucoma.	4.31	0.68	Likert
I am interested in ophthalmology as a career.	3.88	0.78	Likert
The course increased my awareness of ocular signs and symptoms in patients.	4.56	0.50	Likert
Please provide additional feedback and suggestions you may have about the virtual surgery session.	Interested in more experience (15 of 17)		Free response

Average Rating was calculated by assigning a numeric value to each response (Strongly disagree=1, Disagree=2, Neither agree nor disagree=3, Agree=4, Strongly agree=5), and obtaining a weighted average of all the responses.

Island Free Clinic (RIFC) with the members of a medical student-organized community vision screening initiative.<sup>7</sup> The student organization provided instruction for operating the automated perimetry and automated visual acuity screening machines prior to the start of the session.

The third portion of the course was designed to use virtual surgery technology to foster a more complete mastery of the academic topics of the course. From the five cataract modules available on the EyeSi® (*VRmagic*, Mannheim, Germany), six tasks of difficulty levels thought to be appropriate for first and second year medical students were selected. Each student was assigned a three-hour individual block of time to complete the virtual surgery session with EyeSi® ophthalmic-surgical simulator housed at the Providence VA Medical Center Eye Clinic. In the virtual surgery suite, the student followed a detailed instruction manual (first created for the predecessor cataract course, and then edited for the purposes of this course) explaining the step-by-step use of the simulator to allow the student to work independently.<sup>5</sup> As our goal was for students to attain a holistic understanding of the eye and to provide an introduction to ocular surgery, the students were allowed

to repeat individual tasks of the virtual surgery as many times as needed in the three-hour session.

The entire web-based didactic course and the virtual surgery instruction manual can be accessed online at mycourses.brown.edu. Visitors can login as a guest and click on the title of the elective (*Alpert Medical School – Adventures in Ophthalmology and Virtual Surgery*) to be directed to the course website.

**Course Evaluation**

The elective was offered on a pass/fail basis at the Warren Alpert Medical School for the 2011–2012 academic year. Students were assessed with five online quizzes (50 questions total) that tested the content presented in the web-based didactic modules. Requirements to pass the course were: grades of 70% correct on each of the five content-based quizzes, participation in the vision screening, and participation in the virtual surgery session.

Students were asked to complete anonymous surveys before and after the course to validate educational content and determine how the elective can be improved in the future. These pre- and post-course surveys specifically measured students’ motivation for enrolling in

the course, students’ knowledge of ophthalmology before and after the course, students’ perceptions of eye diseases as a manifestation of other systemic diseases, students’ interests in pursuing a career in ophthalmology, and students’ evaluations of the didactic and practical portions of the course. The pre-course survey consisted of four Likert-style questions, three multiple-choice questions, and one free response question. The post-course survey consisted of 17 Likert-style questions and three free response questions. Five response choices were given for each of the Likert-style questions: “strongly agree,” “agree,” “neither agree nor disagree,” “disagree,” and “strongly disagree.”<sup>12</sup> The free response sections expanded on the quantitative aspects of the surveys by asking students to provide feedback and suggestions about the individual components of the course.

The Institutional Review Board (IRB) of the Providence VA Medical Center (PVAMC) concluded that this course evaluation did not meet the definition of research and thus IRB approval was not required.

**RESULTS**

Twenty-three of the 205 first and second year students (11%) enrolled in

the preclinical elective, making it the most popular elective in the 2011–2012 academic year. This paper reports the pre- and post-course survey results from the 17 students enrolled in the elective during the 2011 fall semester. The mean score of the content-based quizzes administered before the course was 49%. The mean score of the same quizzes administered after completion of the didactic portion of the course was 94%. All 17 students achieved a passing score of 70% or greater in the course.

### Pre-Course Survey

Selected results from the pre-course survey are included in Table 1. This survey indicated that the elective attracted students interested in ophthalmology: 13 (76%) enrolled medical students were interested in pursuing ophthalmology as a career, and 100% of the students reported in the free response section that “interest” in the topic of ophthalmology was their primary reason for enrolling in the course.

Though students exhibited desire to expand their exposure to ophthalmology, they were most attracted by the multifaceted nature (web-based, clinical, virtual surgery components) of the elective: only one student (6%) disagreed when asked if the ophthalmology content in medical school classes were limited whereas none of the students disagreed when asked if the multifaceted nature of the course interested them. Most students had no prior experience working with virtual surgery simulators (16/17; 94%) and ophthalmic diagnostic equipment (12/17; 71%).

### Post-course Survey

Selected results from the post-course survey are included in Table 2. This survey indicated that the web-based component of the course was well received. All enrolled medical students responded “strongly agree” or “agree” to the following: the course was easy to access and navigate, the course could be completed in a reasonable amount of time, and course content was at a level of difficulty appropriate to first and second year medical students. Most (15/17; 88%) agreed that the quiz questions were an appropriate test of the material covered in the didactic modules and that the surgical videos were helpful in understanding the treatment

of the diseases studied. In terms of constructive feedback, three students (18%) indicated that the web-based curriculum could be expanded to include information on more eye conditions.

Students expressed a high level of satisfaction with the vision screening session: 15 (88%) reported feeling more comfortable using ophthalmic diagnostic equipment after the session and 14 (82%) reported that screening vision first-hand helped them understand the importance of early diagnosis of eye diseases. In the free response section, four students (24%) suggested that additional instruction regarding operation of the screening machines would have been useful in preparing them to give the patients the most benefit. In particular, three of these four students stated that a written guide or protocol would have been helpful.

The feedback from the free responses indicated that the virtual surgery session was a positive educational experience. Most students (15/17; 88%) indicated an interest in gaining more experience with the virtual surgery simulator; five students (29%) found navigating the machine to be challenging.

With respect to the combined impact of the three components of the course, all students agreed that the course helped increase their awareness of ocular signs and symptoms in patients.

## DISCUSSION

This course was successful in supplementing gaps in the ophthalmology curriculum by providing academic, clinical, and surgical experience to preclinical students. Using the tools of virtual surgery simulation technology to help consolidate the concepts learned in the web-based and clinical components, this elective was well received and highly effective in increasing awareness of the impact of eye conditions on the quality of life. Moreover, the unique learning modalities of this course allow for the possibility of the elective holding a sustainable spot in the medical curriculum; course offerings will not need to depend on the availability of lecturing instructors, and the materials can be easily passed on and updated from semester-to-semester based on feedback from post-course surveys.

This study has several limitations. First, the sample size of students was small

and inadequately powered, increasing risk for biased results. Second, this project was susceptible to selection bias: enrolled students may have had a predilection for surgery, ophthalmology or other surgical specialties. Thirdly, the clinical and virtual surgery components of the course were graded on participation, not on competency or performance. Use of the EyeSI® simulator has been shown as a reliable quantifiable performance analysis tool,<sup>13</sup> but further work is needed to develop a method of assessing skill improvement specific and appropriate to the level of preclinical students. Though the goal of this course is not acquisition of microsurgical performance, a more definitive method of assessing learning would be helpful to evaluate the efficacy of virtual surgery in preclinical medical education.

This preclinical elective course in ophthalmology suggests that with a relatively small investment of time, students can learn the epidemiology, pathophysiology, and treatment of common eye conditions with the tools of web-based instruction, clinic participation, and virtual surgery. Ophthalmology is a field acknowledged for creative innovation and technological advancement. Applying these attributes to our educational mission, an elective of this nature provides a unique opportunity to introduce this subspecialty as a possible career choice to future doctors early in their careers. Using a similar strategy, representatives from other fields can integrate their specialty into their institution’s medical curriculum to maximize exposure to the necessary field-specific knowledge all medical students should attain before graduating.

## REFERENCES

1. Jacobs DS. Teaching doctors about the eye: trends in the education of medical students and primary care residents. *Survey of Ophthalmology*. 1998;42(4):383–9.
2. Fan J, Sherwin T, McGee C. Teaching of ophthalmology in undergraduate curricula: a survey of Australasian and Asian medical schools. *Clin Exp Ophthalmol*. 2007;35(4):310–7.
3. Baylis O, Murray PI, Dayan M. Undergraduate ophthalmology education – a survey of UK medical schools. *Med Teach*. 2011;33(6):468–71.
4. Chan TY, Rai AS, Lee E, Glicksman JT, Hutnik CM. Needs assessment of ophthalmology education for primary care physicians in training: comparison with the International Council of Ophthalmology recommendations. *Clin Ophthalmol*. 2011;5: 311–9.

5. Seidman C, Ingrid SU, Greenberg PB. Ophthalmology in the Undergraduate Medical Curriculum: Web-based Learning and Virtual Surgery in an Elective Course on Cataracts. *J Acad Ophthalmol.* 2011;4:15–9.
6. Preclinical Electives List. Available at: <http://brown.edu/academics/medical/education/preclinical-curriculum-overview/preclinical-electives-list>. Accessed: February 1, 2012.
7. Cheung NC, Greenberg PB, Anderson KL, Feller ER. Effectiveness of a medical student-organized community vision screening initiative. *MHRI.* 2010;93(8):239, 242–3.
8. Bobrow JC, ed. 2010-2011. *Basic and Clinical Course (BCSC) Section 11: Lens and Cataract.* San Francisco: American Academy of Ophthalmology.
9. Bobrow JC, ed. 2010-2011. *Basic and Clinical Course (BCSC) Section 10: Glaucoma.* San Francisco: American Academy of Ophthalmology.
10. Bobrow JC, ed. 2010-2011. *Basic and Clinical Course (BCSC) Section 1: Update on General Medicine.* San Francisco: American Academy of Ophthalmology.
11. Bobrow JC, ed. 2010-2011. *Basic and Clinical Course (BCSC) Section 12: Retina and Vitreous.* San Francisco: American Academy of Ophthalmology.
12. Likert Scaling. Available at: <http://www.social-researchmethods.net/kb/scallik.php>. Accessed February 1, 2012.
13. Solverson DJ, Mazzoli RA, Raymond WR, Nelson ML, Hansen EA, Torres MF, Bhandari A, Hartranft CD. Virtual reality simulation in acquiring and differentiating basic ophthalmic microsurgical skills. *Stimul Healthc.* 2009;4(2):98–103.

*Jennifer J. Yong, BS, is a third year student at the Warren Alpert Medical School of Brown University.*

*Michael E. Migliori, MD, is a Clinical Associate Professor of Surgery (Ophthalmology) at the Alpert Medical School of Brown University and Ophthalmologist-in-Chief at Rhode Island Hospital.*

*Paul B. Greenberg, MD, is a Clinical Associate Professor of Surgery (Ophthalmology) at the Alpert Medical School of Brown University, Chief of Ophthalmology at the Providence Veterans Affairs Medical Center, and Associate Director of the Brown/Rhode Island Hospital Ophthalmology Residency Program.*

#### **Disclosure of Financial Interests**

The authors and/or their spouses/significant others have no financial interests to disclose.

#### **Disclaimer**

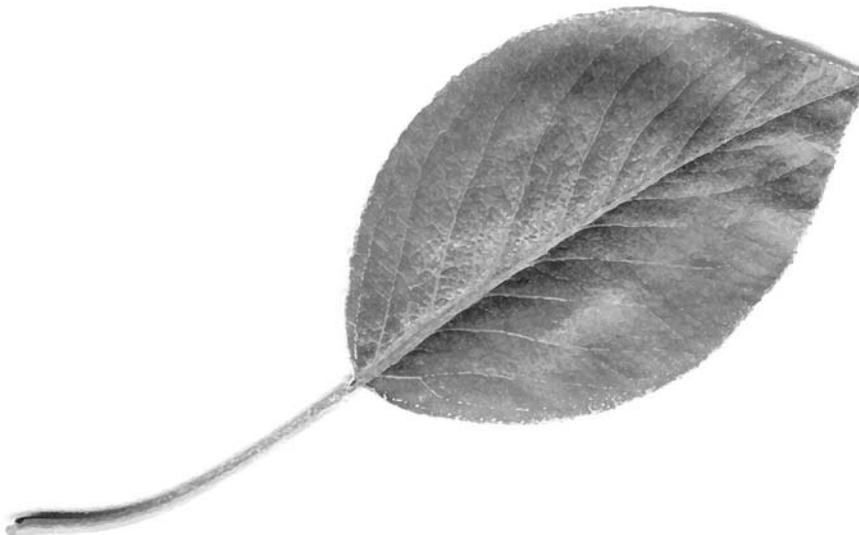
The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the United States (US) Department of Veterans Affairs or the US government.

#### **Acknowledgements**

The authors thank Edward Feller, MD for his assistance in the preparation of this manuscript.

#### **CORRESPONDENCE**

Paul B. Greenberg, MD  
Section of Ophthalmology  
VA Medical Center  
830 Chalkstone Avenue  
Providence, RI 02908  
phone: (401) 273-7100 x1500  
e-mail: paul\_greenberg@brown.edu



# Cubital Tunnel Syndrome: Diagnosis and Management

Samir K. Trehan, MD, John R. Parziale, MD, and Edward Akelman, MD

**CUBITAL TUNNEL SYNDROME IS, AFTER CARPAL tunnel syndrome, the second most common compression neuropathy of the upper extremity. Patients often present with pain, paresthesias and/or weakness that if left untreated may lead to significant disability. This article reviews the etiology, diagnosis and management of cubital tunnel syndrome.**

## ANATOMY AND ETIOLOGY

The ulnar nerve originates from branches of the C8 and T1 spinal nerve roots and is the terminal branch of the medial cord of the brachial plexus. In the arm, the ulnar nerve courses between the medial head of the triceps and the brachialis muscles. It then travels posterior to the medial epicondyle of the humerus and enters the cubital tunnel. The roof of the cubital tunnel consists of Osborne's ligament, which spans from the medial epicondyle of the humerus to the olecranon of the ulna, and the floor consists of the medial collateral ligament and joint capsule of the elbow. After exiting the cubital tunnel, the ulnar nerve passes between the humeral and ulnar heads of the flexor carpi ulnaris muscle and enters the anterior compartment of the forearm. In the forearm, it courses between, and innervates, the flexor carpi ulnaris and ulnar half (i.e., fourth and fifth fingers) of the flexor digitorum profundus muscles. The ulnar nerve then divides into superficial and deep branches. The deep branch innervates the hypothenar, third and fourth lumbrical, interosseous, adductor pollicis and deep head of the flexor pollicis brevis muscle, and the superficial branch provides sensory function for the medial hand.

Ulnar nerve compression most commonly occurs at the elbow. At the elbow, the ulnar nerve can be compressed at five sites: the arcade of Struthers, medial intermuscular septum, medial epicondyle, cubital tunnel and deep flexor pronator aponeurosis.<sup>1</sup> (Figure 1) Ulnar nerve compression within the cubital tunnel, known as cubital tunnel syndrome, is the most common site of compression.

During elbow flexion, the ulnar nerve is stretched 4.5 to 8 mm (since it lies posterior to the axis of motion of the elbow) and the cubital tunnel cross-sectional area narrows by up to 55% as intraneural pressures increase up to 20-fold.<sup>2,3</sup> As a result, repeated and sustained elbow flexion can irritate the ulnar nerve and eventually lead to cubital tunnel syndrome. This relationship between prolonged elbow flexion and cubital tunnel syndrome has been reported in patients who habitually sleep in the fetal position or sleep in the prone position with their hands tucked under the pillow. More recently, this relationship has been reported in patients with frequent prolonged cell phone use (i.e. "cell phone elbow"). Cubital tunnel syndrome can also develop in patients years after elbow trauma leading to cubitus varus deformity, such as supracondylar humerus fractures (i.e., "tardy ulnar nerve palsy"). Other causes of cubital tunnel syndrome include chronic external compression (e.g., wheelchair-bound patients and truck drivers), ulnar collateral ligament laxity (e.g., baseball pitchers), local edema or inflammation, space-occupying lesions (e.g., tumor) and repeated subluxation or dislocation of the ulnar nerve.

The incidence of cubital tunnel syndrome in the general population has been reported at 24.7 per 100,000.<sup>4</sup>

Populations at risk for cubital tunnel syndrome include patients with diabetes, obesity, as well as occupations involving repetitive elbow flexion and extension, holding tools in constant positions and using vibrating tools. The prevalence within these populations ranges from 2.8% among workers whose occupations require repetitive work (e.g., assembly line workers, packagers and cashiers) to 6.8% in floor cleaners to 42.5% among vibrating tool operators.<sup>4</sup>

## CLINICAL EVALUATION AND DIAGNOSIS

Diagnosis of cubital tunnel syndrome requires a thorough history and physical examination. Patients frequently initially present with intermittent paresthesias, numbness and tingling in the small finger and ulnar half of the ring finger (i.e., ulnar nerve distribution). As the disease progresses, these symptoms may become more constant and patients may complain of elbow pain in the region of the cubital tunnel (i.e., the "funny bone" area). Patients may also initially present with non-specific complaints of hand clumsiness or weakness, however atrophy of the intrinsic hand muscles innervated by the ulnar nerve is a sign of advanced disease. Motor impairment may manifest as grip weakness (e.g., difficulty opening bottles

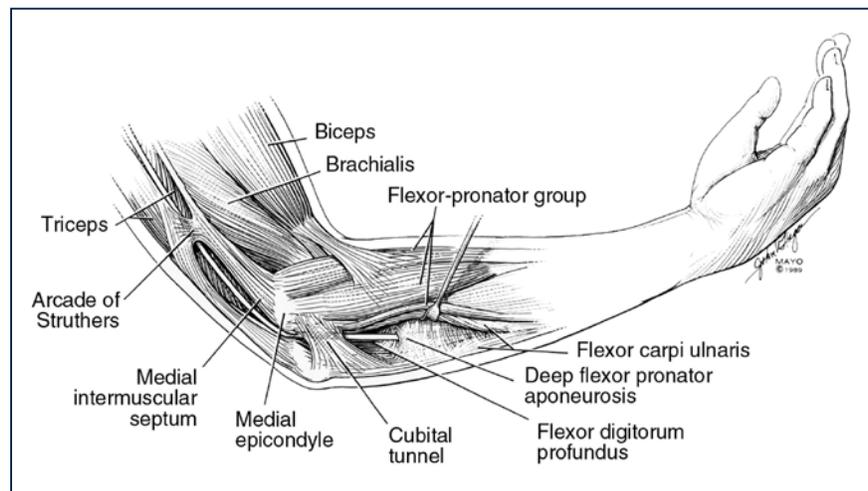


Figure 1. Ulnar nerve anatomy and sites of compression around the elbow. By permission of Mayo Foundation for Medical Education and Research. All rights reserved.

or jars), hand clumsiness (e.g., difficulty typing) or difficulty with precision pinch activities (e.g., buttoning buttons).<sup>1</sup>

Since patients with mild disease may have no symptoms at the time of examination, various provocative exam techniques may aid in diagnosis of these patients. The elbow flexion test is performed by placing the elbow in maximal flexion and full supination. The test is positive if paresthesias, numbness or tingling are reproduced in the ulnar nerve distribution. This test has been reported to be 75% sensitive after one minute. Tinel's test, in which the cubital tunnel is tapped by the examiner's finger, may also reproduce symptoms and has been reported to be 70% sensitive. Finally, compression of the nerve for one minute just proximal to the cubital tunnel with the elbow in 20° flexion and full supination is 89% sensitive when performed alone and 98% sensitive when performed in combination with the elbow flexion test.<sup>1,5</sup>

With advanced disease, objective findings of weakness in the muscles innervated by the ulnar nerve may be noted on examination. Patients may have weak finger abduction secondary to interosseus muscle atrophy. In particular, the first dorsal interosseus muscle can be examined by asking the patient to abduct the index finger against resistance. Small finger abduction following extension of the digits may also be noted (Wartenberg sign), which patients may notice by the small finger being caught when trying to place the hand inside of a pant pocket. Patients may also be unable to grasp with a key-pinch grip and instead compensate with a fingertip grip (Froment sign) secondary to adductor pollicis, first dorsal interosseus and flexor pollicis brevis atrophy. (Figure 2) Finally, severe clawing of the ring and small fingers (i.e. flexion of the interphalangeal joints with extension of the metacarpophalangeal joints) may be noted secondary to lumbrical and interosseus muscle atrophy.<sup>6</sup>

Physical examination must also include investigation of potential underlying causes for cubital tunnel syndrome. Thus, the elbow should be examined for range of motion, crepitus, ligament stability and deformity. In particular, patients whose chief complaint is medial elbow pain (as opposed to paresthesias, numbness, tingling or hand clumsiness) should

be evaluated for medial epicondylitis and elbow instability.

During the work-up of patients with suspected cubital tunnel syndrome, it is important to consider other potential sites of ulnar nerve compression, C8 radiculopathy, thoracic outlet syndrome, vascular disease, amyotrophic lateral sclerosis and peripheral neuropathy (which can be secondary to chronic alcoholism, diabetes, vitamin B<sub>12</sub> deficiency and hypothyroidism among other causes). Patients with C8 radiculopathy can have co-existent cubital tunnel syndrome—a phenomenon referred to as “double crush”—and therefore one diagnosis does not preclude the other.

Although no disease-specific outcome measures have been validated for cubital tunnel syndrome, numerous severity scales have been reported based on findings from history and physical examination.<sup>7</sup> McGowan first classified cubital tunnel syndrome severity into three categories: mild, moderate and severe. Mild disease is defined as occasional paresthesias, positive Tinel's sign and subjective weakness. Moderate disease is defined as occasional paresthesias, positive Tinel's sign and objective weakness. Severe disease is defined as constant paresthesias and muscle wasting.<sup>8</sup>

#### LABORATORY, RADIOGRAPHIC AND ELECTRODIAGNOSTIC ASSESSMENT

Diagnostic testing may be helpful in patients with suspected cubital tunnel syndrome. Radiographs of the elbow may identify osteophytes, bone fragments or malalignment in patients with arthritis or a history of trauma. **Electromyographic (EMG)** and nerve conduction studies may be helpful in confirming the diagnosis of ulnar neuropathy at the elbow, assisting in precise localization of the compressive lesion (e.g., proximal versus distal to the innervation of the flexor carpi ulnaris), quantifying the degree of the neurologic deficit and/or identifying alternate sites of nerve dysfunction simulating cubital tunnel syndrome such as cervical radiculopathy, brachial plexopathy and/or ulnar nerve compression at the wrist at Guyon's canal. Ulnar nerve compression can be diagnosed if **motor nerve conduction velocity (NCV)** across the elbow is less than 50 m/s. Performing NCV studies with the elbow in moderate flexion (i.e., 70 to 90



Figure 2. First dorsal interosseus muscle atrophy secondary to ulnar nerve neuropathy.

degrees from the horizontal) maximizes test sensitivity by providing the greatest correlation between the skin surface measurement and true nerve length.<sup>1,9</sup> Needle EMG examination should always include the first dorsal interosseus muscle, which is the most frequent muscle to first demonstrate abnormalities following ulnar nerve compression.<sup>9</sup> In addition, electrodiagnostic testing has been shown to have prognostic value in predicting subjective recovery.<sup>10</sup>

MRI may be helpful if a space-occupying lesion is suspected, but otherwise is not routinely used. In addition to also being useful for visualizing space-occupying lesions, ultrasound has recently been proposed as a diagnostic tool for cubital tunnel syndrome via measurement of nerve diameter. A literature review of clinical trials of ultrasonography used to test ulnar neuropathy at the elbow noted that numerous studies had significant methodological flaws, some studies were uncontrolled, and that the study designs differed significantly. The authors concluded that the role of ultrasound in ulnar neuropathy at the elbow could not be firmly established.

#### MANAGEMENT

##### Conservative Management

In the absence of intrinsic muscle atrophy, conservative treatment should be attempted. Non-operative treatment includes patient education and activity modification to avoid elbow flexion and/

or cubital tunnel compression. Depending on the provocative activity, this can be accomplished by wearing an elbow extension splint at night (or, more simply, limiting elbow flexion by wrapping a pillow around the anterior elbow), adjusting posture at work to reduce elbow flexion, using a hands-free headset with cell phone use, or padding the posterior surface of the elbow. In addition, non-steroidal anti-inflammatory drugs or ice can be used to reduce acute pain and inflammation. Following resolution of acute symptoms, physical therapy is initiated to first establish pain-free range of motion of the affected extremity and then increase strength. Dellon, et al. reported symptom improvement in 90% of patients with mild disease and 38% of patients with moderate disease. A history of elbow trauma is a poor prognosticator and risk factor for eventual surgery.<sup>11</sup>

#### Operative Management

When patients fail to respond to conservative measures, have persistent severe symptoms or present with intrinsic muscle atrophy, operative management should be considered. Surgical options include ulnar nerve in situ decompression, anterior transposition of the ulnar nerve (subcutaneous, intramuscular or submuscular), partial medial epicondylectomy and endoscopic ulnar nerve decompression. Studies of in situ decompression report 75% to 90% of patients achieve good or excellent pain relief, while 7% to 15% do not benefit.<sup>12</sup> Despite discussion in the literature regarding in situ decompression's potential advantages (e.g., minimal disruption of the ulnar nerve's vascular supply) and disadvantages (e.g., limited exposure to explore other potential sites of ulnar nerve compression and risk of post-operative ulnar nerve subluxation) versus anterior transposition, two meta-analyses have demonstrated similar outcomes between these techniques.<sup>13, 14</sup> In the 7% to 15% of patients who have recurrent disease following in situ decompression, many can be successfully treated with anterior transposition of the ulnar nerve.<sup>14</sup>

Patients with post-traumatic elbow stiffness or deformity, ulnar nerve subluxation, ulnar collateral ligament laxity and "tardy ulnar nerve palsy" may benefit from initial anterior transposition of the ulnar nerve. Patients with medial epicon-

dylitis may benefit from partial medial epicondylectomy, although this procedure has been associated with increased medial elbow pain post-operatively. Finally, endoscopic ulnar nerve release has been reported to have a similar success rate to open procedures with potentially less post-operative pain. A common surgical complication of all of these techniques is potential injury to the posterior branch of the medial antebrachial cutaneous nerve. Taken together, given the similarity in outcomes reported between the surgical treatments for cubital tunnel syndrome, the choice of procedure is based largely on surgeon experience and sometimes underlying etiology.<sup>1</sup>

---

**When patients fail to respond to conservative measures, have persistent severe symptoms or present with intrinsic muscle atrophy, operative management should be considered.**

---

#### POST-OPERATIVE REHABILITATION

Once the incision and soft tissues have healed, rehabilitation therapies are often used to help the patient regain pain-free range of motion, normal strength and function. The extent and duration of a post-operative rehabilitation program varies with the extent of injury and the physical demands of a return to normal activities such as ADLs, occupational activities or sports. Goals of a postoperative rehabilitation program include (a) full active range of motion for elbow flexion, extension, pronation and supination, (b) normal elbow strain, with balance maintained between agonists and antagonists muscles, and (c) resumption of sports-specific and work specific functional activities. Exercises to establish neuromuscular control include proprioceptive neuromuscular facilitation and progression from closed-kinetic chain

activities through open-kinetic chain exercises. A rehabilitation program may be necessary for six weeks or more post-operatively.<sup>15</sup>

#### CONCLUSIONS

Cubital tunnel syndrome is a common cause of upper extremity pain and disability. The treating clinician should possess a high degree of familiarity with the relevant aspects of anatomy, epidemiology and clinical presentation. The diagnosis of cubital tunnel syndrome frequently requires a combination of clinical suspicion and may require electrodiagnostic confirmation. Once diagnosed, cubital tunnel syndrome is initially treated by conservative measures focused on patient education and avoidance of provocative activities. In the presence of intrinsic hand muscle atrophy or persistent severe symptoms, operative treatment should be considered.

#### REFERENCES

1. Palmer BA, Hughes TB. Cubital tunnel syndrome. *J Hand Surg Am.* Jan 2010;35(1):153-63.
2. Werner CO, Ohlin P, Elmqvist D. Pressures recorded in ulnar neuropathy. *Acta Orthop Scand.* Oct 1985;56(5):404-6.
3. Apfelberg DB, Larson SJ. Dynamic anatomy of the ulnar nerve at the elbow. *Plast Reconstr Surg.* Jan 1973;51(1):79-81.
4. van Rijn RM, Huisstede BM, Koes BW, Burdorf A. Associations between work-related factors and specific disorders at the elbow: a systematic literature review. *Rheumatology (Oxford).* May 2009;48(5):528-36.
5. Novak CB, Lee GW, Mackinnon SE, Lay L. Provocative testing for cubital tunnel syndrome. *J Hand Surg Am.* Sep 1994;19(5):817-20.
6. Folberg CR, Weiss AP, Akelman E. Cubital tunnel syndrome. Part I: Presentation and diagnosis. *Orthop Rev.* Feb 1994;23(2):136-44.
7. Macadam SA, Bezuhly M, Lefaivre KA. Outcomes measures used to assess results after surgery for cubital tunnel syndrome: a systematic review of the literature. *J Hand Surg Am.* Oct 2009;34(8):1482-91 e1485.
8. McGowan AJ. The results of transposition of the ulnar nerve for traumatic ulnar neuritis. *J Bone Joint Surg Br.* Aug 1950;32-B(3):293-301.
9. Practice parameter: electrodiagnostic studies in ulnar neuropathy at the elbow. American Association of Electrodiagnostic Medicine, American Academy of Neurology, and American Academy of Physical Medicine and Rehabilitation. *Neurology.* Mar 10 1999;52(4):688-90.
10. Friedrich JM, Robinson LR. Prognostic indicators from electrodiagnostic studies for ulnar neuropathy at the elbow. *Muscle Nerve.* Apr 2011;43(4):596-600.
11. Dellon AL, Hament W, Gittelshon A. Non-operative management of cubital tunnel syndrome: an 8-year prospective study. *Neurology.* Sep 1993;43(9):1673-7.

12. Abuelem T, Ehni BL. Minimalist cubital tunnel treatment. *Neurosurgery*. Oct 2009;65(4 Suppl):A145-9.
13. Goldfarb CA, Sutter MM, Martens EJ, Manske PR. Incidence of re-operation and subjective outcome following in situ decompression of the ulnar nerve at the cubital tunnel. *J Hand Surg Eur Vol*. Jun 2009;34(3):379-83.
14. Macadam SA, Gandhi R, Bezuhly M, Lefavre KA. Simple decompression versus anterior subcutaneous and submuscular transposition of the ulnar nerve for cubital tunnel syndrome: a meta-analysis. *J Hand Surg Am*. Oct 2008;33(8):1314 e1311-2.
15. Hertling D KR, ed *Management of Common Musculoskeletal Disorders. Physical Therapy Principles and Methods*. 4 ed. Philadelphia: Lippincott Williams & Wilkins; 2006.

*Samir K. Trehan, MD, is a second year orthopaedic surgery resident at Hospital for Special Surgery in New York, NY*

*John R. Parziale, MD, is a Clinical Associate Professor, Department of Orthopaedics, Warren Alpert Medical School of Brown University*

*Edward Akelman, MD, is a Professor, Department of Orthopaedics, Warren Alpert Medical School of Brown University*

## **CORRESPONDENCE**

John R. Parziale, MD  
 University Rehabilitation, Inc.  
 450 Veterans' Memorial Parkway,  
 Building #12  
 East Providence, RI 02914  
 phone: (401) 435-2288  
 fax: (401) 435-2282  
 e-mail: jrp@urehab.necoxmail.com

## **Disclosure of Financial Interests**

The authors and/or their spouses/significant others have no financial interests to disclose.



**Blue Cross & Blue Shield of Rhode Island (BCBSRI)** is looking for a Part Time Medical Director of Quality to provide leadership to the organization regarding integrated health management programs, practices, and partnerships. This person will enhance and maintain relationships with physicians and provide leadership, technical expertise and motivation to reshape the healthcare delivery system to achieve efficiency, quality and affordability of healthcare services. This position requires that you are a Board Certified Doctor of Medicine in a primary care specialty or other specialty as needed by the health plan, with a current, unrestricted license to practice in Rhode Island or eligible for a Rhode Island license along with eight or more years experience in private practice.



**This is a part time opportunity, with the possibility of additional hours in the future.**

At BCBSRI, diversity and inclusion are central to our core values and strengthen our ability to meet the challenges of today's healthcare industry. BCBSRI is an equal opportunity, affirmative action employer. We provide equal opportunities without regard to race, color, religion, gender, age, national origin, disability, veteran status, sexual orientation, gender identity or expression.

## *The ultimate out-patient imaging experience*



### 3T MR Imaging and Entertainment Center

- Larger opening for ultimate patient comfort
- Fastest exams with highest resolution possible
- Entertainment center offers DVD and MP3
- Now available in East Providence and East Greenwich
- ONLY 3T out-patient centers available in Rhode Island



**RHODE ISLAND  
MEDICAL IMAGING®**  
**401.432.2400**  
[www.rimirad.com](http://www.rimirad.com)



# Rhode Island Physicians Don't Miss a Thing

**Earn CME credits where and when it is most convenient for you.**

Online courses provide the educational content you need, from a source you can trust, and without taking time away from your busy practice.

Registering and participating in online CME is easy. Simply visit <http://rimed.inreachce.com>, browse the RIMS' catalog, and choose your courses.

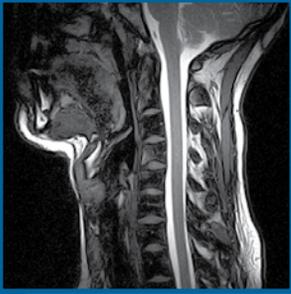


**Online CME from RIMS. Don't Miss a Thing.**



# THE IMAGING INSTITUTE

OPEN MRI • MEDICAL IMAGING



High Field MRI

- Offering both 1.5T High Field & Higher Field OPEN MRI Systems

- Advanced CT with multi-slice technology, 3D reconstruction

- Digital Ultrasound with enhanced 3D/4D technology

- Digital Mammography with CAD (computer assisted diagnosis)



MRA



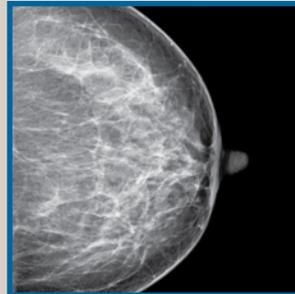
CT • 3D CT



CTA



3D Ultrasound



Digital Mammography



Digital X-Ray & DEXA

- Electronic Medical Record (EMR) Interfaces now available
- Preauthorization Department for obtaining all insurance preauthorizations
- Fellowship, sub-specialty trained radiologists
- Friendly, efficient staff and convenient, beautiful office settings
- Transportation Service for patients



Higher Field OPEN MRI

## WARWICK

250 Toll Gate Rd.  
TEL 401.921.2900

## CRANSTON

1301 Reservoir Ave.  
TEL 401.490.0040

## CRANSTON

1500 Pontiac Ave.  
TEL 401.228.7901

## N. PROVIDENCE

1500 Mineral Spring  
TEL 401.533.9300

## E. PROVIDENCE

450 Vets. Mem. Pkwy. #8  
TEL 401.431.0080

**We're not LIKE A Good Neighbor,  
WE ARE  
The Good Neighbor Alliance**



*Specializing in Employee Benefits since 1982*

Health    Dental    Life    Disability    Long Term Care  
Pension Plans    Section 125 Plans



**The Good Neighbor Alliance Corporation**  
*The Benefits Specialist*

*Affiliated with*

**RHODE ISLAND  
MEDICAL SOCIETY**



**RIMS-INSURANCE  
BROKERAGE  
CORPORATION**

**401-828-7800 or 1-800-462-1910**

P.O. Box 1421 Coventry, RI 02816

[www.goodneighborall.com](http://www.goodneighborall.com)

FINANCIAL SERVICES *for healthcare providers*

# *Pain-free* **BANKING.**

Whether it's a customized cash management solution or 100% financing for EHR and healthcare IT, our healthcare business bankers specialize in providing the right banking solutions your practice needs to manage your cash flow.

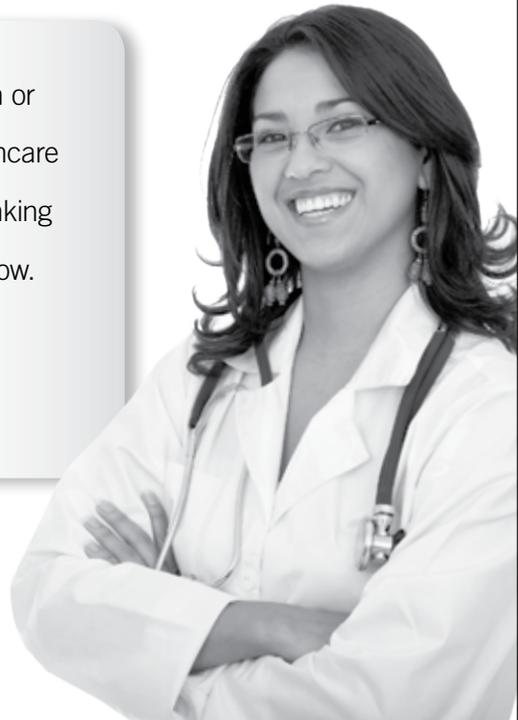
We call it delivering pain-free banking.

And it's part of Webster's *Type*  *Personality.*

To learn more, contact:

Dev Singh, Healthcare Financial Services

401-688-3314 or [asingh@websterbank.com](mailto:asingh@websterbank.com).



 **WebsterBank<sup>®</sup>**  
WebsterBank.com



Webster Bank, N.A.  
Member FDIC

The Webster Symbol and Webster Bank are registered in the U.S. Patent and Trademark Office.

# Eligibility For Financial Incentives and Electronic Medical Record Use Among Physicians

Chang Liu, MA, Rosa Baier, MPH, Rebekah Gardner, MD, and Amal Trivedi, MD, MPH

**ALTHOUGH ELECTRONIC MEDICAL RECORDS (EMRs)** may improve quality of care<sup>1-5</sup> and reduce healthcare spending,<sup>6</sup> uptake remains low in the United States.<sup>7,8</sup> A 2009 national survey of hospitals found that only 2.9% of hospitals had a comprehensive, electronic system and an additional 7.9%, a basic system.<sup>9</sup> The same year, a physician-level study found that 43.9% of physicians were using basic EMRs, though only a subset, 6.3% of physicians, had a fully-functional system.<sup>10</sup> Interestingly, physicians cite costs as both the most important barrier and financial incentives as the most important facilitator of EMR adoption.<sup>9, 11, 12</sup>

Although some published research casts doubt on the impact of financial incentives on healthcare quality improvement initiatives,<sup>13</sup> studies have shown that financial incentives are key to EMR adoption.<sup>9, 11</sup> For physicians, incentives address a fundamental imbalance, where physicians assume the costs of EMR implementation and maintenance, yet nearly all the financial benefits accrue to payers and purchasers.<sup>12</sup> This misalignment has prompted calls for greater financial support from payers and regulators. However, to our knowledge, no peer-reviewed study has assessed the effectiveness of financial

incentives on EMR adoption and use.

Recognizing the significant role of financial incentives in accelerating EMR adoption, the **Federal American Recovery and Reinvestment Act (ARRA)** of 2009 provides \$20 billion in Medicare and Medicaid incentive payments to physicians and hospitals whose use of certified EMRs meets a minimum set of requirements (“meaningful use”). State government and commercial health plans are also engaged in local efforts to provide incentives (financial and non-financial) for physicians to purchase and use EMRs.

As the first and only state to systematically assess and publicly report EMR adoption for every licensed physician providing direct patient care, Rhode Island provides an opportunity to assess the relationship between eligibility for financial incentives and EMR adoption. **Blue Cross & Blue Shield of Rhode Island (BCBSRI)** and **UnitedHealthcare of New England (UHC)**, the state’s two largest commercial health plans representing 96% of the non-elderly, commercial market<sup>14</sup>, began offering EMR-based payments to office-based **primary care physicians (PCPs)** in 2008 and 2009, respectively. BCBSRI increased primary

reimbursements for all evaluation and management services by 5% to 13% and UHC offered fixed-sum payments for office-based PCPs with EMRs meeting pre-specified standards. We hypothesize that these efforts may be associated with greater EMR adoption than the rates reported in national studies, particularly among those office-based PCPs eligible for the health plans’ payments. We therefore evaluated the association between physician specialty, practice site, and EMR adoption. Using the state’s comprehensive survey, we assessed EMR implementation and functionality use among Rhode Island physicians after the initiation of health plan incentive payments.

## METHODS

### Sample

The Rhode Island Department of Health administered the **Physician Health Information Technology (HIT) Survey** electronically over the course of three weeks in January and February 2009 using a Web-based survey tool.<sup>15</sup> This was the Department’s second annual administration of the survey, and the first year when the physician-level results were publicly reported. The Department used its licensure database to

**Table 1:** Basic and Advanced EMR Functionalities

EMR Type	Functionality	Minimum Inclusion
Basic EMR	Clinical documentation	<ul style="list-style-type: none"> <li>• Electronic visit notes</li> <li>• Electronic lists of each patient’s medications</li> <li>• Electronic problem lists</li> <li>• Patient clinical summaries for referral purposes</li> </ul>
	Results management	<ul style="list-style-type: none"> <li>• Lab test results via electronic interface AND/OR scanned paper</li> <li>• Radiology test results via electronic interface AND/OR scanned paper</li> </ul>
Advanced EMR	Decision support	<ul style="list-style-type: none"> <li>• Drug interaction warnings</li> <li>• Letters or other reminders directed at patients regarding indicated or overdue care</li> <li>• Prompts to providers at the point of care</li> </ul>
	External communication	<ul style="list-style-type: none"> <li>• Electronic referrals</li> <li>• Secure emailing with providers outside the physician’s office</li> </ul>
	Order management	<ul style="list-style-type: none"> <li>• Laboratory order entry</li> <li>• Radiology order entry</li> </ul>
	Reporting	<ul style="list-style-type: none"> <li>• Clinical quality measures</li> <li>• Patients out of compliance with clinical guidelines</li> <li>• Patients with a condition, characteristic or risk factor</li> </ul>

EMR = electronic medical record

send letters and emails (when available) to all 3,883 licensed physicians providing direct patient care, and then excluded respondents who reported that they were not providing direct patient care in Rhode Island or an adjacent state (Connecticut or Massachusetts). In this analysis, we also excluded two subjects who did not report their practice site information. After exclusions, the survey response rate was 58.3% (N=1,891). We linked survey responses with the licensure database to create an analytic dataset.

## Measures

### Dependent (Outcome) Variables

For our dependent variables, we used the five measures publicly reported by the Rhode Island Department of Health. These include both structure measures (EMR implementation) and process measures (EMR and e-prescribing functionality use). Measure definitions are described elsewhere,<sup>16</sup> and briefly summarized below and in Table 1:

- **EMR Adoption:** Physicians who have EMR components at any practice site (Y/N). The survey defined EMR components as an integrated electronic clinical information system which can

track patient health data and may include other functions.

- **“Qualified” EMR Adoption:** Physicians who have a “qualified” EMR at any practice site (Y/N). The Rhode Island stakeholder definition for “qualified” EMRs includes Certification Commission on Health Information Technology (CCHIT) certification and the presence of one or more of the following five functionalities: clinical documentation, reporting, results management, clinical decision support, and e-prescribing.
- **Basic EMR Functionality Use:** Among physicians with EMRs, composite scores reflecting physicians’ use of basic EMR functionalities (0-100 points). Scores are calculated by giving equal weight to physicians’ use of six clinical documentation and results management functionalities (Table 1), with points assigned proportional to frequency of use: Don’t have; 0%; <30%; 30%-60%; >60%. Possible scores range from 0 to 100 points, with 100 points representing maximum use.
- **Advanced EMR Functionality Use:** Among physicians with EMRs, com-

posite scores reflecting physicians’ use of advanced EMR functionalities (0-100 points). Scores are calculated by giving equal weight to physicians’ use of 10 decision support, external communication, order management, and reporting functionalities (Table 1), with points assigned proportional to frequency of use: Don’t have; 0%; <30%; 30%-60%; >60%. Possible scores range from 0 to 100 points, with 100 points representing maximum use.

- **E-prescribing:** Physicians who transmit some or all prescriptions or medication orders electronically to the pharmacy (Y/N).
- **Independent (Predictor) Variables Specialty:** Physicians’ specialty was self-reported by over 99% of respondents (n=1884). For 7 subjects who did not submit this information in the survey, we obtained their specialty information from the licensure database. We categorized specialty into two groups: generalists and specialists. Generalists are physicians with a specialty of Internal Medicine (without sub-specialty), Geriatrics, Hospitalist Medicine, Family Medicine, or Pedi-

**Table 2: Physician Characteristics, by Practice Site and Specialty\*\***

Characteristics	Practice Site				Entire Sample (N=1,891)
	Office-Based		Hospital-Based		
	Generalists (N=516)	Specialists (N=670)	Generalists (N=155)	Specialists (N=550)	
Age, mean (SD)	49.7 (10.3)	52.7 (10.9)	45.3 (10.1)	47.7 (10.5)	49.8 (10.8)
MD License, n (%)	462 (89.5)	648 (96.7)	149 (96.1)	529 (96.2)	1,788 (94.6)
License State, n (%):					
RI Only	461 (89.3)	566 (84.5)	129 (83.2)	432 (78.6)	1,588 (84.0)
RI and MA	47 (9.1)	88 (13.1)	18 (11.6)	106 (19.3)	259 (13.7)
RI and CT	8 (1.6)	16 (2.4)	8 (5.2)	12 (2.2)	44 (2.3)
Mainly Practice in RI, n (%)	475 (92.1)	590 (88.1)	132 (85.2)	474 (86.2)	1,671 (88.4)
Practice Size, n (%):					
<5 Clinicians	286 (55.8)	343 (51.8)	19 (12.8)	79 (14.5)	727 (38.9)
5-10 Clinicians	134 (26.1)	153 (23.1)	38 (25.5)	144 (26.4)	469 (25.1)
>10 Clinicians	93 (18.1)	166 (25.1)	92 (61.7)	323 (59.2)	674 (36.0)
Care Hours, n (%):					
<10 Hours	19 (3.7)	21 (3.2)	25 (16.5)	37 (6.8)	102 (5.5)
10-20 Hours	54 (10.5)	69 (10.6)	28 (18.4)	80 (14.7)	231 (12.4)
>20 Hours	440 (85.8)	563 (86.2)	99 (65.1)	427 (78.5)	1,529 (82.1)

RI, CT, and MA refer to Rhode Island, Connecticut, and Massachusetts, respectively.

\*\*Specialty variable comes from the survey data, where generalists were defined as: Internal Medicine (without subspecialty), Geriatrics, Hospitalist Medicine, Family Medicine, and Pediatrics. For missing data (n=7), we used the “Primary Care” variable from the licensure file to define generalists.

†Overall p-values are results of the Chi-square test (for categorical variables) and T test (for continuous variables). Here p values are <0.01 when comparing all the characteristics shown in the table among the four practice sites and specialty subgroups.

**Table 3:** Physician HIT Adoption by Practice Site and Specialty,\* Unadjusted

HIT Adoption Measures	Stratified Analysis									Overall (N=1,891)
	Practice Site			Office-Based			Hospital-Based			
	Office (N=1,186)	Hospital (N=705)	p-value	Generalists (N=516)	Specialists (N=670)	p-value	Generalists (N=155)	Specialists (N=550)	p-value	
EMR Adoption, %	58.4	83.3	<0.001	66.3	52.2	<0.001	79.4	84.4	0.14	67.6
“Qualified” EMR Adoption, %	16.4	5.8	<0.001	31.2	5.1	<0.001	9.7	4.7	0.02	12.5
Basic EMR Use, mean	66.5	60.2	<0.001	77.9	55.3	<0.001	64.0	59.2	0.08	63.6
Advanced EMR Use, mean	37.8	51.4	<0.001	49.8	26.1	<0.001	51.2	51.4	0.97	44.0
e-Prescribing, %	42.6	38.7	0.10	56.2	32.1	<0.001	52.3	34.9	<0.001	41.1

EMR = electronic medical record; HIT = health information technology

\*Specialty variable comes from the survey data, where generalists were defined as: Internal Medicine (without subspecialty), Geriatrics, Hospitalist Medicine, Family Medicine, and Pediatrics. For missing data (n=7), we used the “Primary Care” variable from the licensure file to define generalists.

†Overall p-values are results of the Chi-square Test (for categorical variables) and T test (for continuous variables).

atrics; specialists are those with any other specialties.

- *Practice Site:* Physicians’ practice site was self-reported as hospital- or office-based and reflects the location where they spend the majority of time providing direct patient care. Physicians who do not have EMR components at their main practice site may opt to answer the survey based on a secondary practice site with EMR components, if applicable.
- *Individual and Organizational Characteristics:* From the analytic dataset, we chose the following characteristics: age, license type (DO or MD), licensure state, practice size (<5, 5-10, or >10 clinicians), and direct patient care hours per week (<10, 10-20, or >20 hours).

#### Analytic Plan

We conducted bivariate analyses to assess physician characteristics and HIT adoption by practice site and specialty,

using Chi-square tests and t-tests as appropriate. Since our hypothesis focused on office-based generalists, who were eligible for the health plan incentive payments, we examined four groups of physicians: hospital-based generalists, hospital-based specialists, office-based generalists, and office-based specialists.

To examine the adjusted association between by practice site subgroup (specialty) and HIT adoption, we constructed regression models controlling for the following individual and organizational characteristics: age, license type, license state, practice state, practice size, and care hours. We fit logistic regression models for the binary HIT measures (EMR Adoption, Qualified EMR Adoption, and e-Prescribing Adoption) and linear regression models for the continuous HIT measures (Basic EMR Functionality Use and Advanced EMR Functionality Use).

We conducted all statistical analyses using STATA version 10 (StataCorp, College Station, TX).

## RESULTS

### Individual and Organizational Characteristics

Table 2 presents individual and organizational characteristics for the 1,891 survey respondents (response rate of 58.3%). Most respondents reported spending more than 20 hours a week in direct patient care, and almost two-thirds indicated that they are office-based. More than a third of the sample were generalists. Practice size was relatively evenly distributed.

All individual and organizational characteristics differed across the four practice site and specialty subgroups. For example, when compared to hospital-based respondents, office-based respondents were, overall, slightly older, more likely to work in practices with less than ten clinicians, and more likely to provide more than 20 hours of direct patient care each week. Among office-based physicians, generalists were slightly younger and working in smaller practices. Among

**Table 4:** Physician HIT Adoption by Practice Site and Specialty,\* Adjusted for Covariates

HIT Adoption Measures	Stratified Analysis			
	Office-Based		Hospital-Based	
	Generalists (N=516)	Specialists (N=670)	Generalists (N=155)	Specialists (N=550)
EMR Adoption, OR (95% CI)	1.97 (1.32-2.23)	1.00 (Ref)	0.65 (0.40-1.06)	1.00 (Ref)
“Qualified” EMR Adoption, OR (95% CI)	10.32 (6.78-15.74)	1.00 (Ref)	1.73 (0.84-3.56)	1.00 (Ref)
Basic EMR Use, coefficient (95% CI)	24.48 (19.42-29.54)	1.00 (Ref)	3.96 (-1.62-9.54)	1.00 (Ref)
Advanced EMR Use, coefficient (95% CI)	26.70 (22.24-31.15)	1.00 (Ref)	-1.47 (-11.00-8.05)	1.00 (Ref)
e-Prescribing, OR (95% CI)	2.93 (2.27-3.80)	1.00 (Ref)	2.01 (1.37-2.95)	1.00 (Ref)

EMR = electronic medical record; HIT = health information technology; OR: odds ratio

\*Specialty variable comes from the survey data, where generalists were defined as: Internal Medicine (without subspecialty), Geriatrics, Hospitalist Medicine, Family Medicine, and Pediatrics. For missing data (n=7), we used the “Primary Care” variable from the licensure file to define generalists.

†We stratified the samples into two groups based on practice setting. For EMR Adoption, “Qualified” EMR Adoption and e-prescribing, the odds ratio results from logistic regression analyses; for Basic EMR Use and Advanced EMR Use, the coefficient results from linear regression analyses. In both models, we controlled for age, license type, license state, practice state, practice size and care hours.

hospital-based physicians, generalists were more likely to be practicing less than 20 hours per week.

### Association between Practice Site and EMR Adoption

Overall, two-thirds of respondents ( $n=1,279$ , 67.6%) reported having EMR components, while a significantly smaller proportion (12.5%) had qualified EMRs (Table 3). EMR adoption was higher among hospital- versus office-based respondents (hospital: 83.3%, office: 58.4%;  $p<0.001$ ), although this trend was reversed for qualified EMRs, with office-based respondents reporting greater adoption of EMRs that meet the minimum criteria (hospital: 5.8%; office: 16.4%;  $p<0.001$ ).

Among the 1,279 respondents with any EMR (qualified or not), mean scores for basic and advanced EMR functionality use was 63.6 and 44.0 points, respectively. Hospital-based physicians had lower basic EMR functionality scores (hospital: 60.2; office: 66.5;  $p<0.001$ ) and higher advanced EMR functionality scores (hospital: 51.4; office: 37.8;  $p<0.001$ ).

Among all respondents, approximately forty percent ( $n=778$ , 41.1%) reported use of e-prescribing. Unlike the EMR measures, e-prescribing did not differ by practice site.

### Association between Specialty and EMR Adoption

Office-based generalists reported greater HIT adoption than office-based specialists for all five measures of EMR adoption (Table 3): office-based generalists were more likely to have EMRs, have qualified EMRs, and e-prescribe. Office-based generalists also had higher scores for both basic EMR functionality use and advanced EMR functionality use. Among hospital-based physicians, there was not a consistent difference between generalists and specialists. Only two measures differed significantly by specialty: hospital-based generalists were more likely to have qualified EMRs and e-prescribe.

Table 4 presents the stratified analyses for the association between physician specialty and HIT adoption, controlling for those individual and organization characteristics. In the office-based respondent stratum, generalists were more likely than specialists to have HIT and to use it,

as demonstrated by statistical significance across all five measures. This difference was especially pronounced for qualified EMRs (OR: 10.35; 95% CI: 6.78-15.74) and use of basic and advanced EMR functionality. As with the unadjusted analyses, there was no consistent difference in HIT use between generalists and specialists in the hospital. Hospital-based generalists were more likely than hospital-based specialists to use e-prescribing, but the associations between specialty type and EMR adoption were not significant for the remaining four measures.

---

**Regardless of the nature of this relationship, the association between EMR adoption and specialty type among office-based physicians is pronounced...**

---

### DISCUSSION

In this analysis of statewide survey results from nearly 60% of Rhode Island physicians, we found that office-based generalists—who were eligible for the state's commercial health plan HIT payments—had significantly higher levels of EMR adoption and basic and advanced EMR functionality use when compared to office-based specialists. After controlling for covariates, this trend holds and was further magnified, with office-based generalists more likely than office-based specialists to have and use EMRs and e-prescribing for all five measures publicly reported by the Rhode Island Department of Health. In contrast, we did not observe a difference in EMR adoption between hospital-based generalists and specialists. These results support our hypothesis that EMR adoption and use is greater among the Rhode Island physicians eligible for HIT-based financial incentives.

Although these results demonstrate an association between eligibility for incentive payments and EMRs, the data

do not allow us to establish a causal relationship. EMR adoption and use may be higher among office-based generalists versus specialists for reasons that are unrelated to incentive payments. For example, there are significant differences in clinical practice between both generalists and specialists and also hospital- and office-based physicians. EMRs have historically been developed for generalists' use and may be (or be perceived as) less applicable to specialty practice, regardless of practice setting. Additionally, hospital-based physicians' EMR use may be a function of hospital policy, rather than physician choice. In contrast, office-based physicians likely have greater influence over their practices' decisions to implement EMRs—particularly in Rhode Island, where the majority of office-based physicians are located in practices with fewer than five clinicians.

Regardless of the nature of this relationship, the association between EMR adoption and specialty type among office-based physicians is pronounced: even after limiting the population to those 692 office-based respondents who have EMRs, use of both basic and advanced functionalities is significantly higher among office-based generalists than office-based specialists. We did not find a relationship between specialty type and EMR adoption among hospital-based generalists and specialists, which suggests that the findings for office-based physicians cannot be explained purely by differences in clinical practice between generalists and specialists. Although we do not have data identifying the specific physicians receiving the health plan incentive payments, the strong trend in our results suggest that a large proportion of office-based generalists were receiving financial incentives for EMR implementation. This is supported by the especially high use of qualified EMRs, specifically, among office-based generalists; qualified EMRs are a prerequisite for at least one of the commercial health plans' incentive payments. The fifth HIT measure, e-prescribing adoption, is not currently part of incentive payments by commercial health plans in Rhode Island. Both hospital- and office-based generalists are two to three times likely to report e-prescribing than their specialist counterparts. This finding may be explained by the higher proportion of

specialists who do not routinely prescribe medications (e.g., radiologists) or may be more likely to consult on patient care, deferring prescriptions to patients' primary care physicians.

Our findings have several limitations. First, the survey data are self-reported. Additionally, the Department of Health's survey request informs physicians that failure to respond to the survey will be publicly reported as non-use of HIT. Although these limitations may inflate our estimate of HIT adoption in the state, at least one local health plan requires office-based generalists applying for the incentive payments to sign legal attestations that their responses are accurate. This may mitigate any bias. Second, physicians using HIT may be more likely to have computers and therefore be able to respond to an electronic survey, attenuating apparent practice site or specialty differences. Finally, as mentioned previously, our study is cross-sectional, and therefore cause and effect cannot be inferred.

## CONCLUSIONS

Our results suggest that office-based generalists' eligibility for Rhode Island health plan financial incentives may increase their adoption and use of EMRs, and that Federal incentive payments that began in 2011 may play a crucial role in accelerating EMR adoption nationwide. This may further magnify differential EMR adoption by practice site and specialty. However, for policy to adequately reflect the role of practice site and specialty as factors in EMR adoption and use, further research is needed to: (1) definitively link eligibility and receipt of financial incentives to subsequent EMR adoption, and (2) assess inherent differences between inpatient and outpatient clinical practice that will likely affect the value proposition and messaging necessary to further accelerate EMR adoption for all physicians.

## Acknowledgements:

All authors contributed to the study concept and design, and participated in analysis and interpretation of data. CL drafted the manuscript. RB, RG, and AT contributed to critical revision of subsequent drafts of the paper and agreed on the final version.

The annual Physician HIT Survey is funded by the State of Rhode Island's

Healthcare Quality Reporting Program, a legislatively-mandated quality reporting program. The survey is jointly administered by the Rhode Island Department of Health and its public reporting contractor, Healthcentric Advisors. An early draft of these results was presented at the AcademyHealth Annual Research Meeting in Boston, MA in June 2010.

## REFERENCES:

1. Hartzband P, Groopman J. Off the record--avoiding the pitfalls of going electronic. *N Engl J Med.* 2008;358:1656-8.
2. Blumenthal D, Glaser JP. Information technology comes to medicine. *N Engl J Med.* 2007;356:2527-34.
3. Chaudhry B, Wang J, Wu S, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med.* 2006;144:742-52.
4. Parente ST, McCullough JS. Health information technology and patient safety: evidence from panel data. *Health Aff (Millwood).* 2009;28:357-60.
5. Sequist TD, Cullen T, Hays H, et al. Implementation and use of an electronic health record within the Indian Health Service. *J Am Med Inform Assoc.* 2007;14:191-7.
6. Hillestad R, Bigelow J, Bower A, et al. Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Aff (Millwood).* 2005;24:1103-17.
7. Ferlie EB, Shortell SM. Improving the quality of health care in the United Kingdom and the United States: a framework for change. *Milbank Q.* 2001;79:281-315.
8. Jha AK, Ferris TG, Donelan K, et al. How common are electronic health records in the United States? A summary of the evidence. *Health Aff (Millwood).* 2006;25:w496-507.
9. Jha AK, DesRoches CM, Campbell EG, et al. Use of electronic health records in U.S. hospitals. *N Engl J Med.* 2009;360:1628-38.
10. National Ambulatory Medical Care Survey (NAMCS). In. December 2009 ed: Centers for Disease Control and Prevention; 2009.
11. Simon SR, Kaushal R, Cleary PD, et al. Correlates of electronic health record adoption in office practices: a statewide survey. *J Am Med Inform Assoc.* 2007;14:110-7.
12. Walker J, Pan E, Johnston D, et al. The value of health care information exchange and interoperability. *Health Aff (Millwood).* 2005;Suppl Web Exclusives:W5-10-W5-8.
13. Fisher ES. Paying for performance--risks and recommendations. *N Engl J Med.* 2006;355:1845-7.
14. RI Rate Review Project Narrative: The Office of the Health Insurance Commissioner (OHIC) of the State of Rhode Island; 2010.
15. Baier R, Gardner R, Buechner J, et al. Creating a survey to assess physicians's adoption of health information technology. *Medical Care Research and Review.* 2011;In press.
16. Annual Report to the General Assembly R.I.G.L.23-17.17-5, Fiscal Year 2008. Rhode Island Health Care Quality Performance (HCQP) Program; 2009.

*Chang Liu, MA, is a Doctoral Student of Health Services Research, Department of Health Services, Policy and Practice at the Warren Alpert Medical School of Brown University.*

*Rosa Baier, MPH, is a Teaching Associate at the Warren Alpert Medical School of Brown University, and a Senior Scientist at Healthcentric Advisors.*

*Rebekah Gardner, MD, is an Assistant Professor of Medicine at the Warren Alpert Medical School of Brown University, and a Senior Medical Scientist at Healthcentric Advisors.*

*Amal Trivedi, MD, MPH, is an Assistant Professor of Health Services, Policy and Practice at the Warren Alpert Medical School of Brown University, and an Investigator at the Research Enhancement Award Program, Providence VA Medical Center.*

## Disclosure of Financial Interests

The authors and/or their spouses/significant others have no financial interests to disclose.

## CORRESPONDENCE

Chang Liu, MA  
Warren Alpert Medical School of Brown University  
121 South Main St, Box-G  
Providence, RI 02912  
phone: (401) 523-7299  
fax: (401) 863-3489  
e-mail: Chang\_liu@brown.edu

# Staying Healthy During Hard Times: The Impact of Economic Distress On Accessing Care and Chronic Disease Management

Thomas P. O'Toole, MD, Lauren Buckel, MPH, Stephen Redihan, BS, Stacey DeOrsey, MSW, and Daniel Sullivan, MSW

**THE RECENT ECONOMIC DOWNTURN AND** limited “jobless recovery” has placed an increasing number of individuals at financial risk. In Rhode Island the unemployment rate has consistently ranked among the highest in the country, exceeding 12% throughout much of the recession. The loss of jobs coupled with the out-migration of younger workers to more areas with more robust economies has concentrated need among those remaining while at the same time reducing the tax base and resources available to assist them.<sup>1,2,3,4,5</sup> What is less well known is how medical costs are considered during economic downturns and in the context of other competing basic needs, particularly when those costs are “fixed” and health care or medications are considered less urgently. Medical debts are the second most common cause of personal bankruptcy<sup>6</sup> and cost has a direct effect on where and when an individual seeks care.<sup>7</sup>

In this paper we report on data from the “Making Ends Meet” initiative at the Providence Veterans Administration Medical Center which was launched in November, 2008. Patients at the VA who self-identified in response to posted fliers within the hospital as being affected by current economic conditions were asked to complete a survey and meet with a social worker. They initially had a telephone screening and received an information packet of available VA and community resources. All respondents were then offered assistance navigating the care system, pursuing food, housing and utility assistance programs, and stress-management counseling through scheduled group and individual sessions with the social work staff. Our findings help define the role hospitals play as part of the safety net during recessionary periods.

## METHODS

We conducted an observational cohort study of individuals completing the “Making Ends Meet” financial hardship

survey and program at the Providence VA Medical Center (PVAMC). Survey results were correlated with health services data from the electronic medical record system and most recently recorded blood pressure, diabetes and lipid levels. A subset of patients with diabetes mellitus was identified and their data reviewed from one year prior to their enrollment in the program to assess any impact on chronic disease management. Institutional Review Board approval was received for this project.

## Study population

Study subjects were active patients who completed an economic distress survey made available to anyone accessing the PVAMC for care. The initial 348 veterans completing this survey are included in this analysis.

## Data Collection and Analyses

Survey data for each respondent was correlated with baseline demographics, income (above or below preset VA income waiver thresholds) medical, mental health and substance use co-morbidities identified from the medical record, six month health services use (primary care, mental health emergency department use), appointment cancellations, and chronic disease management (most recent blood pressure, hemoglobin A1C readings (for diabetics only), and low density lipoprotein).

A chart review of those patients with a diagnosis of diabetes was conducted to determine any changes in chronic disease management from one year prior to the time they completed the survey. Patients with LDL, blood pressure or HBA1C recordings that worsened during this

**Table 1. Self-reported effect of the economic recession**

	Overall Sample (N=348)	Problems with VA medical bills (N=171)	Increased stress (N=255)	Negative effect on health care (N=180)
Age				
<40	9.2% (32)	40.6% (13)	84.4% (27)	56.3% (18)
41-64	67.5% (235)	47.2% (111)	79.1% (186)	55.3% (130)
>65	23.3% (81)	58.0% (47)*	51.9% (42)*	39.5% (32)*
Income < waiver level (prescription meds copay)	41.7% (145)	29.4% (50)*	42.2% (108)	42.6% (77)
Income < waiver level (appt. co-pays)	63.8% (222)	61.0% (104)	62.3% (159)	60.6% (109)
Medical cond. (any)				
HTN	90.8% (316)	93.6% (160)	90.4% (230)	92.6% (167)
COPD	48.0%	50.8%	48.2%	49.5%
DM	8.3%	7.5%	6.8%	8.5%
	22.1%	24.1%	22.5%	22.3%
Mental health cond. (any)	62.3% (217)	62.0% (106)	68.3% (174)	73.4% (132)*
Depression	37.6%	39.6%	39.8%	44.2%
Anxiety	17.0%	18.7%	18.9%	20.2%
Substance abuse	34.8% (121)	33.2% (58)	37.8%(96)	39.4% (71)
Primary care appt (last 6 months)	88.8% (309)	90.4% (155)	89.2% (227)	89.9% (162)
Primary care appointment cancellation	13.5% (47)	12.8% (22)	12.9% (33)	13.8% (25)
Specialty care appt (last 6 months)	81.9% (285)	82.9% (142)	82.3% (209)	84.0% (151)
Specialty care appt cancellation	13.5% (47)	11.8% (20)	14.5% (37)	16.5% (30)
Mental health appt (last 6 months)	64.9% (226)	65.8% (113)	72.7%* (185)	76.6%* (138)
Mental health appt cancellation	24.1% (84)	20.9% (36)	27.3% (70)	29.3% (53)
Emergency Dept visit (last 6 months)	39.9% (139)	36.9% (63)	38.6% (98)	43.6% (78)

\* statistically significant p<0.05

**Table 2. Patients Canceling Scheduled Appointments or No Shows**

Demographic	No Cancellations (N=210)	One or more Cancellations (n=138)	P value
Age			
<41 (32)	40.6% (13)	59.4% (19)	0.03
41-64 (235)	59.1% (139)	40.9% (96)	<0.001
>64 (81)	71.6% (58)	28.5% (23)	<0.001
Gender (male)	94.8%	91.3%	0.20
Race (nonwhite)	8.6%	10.1%	0.64
Income < waiver (prescription meds)	37.1%	48.6%	0.03
Income < waiver (visit copays)	62.4%	65.6%	0.54
Chronic Medical Condition (any)	90.0%	92.0%	0.53
HTN	50.1%	43.5%	0.23
COPD	8.1%	8.7%	0.84
DM	26.2%	16.0%	0.03
Mental Health Condition (any)	51.4%	79.0%	<0.001
Depression	31.0%	47.8%	<0.01
Anxiety	11.4%	25.4%	<0.01
Substance abuse	26.7%	47.1%	<0.001
Emergency Dept. visit	34.8%	47.8%	0.02
Chronic disease management			
BP>140/90	21.0%	19.6%	0.75
LDL >100;130	28.6%	35.5%	0.17
HBA1C>9	2.4%	5.1%	0.18
Self-reported distress			
VA bills			
Feeling stressed	57.1%	48.6%	0.12
Impact on health	70.0%	73.9%	0.43
	49.1%	61.6%	0.02

time interval, those who were consistently above target, and those above target on enrollment in VA, were compared with the overall sample. All analyses employed a two sided p value of 0.05 for significance.

**RESULTS**

**Demographics**

Overall 348 individuals who completed the survey between November, 2008 and May 2009 were included in the study. The mean age was 57.2 years (95% CI: (55.8-58.6)), 93.6% were male, and 83.2% were white; 10.6% were homeless. Almost two thirds (63.8%) had a documented income below the threshold for visit co-pay waivers (\$11,800 per year/individual; \$25,000 per year/couple). The majority had at least one chronic medical condition (90.8%) with hypertension (48.0%), diabetes (22.1%), and coronary heart disease (19.3%) the most common. Similarly, 62.3% had at least one mental health condition with depression (37.6%) and anxiety (17.0%) the most common. The average number of medications taken by this group was 11 (range 0-22). During the six month study period 98.0% had at least one appointment scheduled (primary care: 88.8%; Specialty care: 81.9%; mental health: 64.9%), 39.9% went to the emergency department at least once, and 39.6% had at least one patient-initiated

clinic cancellation or “no-show” (primary care: 13.5%; specialty: 13.5%; mental health: 24.1%) (Table 1).

**Self-reported effect of the economic recession**

Overall, 68.1% reported having difficulty paying their utilities, 62.5% difficulty affording food, and 49.1% difficulty with VA-generated medical bills. Similarly, 73.3% reported their current economic condition was causing them “to feel increasingly overwhelmed or stressed” and 51.7% reported it resulted in physical health problems. Those individuals 65 and older reported more difficulty paying medical bills but less stress, and were less likely to report a negative impact from the economy on their health. Having a chronic medical condition was not associated with difficulties from VA medical bills, increased stress or a negative impact on health. However, having a chronic mental health condition was associated with a negative impact on their health (Table 1).

**Health Services Use and Clinic Cancellations**

Overall, 39.7% had a patient-cancelled clinic appointment or “no-show” with most of this occurring among individuals 40 years and younger. Clinic cancellations were associated with having

an income less than the waiver threshold for prescription medications but not for clinic visit co-pays. While cancellations did not vary based on chronic medical condition, significantly more respondents with a mental health condition (depression, anxiety and substance abuse), cancelled their clinic appointments. Those individuals with one or more cancellations were more likely to have gone to the emergency department and to have reported a negative impact from the economy on their health. (Table 2)

**Chronic Disease Management outcomes**

The proportion of respondents with blood pressures above target (>140/90) was 21.0%—significantly higher than for the general medicine population at the Providence VA (13%; p=0.01). Diabetes control was also worse in the survey population compared with the general population (HBA1C>9: 15.5% vs. 4.5%; p<0.001). While 63.8% of all respondents had income levels less than the visit co-pay waiver threshold, only 32.4% of individuals with blood pressures >140/90 and 35.8% of individuals with LDLs above target had incomes below this threshold (p<0.001). There was no association between having co-occurring mental health or substance abuse conditions and either elevated blood pressure or lipids, although those persons with elevated blood pressures were more likely to have had a mental health appointment and to have gone to the emergency department during the study period. (Table 3).

**Impact of Social Work Intervention**

Overall, 82 individuals opted to take part in the group and individual social work sessions. There was no difference in age, gender, race, income or co-morbidities among respondents in this cohort and the overall sample. Similar proportions identified having trouble paying for VA-generated bills, feeling overwhelmed due to their bills, and having physical health problems resulting from their personal economics. There was no difference in clinic cancellation rates or chronic disease management outcomes among the social work group in the three months pre-/post-intervention or when compared with those persons not participating in the social work intervention.

**Table 3. Chronic Disease Management Outcomes**

	Overall Sample (N=348)	BP>140/90 (n=71)	LDL > target (n=109)
Income < waiver level (prescription meds)	41.7%	45.1%	45.0%
Income < waiver level (appt. co-pays)	63.8%	32.4%*	35.8%*
Any mental health condition	62.3%	69.0%	70.7%
Substance abuse	34.8%	42.3%	35.8%
Primary care appt (last 6 months)	88.8%	90.1%	89.0%
Primary care appointment cancellation	13.5%	11.3%	12.8%
Specialty care appt (last 6 months)	81.9%	81.7%	82.6%
Specialty care appt cancellation	13.5%	11.3%	13.8%
Mental health appt (last 6 months)	64.9%	100%*	68.8%
Mental health appt cancellation	24.1%	28.2%	27.5%
Emergency Dept visit (last 6 months)	39.9%	56.3%*	38.5%
Having trouble paying for VA bills	53.7%	46.5%	51.4%
Feeling overwhelmed/ stressed due to bills	71.6%	74.7%	66.1%
Economic conditions resulted in problems w/ physical health	54.0%	60.6%	52.30%

\* statistically significant p<0.05

**Diabetes Management Prior to and during the recession**

Overall, 71 patients were identified with diabetes: 27 (38.0%) were either above target for their HBA1C, LDL or blood pressure during the study period or moved out-of-target during that time interval; five (7.0%) patients new to the system at the time of the survey had poorly controlled diabetes on presentation. Those individuals with worsening or persistently out-of-target diabetes management tended to be younger, with a higher prevalence of substance use but no difference in gender, race, or comorbidities and had comparable difficulty with medical bills, paying rent, mortgage, or utilities and affording food. A review of medication refills and renewals identified 17 of the 27 established patients as noncompliant with their medications (having at least a two week gap in filling a prescription of a diabetes, lipid control or antihypertensive medication).

**CONCLUSIONS**

In this study the recent economic downturn was associated with worse chronic disease management, a high rate of missed clinic appointments and increased emergency department use. Over half reported having difficulty paying for prescription and visit co-pays (\$8 per prescription at the time of this

survey; \$15 for a primary care visits and \$50 for a specialty care visits). In addition, almost three quarters reported the current economy was causing them increased stress and over 50% reported it was having an adverse effect on their health. While younger veterans reported higher levels of stress and had higher rates of clinic cancellations, older veterans were disproportionately concerned about their VA bills. This is despite receiving care in a system with uniform access for all enrolled veterans and a universally applied means testing program and income waiver and hardship care policies. We suspect the differences based on age may in explained in part by younger respondents being more dependent on employment-based income which is less secure in a recession than an entitlement or pension. They are also more likely to have dependents they support, compounding the stress. This is consistent with previous studies that have identified the spectrum of problems and needs associated with medical debt.<sup>6,7,9,10,11</sup>

While qualifying for a co-pay waiver was associated with better chronic disease outcomes, it did not improve no-show rates, lower stress or protect one from reporting worse health status. This suggests the effects of the recession go beyond affordability of medical care. This is underscored by our finding that the majority

of respondents also reported difficulty paying utilities, and affording food. It is likely that the economic demands from paying for these and other sustenance needs magnified the challenges of navigating the health system and stressors related to medical care.<sup>8</sup> In the short run, rent, food and utilities are fixed costs that come to represent a larger proportion of one’s budget. Of note, those persons who did cancel or no-show appointments were significantly more likely to go to an emergency department for care highlighting adverse systems costs when ambulatory care is deferred.

Broader social determinants of health need to be considered when thinking about the formulating an effective response to this need. Likely to be included are expanded waiver programs, bridge loans and other emergency supports as well as the capacity to leverage resources that include legal assistance, rent, mortgage and utility assistance, improved food security and family supports. As noted earlier, health access alone will not compensate for a loss of economic security.

Previous studies have shown provider ambivalence and, at times, bias with regard to how the financial means of their patients is considered. Limited assistance with medical billing and the indiscriminant use of aggressive debt retrieval approaches on patients with medical debt can serve as a direct impediment to the care goals for vulnerable patient populations.<sup>7,12,13</sup> While this was not noted in this study, it does underscore the need for any strategy to include efforts that increase the awareness among providers of the role personal economics has in clinical care and the roles they can play in minimizing adverse consequences.

There are several limitations to acknowledge in this study. Our findings are based at one facility may not necessarily be generalizable beyond the VA or beyond Rhode Island. The use of a voluntary self-reported economic hardship survey and recruitment within a medical center also introduces a selection bias that restricts recruitment to those persons actively seeking/needing health care. Finally, we do not have details on how the economic downturn has specifically impacted those people responding to the survey (i.e. job loss, reduction in retirement income, addition of family members or friends

to a household, or the loss of housing to foreclosure or eviction). Strengths to the study include the ability to control for access given that it is VA-based. Further, the study design allows us to consider the recession as a discrete temporal event and show the impact an economic downturn can have on health outcomes.

Ultimately these findings suggest the need for a regional health systems-based *Poverty Strategy* to proactively address the complex needs of at-risk individuals during an economic downturn. Creating the motivation to enact such a policy will require community- and patient-level advocacy to highlight both the shared responsibility we all have to those most impacted by economic downturns as well as the costs we all share when those in need are neglected.

## REFERENCES

1. Holahan J. The 2007-09 recession and health insurance coverage. *Health Aff.* 2010 (epub).
2. Gilmer TP, Kronick RG. Hard times and health insurance: how many Americans will be uninsured by 2010? *Health Aff.* 2009;28(4):w573-7.
3. Rowland D. Health care and Medicaid – Weathering the recession. *N Engl J Med.* 2010. 360 (13):1273-6.
4. Felland LE, Cunningham PJ, Cohen GR, November EA, Quinn BC. The economic recession: early impact on health care safety net providers. *Res Briefs.* 2010;(15):1-8.
5. Catalano R. The health effects of economic insecurity. *Am J Public Health.* 1991;81:1148-52.
6. Himmelstein DU, Warren E, Thorne D, Woolhandler S. Illness and injury as contributors to bankruptcy. *Health Aff.* 2005: W5-63-W5-73
7. O'Toole TP, Arbelaez JJ, Lawrence RS, The Baltimore Community Health Consortium. Medical debt and aggressive debt restitution practices: Predatory billing among the urban poor. *J Gen Intern Med.* 2004 Jul;19(7):772-8.
8. Gelberg L, Gallagher TC, Andersen RM, Koegel P. Competing priorities as a barrier to medical care among homeless adults in Los Angeles. *Am J Public Health.* 1997;87:217-20.
9. Doty MM, Collins SR, Rustgi SD, Kriss JL. Seeing Red: The growing burden of medical bills and debt faced by U.S. families. The Commonwealth Fund pub 1164, Vol. 42. August, 2008. [www.commonwealthfund.org](http://www.commonwealthfund.org). Accessed September 30, 2010.
10. Home sick: How medical debt undermines housing security. [www.accessproject.org/medical.html](http://www.accessproject.org/medical.html). Accessed December 12, 2010.
11. The Consequences of Medical Debt: Evidence for three communities. The Access Project. February, 2003. [www.accessproject.org/medical.html](http://www.accessproject.org/medical.html). Accessed December 12, 2010.
12. O'Toole TP, Simms PM, Dixon BW. Primary care office policies towards care to uninsured adult patients: what resources are made available to patients. *J Gen Intern Med.* 2001;16:693-6.
13. O'Toole TP, Arbelaez JJ, Dixon, BW. Full disclosure of financial costs and options to patients: The roles of race, age, health insurance and usual source for care. *J Health Care Poor and Underserved Populations.* 2004; 15:52-62.

*Thomas P. O'Toole, MD, is Director, National Homeless Veterans PACT Program, at the Providence VA Medical Center, and a Project Director at the Warren Alpert Medical School of Brown University.*

*Lauren Buckel, MPH, is a research assistant at the Rhode Island Department of Health.*

*Stephen Redihan, BS, is a data analyst at the Providence VA Medical Center.*

*Stacey DeOrsey, MSW, is a Primary Care Social Worker and Project Coordinator at the Providence VA Medical Center.*

*Daniel Sullivan, MSW, is a Primary Care Social Worker and Project Coordinator at the Providence VA Medical Center.*

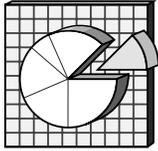
## Disclosure of Financial Interests

The authors and/or their spouses/significant others have no financial interests to disclose.

## CORRESPONDENCE

Thomas P. O'Toole, MD  
Providence VA Medical Center  
Building 32; Room 112  
830 Chalkstone Avenue  
Providence, RI 02908  
[Thomas.otoole@va.gov](mailto:Thomas.otoole@va.gov)





## Hospital Emergency Department Visits For Non-Traumatic Oral Health Conditions Among Rhode Island Adults Age 21–64 Years, 2006–2010

*Junbie Oh, BDS, MPH and Laurie Leonard, MS*

**ACCORDING TO DATA FROM THE BEHAVIORAL RISK FACTOR Surveillance System (BRFSS)**, a statewide health behavior survey, in 2008 and 2010, more than a quarter of Rhode Island adults aged 21–64 years are estimated to be without any dental insurance coverage (26.7%, 95% confidence interval=25.2%–28.3%). Adults with limited or no dental insurance coverage are more likely to avoid routine dental care, delay dental care as symptoms emerge, and rely on hospital **emergency departments (EDs)** to treat acute and urgent oral/dental problems.

2008 and 2010 BRFSS data also indicate that 22% of Rhode Island adults aged 21–64 years reported that they did not obtain preventive dental care (such as dental cleaning) in the past year, and more than half of these adults did not have dental insurance. Even among individuals who have dental insurance, scope of coverage and accessibility to dental care are variable. Rhode Island adults enrolled in Medicaid are eligible for a very limited scope of dental services, and are significantly less likely than those with private insurance to receive preventive dental care (Figure 1).

EDs serve as dental safety net points of access for a significant number of low income and uninsured Rhode Island individuals and families who have limited access to oral health care due to lack of dental insurance, immigration status, or a number of other reasons. However, most non-traumatic and non-urgent dental care needs are more adequately and less expensively addressed and treated in primary outpatient dental offices or clinics.<sup>1,2,3</sup> Reliance on the ED for less severe, or non-emergent oral/dental conditions results in significant health care spending and increased pressure on the already crowded and overburdened EDs throughout the State.

The objectives of this report are to: (a) document the extent of Rhode Island adults' hospital ED visits for oral/dental conditions that are mostly preventable and treatable in primary dental settings; (b) assess ED visits by adults' age, insurance status, and primary diagnosis; and (c) discuss how to assure optimal and regular dental care for all Rhode Island adults and decrease unnecessary hospital ED visits.

### METHODS

The data used for this analysis were obtained from the **Rhode Island Hospital Discharge Data (HDD)**. Since 1989, Rhode Island hospitals have been required to submit financial and statistical data using the statewide uniform reporting system to the Rhode Island Department of Health pursuant to their licensure authority.<sup>4</sup> Data on hospital inpatient and ED encoun-

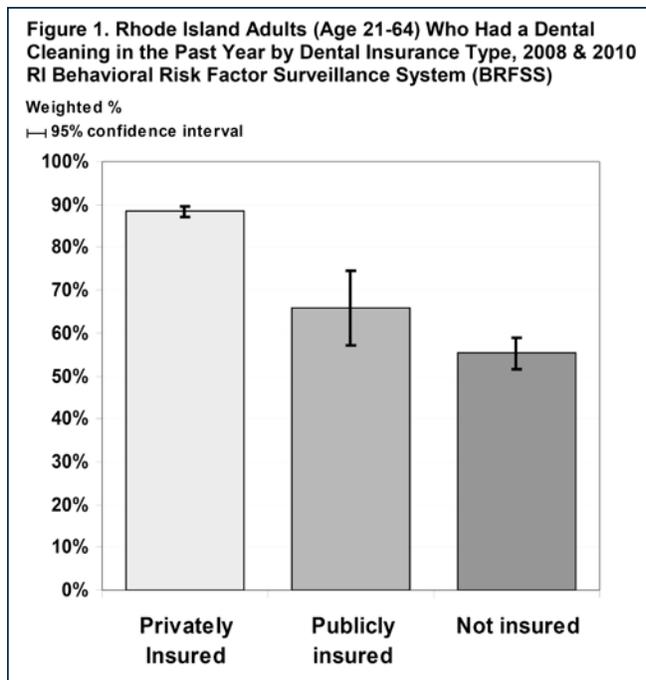
ters are submitted by all 14 Rhode Island non-federal acute-care and specialty hospitals. HDD provides information on patient demographic characteristics, insurance, hospital admission and discharge related details including admitting diagnoses and clinical procedures rendered.

Data extracted and summarized for this report were all ED visits between January 1, 2006 and December 31, 2010 for adults aged 21–64 years old with primary admitting diagnoses related to oral/dental conditions (i.e. ICD-9-CM codes of 520.0–529.9) that were not associated with injuries, such as jaw fractures, dislocations, or other traumatic injuries or wounds, and did not result in hospital admission.

Using SAS® v9.3, descriptive statistics of the ED visits were generated by adults' age (categorized as 21–34, 35–49 and 50–64 years), insurance type (or expected source of payment identified in hospital's initial admission records), and primary diagnosis.

### RESULTS

This report focuses on the oral/dental diagnoses at EDs that are considered non-traumatic and are avoidable through preventive dental care and treatable with access to a dental provider. The underlying cause of these oral/dental conditions



**Table 1. Top 20 primary diagnoses for adults' (age 21–64) ED visits that did not result in hospital admission by patient's insurance (expected payment source\*), RI Hospital Discharge Data 2006–2010.**

	Private insurance		Medicaid		Self-pay (uninsured)	
	Diagnosis description (ICD-9-CD)	Number of visits	Diagnosis description (ICD-9-CD)	Number of visits	Diagnosis description ICD-9-CD)	Number of visits
1	Neck strain (847.0)	14,012	Pregnancy related complication, antepartum (648.93)	9,618	Alcohol abuse (305.00)	11,443
2	Lumbago (724.2)	9,400	Lumbago (724.2)	9,613	Lumbago (724.2)	6,898
3	Headache (784.0)	9,303	Alcohol abuse (305.00)	6,528	Neck strain (847.0)	6,042
4	Chest pain (786.50)	9,222	Headache (784.0)	6,015	<b>Unspecified disorder of teeth and supporting structures (525.9)</b>	<b>4,669</b>
5	Open wound of finger(s) (883.0)	7,434	<b>Unspecified disorder of teeth and supporting structures (525.9)</b>	<b>5,101</b>	Depressive disorder (311)	4,275
6	Abdominal pain (789.09)	7,043	Abdominal pain (789.09)	4,856	Lumbar strain (847.2)	4,262
7	Lumbar strain (847.2)	6,725	Neck strain (847.0)	4,597	Headache (784.0)	4,082
8	Chest pain (786.59)	6,676	Abdominal pain (789.00)	4,309	Chest pain (786.50)	3,545
9	Pregnancy related complication, antepartum (648.93)	6,244	Chest pain (786.50)	4,259	Acute pharyngitis (462)	3,322
10	Abdominal pain (789.00)	5,898	Lumbar strain (847.2)	3,972	<b>Dental caries (521.00)</b>	<b>3,219</b>
11	Ankle strain (845.00)	5,781	Depressive disorder (311)	3,701	Abdominal pain (789.09)	3,074
12	Syncope and collapse (780.2)	5,681	Urinary tract infection (599.0)	3,478	Contusion of face, scalp, and neck except eye(s) (920)	2,969
13	Acute pharyngitis (462)	5,654	Acute pharyngitis (462)	3,350	Abdominal pain (789.00)	2,951
14	Urinary tract infection (599.0)	5,351	Migraine (346.90)	3,313	Acute alcoholic intoxicification (303.00)	2,577
15	Dizziness, giddiness (780.4)	5,308	<b>Dental caries (521.00)</b>	<b>3,159</b>	Open wound of finger(s) (883.0)	2,570
16	Contusion of face, scalp, and neck except eye(s) (920)	5,253	Threatened premature labor, antepartum (644.13)	3,048	Urinary tract infection (599.0)	2,553
17	Migraine (346.90)	5,192	Acute bronchitis (466.0)	3,016	Ankle strain (845.00)	2,528
18	Alcohol abuse (305.00)	5,004	Pregnancy related complication, antepartum (646.83)	2,942	Acute bronchitis (466.0)	2,398
19	Acute bronchitis (466.0)	4,524	Chest pain (786.59)	2,754	Chest pain (786.59)	2,286
20	Abdominal pain (789.03)	4,052	Pain in limb (729.5)	2,718	Anxiety state (300.00)	2,246
	TOTAL ED VISITS FOR TOP 20 DX	133,757 (27.9%)	TOTAL ED VISITS FOR TOP 20 DX	90,347 (31.6%)	TOTAL ED VISITS FOR TOP 20 DX	77,909 (29.9%)
	TOTAL ED VISITS FOR ALL DX	479,426	TOTAL ED VISITS FOR ALL DX	285,984	TOTAL ED VISITS FOR ALL DX	260,194

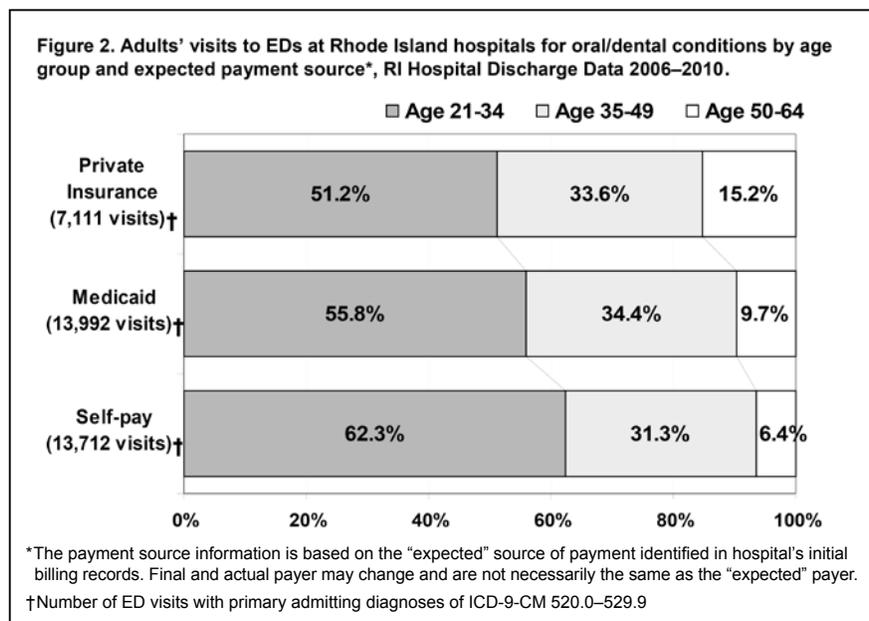
\* The payment source information is based on the "expected" source of payment identified in hospital's initial billing records. Final and actual payer may change and are not necessarily the same as the "expected" payer.

usually cannot be addressed in an ED that does not have routine access to a dental provider on staff, as is the case in most Rhode Island hospitals. From 2006 through 2010, 39,286 adult ED visits at Rhode Island hospitals were primarily attributed to oral/dental conditions (identified with primary admitting diagnoses of ICD-9-CM codes 520.0–529.9). Of these, 30,911 ED visits (79%) were diagnosed as dental decay, tooth decay originated inflammatory pulp/periapical lesions or toothache (primary diagnostic codes of 521.0, 522.0–522.9, 525.8, or 525.9).

Oral/dental problems were more frequently reported by Medicaid-enrolled and uninsured (whose payment sources were identified as "self-pay") adults. For Medicaid-enrolled and uninsured adults, the top 20 primary diagnoses in the EDs

included two dental diagnoses; however, the most common 20 ED primary diagnoses for privately insured adults did not include any oral/dental problems (Table 1).

Figure 2 summarizes that Medicaid and "self-pay" were the most common payment methods for oral/dental complaints in the EDs, accounting for seven out of ten oral/dental problem-related ED visits (13,992 visits and 13,712 visits, respectively). Regardless of payer type (Medicaid, self-pay, or private insurance), younger adults age 21–34 years were the most frequent users at the EDs for oral/dental problems. However, significantly more visits by younger adults (aged 21–34 years) were observed among Medicaid-enrolled and uninsured adults than those with private insurance ( $p < 0.0001$ ).



## DISCUSSION

Many adults sought care at Rhode Island EDs for acute signs and symptoms of oral health problems that are mostly preventable, given access to routine dental care. This report highlights that young uninsured or underinsured (including Medicaid-enrolled) adults seek treatment in hospital EDs for oral health problems more often than those with private insurance. For these people, lack of affordable comprehensive dental coverage, difficulties finding a dentist who accepts Medicaid patients, or not being able to leave work during regular dental office hours, may explain why many young and low income adults postpone needed dental care and finally show up at hospital EDs to address their oral health needs.

Although the ED's role is crucial as a safety net dental provider for a significant number of low income and uninsured Rhode Island adults, EDs typically offer only temporary relief of pain and palliative care that may require return visits or further dental services.<sup>5,6</sup> Additionally, costs for dental care delivered at an ED are much more expensive than care delivered in a primary dental setting. These costs put financial pressure on individuals paying substantial out-of-pocket payments, and the State through uncompensated care incurred by the uninsured and underinsured, including charity and unpaid care. The uncompensated cost is often shifted to the privately or publicly insured, through higher premiums for plans or reduced benefits, which then contributes to the rising cost of the overall health care system.

These findings suggest that the accessibility and expanded scope of coverage offered by private dental insurance allows covered adults to more easily seek routine and necessary dental care in more cost-effective settings with ensured quality of care, which eventually contributes to a savings of public and private funds. However, federal law does not mandate states to provide dental benefits for adults with Medicaid or those that are uninsured. Further, many states address fiscal stress through budget changes to significant Medicaid services, including dental care, which are subject to being reduced or eliminated, and can further strain access to care.<sup>7</sup>

Public health policies and programs should aim to increase awareness of dental benefits under Medicaid, promote preventive and regular dental care in primary dental care settings, and better coordinate these populations' dental service utilization between hospital EDs and private dental providers, community health centers, or other community-based dental programs. As previous studies have shown, transferring patients to a regular and accessible dental office or clinic has a potential to more efficiently and appropriately address most preventable oral health problems.<sup>8,9</sup> These efforts would help reduce emergency dental care treatment needs and generate Medicaid cost-savings by reducing the provision of more expensive dental care at hospital EDs.

## REFERENCES

1. The PEW Center on The States. A Costly Dental Destination - Hospital Care Means States Pay Dearly. February 2012. Available from: [http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/State\\_policy/Pew\\_Report\\_A\\_Costly\\_Dental\\_Destination.pdf](http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/State_policy/Pew_Report_A_Costly_Dental_Destination.pdf).
2. Nalliah RP, Allareddy V, Elangovan S, Karimbux N, Allareddy V. Hospital based emergency department visits attributed to dental caries in the United States in 2006. *J Evid Based Dent Pract.* 2010; 10(4):212-22.
3. Shortridge, E, Moore, J. Use of Emergency Departments for Conditions Related to Poor Oral Health Care. Office of Rural Health Policy Washington, DC. August 2010.
4. Rhode Island Hospital Discharge Data Reporting Manual. Rhode Island Department of Health Center for Health Data & Analysis. June 2004.
5. Okunseri C, Okunseri E, Thorpe JM, Xiang Q, Szabo A. Medications prescribed in emergency departments for nontraumatic dental condition visits in the United States. *Med Care.* 2012; 50(6):508-12.
6. Davis EE, Deinard AS, Maiga EW. Doctor, my tooth hurts: The costs of incomplete dental care in the emergency room. *J Public Health Dent.* 2010; 70(3):205-10.
7. The Keiser Commission on Medicaid and the Uninsured. Access to Affordable Dental Care: Gaps for Low-Income Adults. July 2008. Available from: <http://www.kff.org/medicaid/upload/7798.pdf>.

8. Tulip DE, Palmer NO. A retrospective investigation of the clinical management of patients attending an out of hours dental clinic in Merseyside under the new NHS dental contract. *Br Dent J.* 2008; 205(12):659-64.
9. Graham DB, Webb MD, Seale NS. Pediatric emergency room visits for nontraumatic dental disease. *Pediatr Dent.* 2000; 22(2):134-40.

*Junhie Oh, BDS, MPH, is an Oral Health Epidemiologist for the Oral Health Program, Division of Community, Family Health and Equity, Rhode Island Department of Health.*

*Laurie Leonard, MS, is the Oral Health Program Director for the Oral Health Program, Division of Community, Family Health and Equity, Rhode Island Department of Health.*

## Disclosure of Financial Interests

The authors and their spouses/significant others have no financial interests to disclose.

## CORRESPONDENCE

Junhie Oh, BDS, MPH  
 Oral Health Program  
 Division of Community, Family Health & Equity  
 Rhode Island Department of Health  
 3 Capitol Hill, Room #309  
 Providence RI 02908  
 phone: (401) 222-5931  
 fax: (401) 222-1442  
 email: Junhie.Oh@health.ri.gov



## ADULT PSYCHIATRIST

The Kent Center, a nationally recognized progressive CMHC is seeking a team oriented Board Certified/Board Eligible Adult Psychiatrist to join our Psychiatric Service Team. As a member of our multi-disciplinary team you will provide direct psychiatric services to a diverse population focusing on recovery of adult clients with mental health disorders, trauma, and substance abuse.

Your responsibilities include comprehensive evaluations, treatment planning, medication prescribing and monitoring of clients, and consultation services to members of clinical treatment teams and our integrated primary care practice.

Will consider candidates interested in part time employment.

Competitive salary, comprehensive benefit package including 4 weeks vacation, Blue Cross/Blue Shield medical, dental, life and long term disability insurance and 401k retirement plan. Send resume to Director of Human Resources, The Kent Center, 2756 Post Road, Suite 104, Warwick, RI 02886. Fax 401-691-3398, or e-mail Hr@thekentcenter.org.

## HELP WANTED, SPACE TO LEASE, OR EQUIPMENT TO SELL?



Whether you are a RIMS member or not, you can post all of the particulars of your message on the Medical Society's website – **Classified Ads Section** – for a very reasonable rate. Purchase ad space in *Medicine & Health/RI* and your online classified ad is **FREE**.

Your ad will run for four weeks, with discounted rates for multiple months. We will link your ad to your email address or website for easy replies. For more information, please visit [www.rimed.org](http://www.rimed.org) or contact Cheryl Turcotte at RIMS: 401-331-3207.



## Information for Contributors

*Medicine & Health/Rhode Island* is peer-reviewed, and listed in the *Index Medicus*. We welcome submissions in the following categories:

### CONTRIBUTIONS

Contributions report on an issue of interest to clinicians in Rhode Island: new research, treatment options, collaborative interventions, review of controversies. Maximum length: 2500 words. Maximum number of references: 15. Tables, charts and figures should be submitted as separate electronic files ( jpeg, tif, or pdf). Each submission should also be accompanied by a short (100-150 words) abstract.

### CREATIVE CLINICIAN

Clinicians are invited to describe cases that defy textbook analysis. Maximum length: 1200 words. Maximum number of references: 6. Photographs, charts and figures may accompany the case.

### POINT OF VIEW

Readers share their perspective on any issue facing clinicians (e.g., ethics, health care policy, relationships with patients). Maximum length: 1200 words.

### ADVANCES IN PHARMACOLOGY

Authors discuss new treatments. Maximum length: 1200 words.

### ADVANCES IN LABORATORY MEDICINE

Authors discuss a new laboratory technique. Maximum length: 1200 words.

### IMAGES IN MEDICINE

Authors submit an interesting Image, with a 300-400 word explanation.

For the above articles: Please submit an electronic version (Microsoft Word or Text) with the author's name, mailing address, phone, fax, e-mail address, and clinical and/or academic positions to the managing editor, John Teehan, e-mail: [jtteehan@rimed.org](mailto:jtteehan@rimed.org). For additional information, phone: (631) 903-3389. Faxes may be sent to (401) 826-1926.

Please be sure to provide complete and up-to-date contact information in order to facilitate communication during the editing process.



# Physician's Lexicon

## A Proliferation of Pro- Words

**THE STANDARD MEDICAL DICTIONARY** provides us with 17 pages of technical words beginning with the prefix, *pro-*, totaling about 1,800 health-related terms. This English prefix actually represents two closely related prefixes of Greek origin: *pro-*, generally meaning before, forward or precursor of. And *proto-* (sometimes *proteo-*), denoting something highest in rank or first in a series. Proteus, also, was the mythological sea-god of the Greeks.

Most medical words beginning with *pro-* are self-evident etymologically and need no clarification. Some, however, are worthy of exploration.

The word, protein, was invented by the Swedish chemist, Jons Berzalius (1779-1848) and popularized by the Dutch chemist-physician, Gerardus Mulder (1802-1880). It was based on the Greek, *protos*, to convey how important, how primary, they believed such molecules were. Similarly, the word, protozoa, was coined to describe those

living creatures that came first in life.

A professor is one who puts forth publicly, from the Latin, *fateri*, meaning to acknowledge or confess. A protocol originally defined the record of a business transaction. It was based on the Greek *protos*, meaning first and another Greek word, *kollen*, describing a glue used to paste together the transcriptions of official meetings. Something which is profane is something, literally, in front of or beyond the temple perimeter (from the Latin, *fanum*, meaning temple) and hence a way of describing something confined to the secular realm and hence not sacred.

A procurer, again from the Greek via Latin, was the fusion of *pro-* and *curare*, meaning to attend to, to take care of, leading also to such English church terms as curate or cure. (The botanical substance, *curare*, however, comes from an aboriginal Tupi word meaning to fall down.) And finally, when the early French word, *procurer* crossed the English Channel, it had taken on a disreputable

meaning (to pander or pimp.)

A proboscis, a synonym for the nose, had been applied solely to the snouts of elephants. The word was compounded from the Greek *pro-* and *boskein* (thus meaning to feed in front.)

Proptosis (the junction of *pro-* and *ptosein*) means literally a protrusion, something falling forward. Prognosis is similarly an amalgamation of the Greek, *pro-* and *gnosis*, thus meaning to know beforehand. A progenitor, an ancestor, is from the Latin, *progenitus*, but ultimately, as with so much of Latin, from the Greek.

Many of the *pro-* words, (such as prodigal, prodigy, proctitis, probity and problematic) in their passage from the Greek through centuries of Latin and then French, have their sense so transformed that their current meanings are at best caricatures of their original intent.

— STANLEY M. ARONSON, MD



RHODE ISLAND DEPARTMENT OF HEALTH  
MICHAEL FINE, MD  
DIRECTOR OF HEALTH

## VITAL STATISTICS

EDITED BY COLLEEN FONTANA, STATE REGISTRAR

### Rhode Island Monthly Vital Statistics Report Provisional Occurrence Data from the Division of Vital Records

Underlying Cause of Death	Reporting Period			
	November 2011	12 Months Ending with November 2011		
	Number (a)	Number (a)	Rates (b)	YPLL (c)
Diseases of the Heart	195	2,470	234.5	3,789.5
Malignant Neoplasms	181	2,212	210.0	5,550.0
Cerebrovascular Diseases	34	425	40.4	572.5
Injuries (Accidents/Suicide/Homicide)	75	709	67.3	9,945.5
COPD	30	518	49.2	502.5

Vital Events	Reporting Period		
	May 2012	12 Months Ending with May 2012	
	Number	Number	Rates
Live Births	1,012	14,791	14.1*
Deaths	796	11,998	11.4*
Infant Deaths	(7)	(98)	6.6#
Neonatal Deaths	(5)	(75)	5.1#
Marriages	560	7,487	7.1*
Divorces	320	4,178	4.0*
Induced Terminations	324	4,983	336.9#
Spontaneous Fetal Deaths	48	783	52.9#
Under 20 weeks gestation	(33)	(655)	54.6#
20+ weeks gestation	(15)	(128)	8.7#

(a) Cause of death statistics were derived from the underlying cause of death reported by physicians on death certificates.

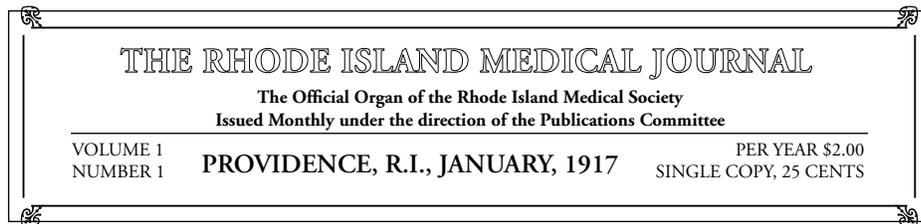
(b) Rates per 100,000 estimated population of 1,052,567. (www.census.gov)

(c) Years of Potential Life Lost (YPLL).

*Note: Totals represent vital events that occurred in Rhode Island for the reporting periods listed above. Monthly provisional totals should be analyzed with caution because the numbers may be small and subject to seasonal variation.*

\* Rates per 1,000 estimated population

# Rates per 1,000 live births



## **NINETY YEARS AGO, NOVEMBER, 1922**

Lincoln Davis, MD, looks at cancer of the uterus while stressing an overall importance to early recognition and treatment to the point of calling for a nationwide, and worldwide, campaign. He goes on to note that many exploratory laparotomies are being done and the abdomen closed without any attempt at removal of any growth on account of its widespread dissemination. Lack of early detection is to blame, and the author deplores the frequency with which inoperable carcinoma is found. In an average surgical clinic, about one third of cases of cancer of the cervix are suitable for operation. Operative mortality should not be over eight and a half percent—and in some hands below five percent. Five-year “cures” could be obtained in about forty percent of cases operated on, but early detection would lead to much better results in the rate of operability, primary mortality, and number of definite cures due to the ample pathological evidence of cancer being a local disease in its early stages.

Noting the arrival in a few days of biennial elections, it is discussed whether or not the physician realizes the responsibility as well as the opportunity which he possesses to further any piece of effective legislation and at the same time help to quash any piece of vicious legislation. “As the doctor goes on his daily rounds, he passes the time of day with many and varied sorts and conditions of people. The conversation naturally turns upon subjects of greatest interest and as the time of the election approached, more and more attention and conversation will be directed to the men who are up for office and to the platforms of the different parties. Here is an opportunity to put in a good word for a man who has interested himself in problems of public health and the protection of the people against contagious diseases and the prevention of illness. There is also the opportunity, by the same token, to call attention to the man who has neglected to stand up for these public safety guards.”

## **FIFTY YEARS AGO, NOVEMBER, 1962**

J. John Yashar, MD, and Stephen J. Hoyer, MD present a paper on two-team colon transplant and esophagectomy noting that while the procedure is not difficult technically in experienced hands, the problem of esophageal replacement has intrigued surgeons for many years. Every method of transplant thus far utilized has at least one major disadvantage and usually several minor ones. Ideal substitutes for the esophagus should be resistant to peptic juices to avoid ulceration, stricture, and bleeding. It should also be a satisfactory conduit for food without encroaching on pulmonary tissue. Furthermore, its transplantation must be technically feasible, and there should be an adequate blood supply to both anastomoses. Restoration of esophageal continuity by colon transplant after resection for benign or malignant disease is a safe and practicable

procedure. The two-team approach, where possible, contributes significantly to reducing operative time and trauma.

Herbert A. Selenkow, MD, discusses the management of common thyroid problems. Despite the relative abundance of dietary iodide in the New England area, goitrous enlargement, both diffuse and nodular, occurs frequently in association with normal thyroid function as well as with myxedema or hyperthyroidism. Fortunately, current knowledge of the physiologic and biochemical pathways incident to thyroid hormonogenesis permits a sound, scientific therapy. In the summary, the author points out that most disorders of thyroid size or function are clinically recognizable and, if properly diagnosed, respond well to relatively simple therapeutic programs. The author further urges that use of all laboratory and diagnostic facilities on hand with prudence and careful deliberation.

Allan J. Ryan, MD, stresses the importance of properly fitted protective equipment in sports. “No matter what care is exercised, it is impossible to protect the athlete against every possible injury. We know by experience, however, that many minor injuries can be prevented by the use of protective equipment. Once this equipment enters the picture several new factors are introduced into the injury situation. First, the equipment may not be sufficiently strong or protective to do the job required. Second, the equipment must be properly fitted and applied to the athlete in order to afford the protection for which it is designed. Third, the equipment must be kept in place as it is initially applied. Fourth, the equipment may satisfy the first three requirements but yet because of its nature or effect in action pose an additional hazard to the athlete wearing it or to another competitor.” The most expensive piece of athletic equipment may offer only poor protection if it is not properly fitted.

## **TWENTY-FIVE YEARS AGO, NOVEMBER, 1987**

Jonathan Goldstein, MD, Augustine Manocchia, MD, and Wayne Trotter, MD, offer an evaluation in “CPR: Ready or Not? A Rhode Island Perspective,” noting that more trained persons and programs in retraining are both desirable. Since 1973, citizen-initiated cardiopulmonary resuscitation has been established as a key first link in the community’s emergency response team. For this scheme to work, some segment of the population must be taught CPR, and must be confident enough to use it and to use it with some degree of competency. Their study uncovers several shortcomings in the present implementation of community-based CPR program in Rhode Island including a lack of involvement of the over-40 age group, decreased participation by those less well educated, lack of proportional increase in CPR training among those having household members at increased risk of sudden death, and poor compliance with the American Heart Association’s recommendations regarding certification one year after training.

# The Name of Choice in MRI



'OASIS' 1.2 Tesla open-sided scanner

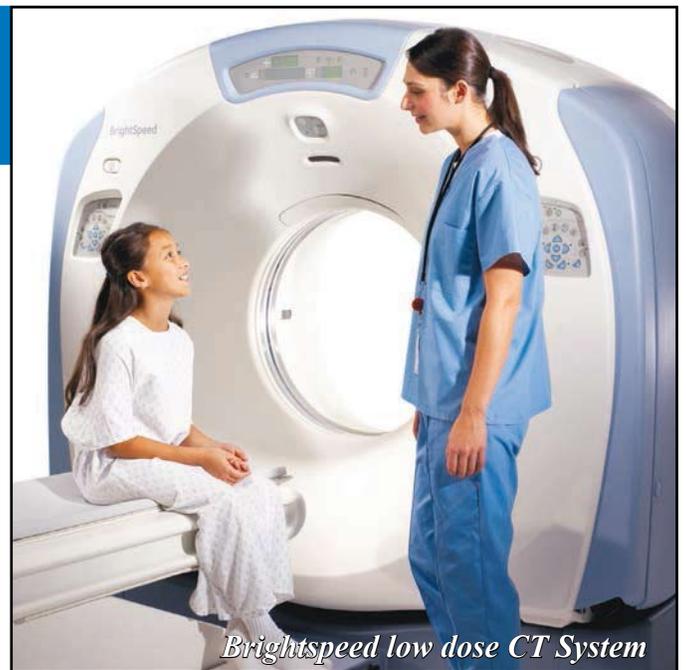
## Open MRI of New England, Inc.

- High Field Open-Sided and Short-Bore Systems
- Fast appointments and reports
- Insurance authorization services, physician web portal and EMR system interfaces



## ADVANCED Radiology, Inc.

- Low dose Multislice CT systems
- Digital xray, bone density and ultrasound
- Insurance authorization services, physician web portal and EMR system interfaces



Brightspeed low dose CT System

525 Broad St. • Cumberland  
T 725-OPEN (6736) F 726-2536

1002 Waterman Ave • East Providence  
T 431-5200 F 431-5205

148 West River St • Providence  
T 621-5800 F 621-8300

501 Great Road • North Smithfield  
T 766-3900 F 766-3906

335 Centerville Rd • Warwick  
T 732-3205 F 732-3276

101 Airport Rd • Westerly  
T 315-0095 F 315-0092



## Local Partner, Superior Service

To understand Rhode Island medicine, patients and the standard of care, your medical professional liability insurer needs to be here, listening to you. That's how NORCAL Mutual delivers superior service to Rhode Island physicians — we're your neighbors.

### Why NORCAL Mutual?

- > endorsed by the Rhode Island Medical Society since 1994
- > represented exclusively by RIMS Insurance Brokerage Corporation
- > local risk management expert available for on-site visits
- > a flexible, fresh approach to underwriting

we want to talk with you.

For a premium estimate  
or on-site office visit, contact:



**RIMS-INSURANCE  
BROKERAGE  
CORPORATION**

- > **Lisa A. O'Neill, Assistant Director**  
**401-272-1050**

Rhode Island Medical Society Insurance  
Brokerage Corporation (RIMS-IBC)  
loneill@rimed.org  
(RI License #: 1049837)

- > **Lynn White, Account Executive**  
**401-276-7523**

NORCAL Mutual Insurance Company  
The Fleet Center on Kennedy Plaza  
lwhite@norcalmutual.com  
(RI License #: 2035061)



*Our Passion Protects  
Your Practice*