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Integrating Emergency Care with Population Health

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Integrating Emergency Care with Population Health

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USEFUL: Ultrasound Exam for Underlying Lesions Incorporated into Physical Exam

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Introduction: The Ultrasound Screening Exam for Underlying Lesions (USEFUL) was developed in an attempt to establish a role for bedside ultrasound in the primary and preventive care setting. It is the purpose of our pilot study to determine if students were first capable of performing all of the various scans required of our USEFUL while defining such an ultrasound-assisted physical exam that would supplement the standard hands-on physical exam in the same head-to-toe structure. We also aimed to assess the time needed for an adequate exam and analyze if times improved with repetition and previous ultrasound training.

Methods: Medical students with ranging levels of ultrasound training received a 25-minute presentation on our USEFUL followed by a 30-minute hands-on session. Following the hands-on session, the students were asked to perform a timed USEFUL on 2-3 standardized subjects. All images were documented as normal or abnormal with the understanding that an official detailed exam would be performed if an abnormality were to be found. All images were read and deemed adequate by board eligible emergency medicine ultrasound fellows.

Results: Twenty-six exams were performed by 9 students. The average time spent by all students per USEFUL was 11 minutes and 19 seconds. Students who had received the University of California, Irvine School of Medicine's integrated ultrasound curriculum performed the USEFUL significantly faster ($p < 0.0025$). The time it took to complete the USEFUL ranged from 6 minutes and 32 seconds to 17 minutes, and improvement was seen with each USEFUL performed. The average time to complete the USEFUL on the first standardized patient was 13 minutes and 20 seconds, while 11 minutes and 2 seconds, and 9 minutes and 20 seconds were spent performing the exam on the second and third patient, respectively.

Conclusion: Students were able to effectively complete all scans required by the USEFUL in a timely manner. Students who have been a part of the integrated ultrasound in medicine curriculum performed the USEFUL significantly faster than students who had not. Students were able to significantly improve upon the time it took them to complete the USEFUL with successive attempts. Future endpoints are aimed at assessing the feasibility and outcomes of an ultrasound-assisted physical exam in a primary care setting and the exam's effect on doctor-patient satisfaction. [West J Emerg Med. 2014;15(3):260–266.]

INTRODUCTION

Records of Hippocratic physical examinations, influenced by the Egyptian, Cretan and Babylonian exams taught before them, included: careful history taking, inspection, palpation, and direct auscultation, and are a tradition that has continued on for thousands of years.[1] It is a great model, yet it is one that has seen few technological advances. Progress was made with the invention of the stethoscope by Laennec in 1816, and was further improved upon by Leyton, Kerr, Bowles, Rappaport, Sprague and Littmann. As newer stethoscopes improved the diagnostic sensitivity and specificity of auscultation, they were implemented into the physical examination. For Ramsay once wrote of Dr. Leyton in the British Medical Journal in 1916, "In spite of careful inquiry into the history of cases and in spite of the many accurate methods of investigation which are nowadays at our command, we cannot invariably form a perfectly definite opinion as to the cause of a patient's symptoms. Any new instrument, therefore, which can help us in our decisions should be of real use to the profession."[2] While his message encourages progress, utilization of new tools in medicine requires a detailed examination of risks and benefits. In modern medicine, we struggle to balance the cost of innovation, time constraints, management of incidental and benign exam findings, patient satisfaction, and managed health care. Our skepticism and curiosity of medical advances drive the use of the scientific method to investigate such developments before they are accepted and implemented by the community of physicians—before they can drive progress.

Over the years, various uses of bedside ultrasound have been adopted by specialties including emergency medicine, obstetrics and gynecology, and trauma. While its use in those fields has been rigorously studied in clinical settings and is the preferred first-line imaging modality for assessment of many of the organs in the abdomen and pelvis,[3] little has been reported on its role in an outpatient primary care setting and this has inspired us to consider the possible role of ultrasound as an addition to the standard physical exam. Given the recent affordability and improved image quality of bedside ultrasound units, we believe bedside ultrasound could be the new figurative stethoscope.

With this first paper, our primary endpoints were to examine the feasibility and time requirements of a medical student-performed ultrasound-assisted physical exam, termed the Ultrasound Screening Exam for Underlying Lesions (USEFUL), wherein students with varying levels of expertise would be evaluated on their ability to correctly and efficiently image individual organs from head to toe. We also sought to define our ultrasound-assisted physical exam for further medical student education and for clinicians interested in integrating ultrasound into their physical exams. Aware of the time restraints for physicians in outpatient clinics, we determined six minutes or less would be an acceptable length for a USEFUL and hoped this would be a reasonable goal. The USEFUL was developed by students and faculty interested in establishing a role for bedside ultrasound in the primary and preventive care setting with the hope that, in the future, an ultrasound-assisted physical exam that would take approximately six minutes might supplement the standard hands-on physical exam.

METHODS

The current ultrasound training at the University of California, Irvine School of Medicine (UCISOM) involves eight tutorials during the first year inclusive of: Knobology, Cardiovascular I and II, GI Physiology, Respiratory, Musculoskeletal, Genitourinary, and Head and Neck Ultrasound. During the second year, there is an additional six sessions reviewing the cumulative skills to date, using ultrasound in the evaluation of fever, a focused assessment of the thorax (FATE), lung ultrasound, and advanced GI and GU ultrasound. While currently only 2 dedicated ultrasound electives exists for third and fourth year medical students (Emergency Medicine Ultrasound and Obstetric and Gynecologic Ultrasound), the authors are currently organizing and implementing an ultrasound clerkship in Family Medicine. Students are also encouraged to take one of our 60 portable ultrasounds with them during all other rotations where educational scans are recorded as video clips, stored in the central Sonosite Workflow Solutions System, and reviewed with the students by faculty. It is our hope to create electives in all specialties so that students may learn how to optimize the utilization of this noninvasive diagnostic technique in the field of their interest.

For this study, medical students at UCISOM with ranging levels of ultrasound training (from one introductory ultrasound session, to fifteen months of the aforementioned integrated ultrasound curriculum) participated in our pilot study. Institutional review board approval was obtained at UCISOM prior to the commencement of the study. First and fourth year students had no previous ultrasound training prior to our study and were therefore placed in Group 1. Second and third year students had received varying quantities of ultrasound training integrated into their medical education curriculum and were placed in Group 2.

Students received a 25-minute demonstration of our primary ultrasound assessment by board eligible emergency medicine ultrasound fellows, followed by a 30-minute hands-on session scanning multiple volunteers using a portable Sonosite Nanomaxx machine. This session was supervised by the ultrasound fellows who provided feedback on proper technique to aid in scanning for appropriate visualization of the organs involved and any potential pathology. The USEFUL included first visualizing the thyroid with a L38 probe in the sagittal and axial planes, followed by an axial view of the carotid arteries and measurement of the carotid intima-media thickness (CIMT) using a L38 probe. It next involved visualization of the heart in the parasternal long axis, subcostal and intercostal views of the liver, sagittal and axial

Table. Examinations compromising in the Ultrasound Screening Exam for Underlying Lesions as well as potential pathologies that may be observed with ultrasound.

Organ	Probe	Plane	Potential pathology
Thyroid	L38	Sagittal/axial	Focal lesion (nodule, tumor)
Carotid intimal thickness	L38	Axial	Atherosclerosis (CIMT > mean for age)*, plaque, dissection
Heart	P21	Parasternal long	LVH, atrial hypertrophy, valvular abnormality, hypertrophic cardiomyopathy, pericardial effusion
Liver	P21	Subcostal/intercostal	Focal lesion (cyst, abscess, tumor, trauma), biliary ductal obstruction, fatty liver, perihepatic fluid collection
Gallbladder	P21	Sagittal/axial	Cholelithiasis, choledocolithiasis, cholecystitis
Abdominal aorta	P21	Axial	AAA, dissection
Kidneys	P21	Short/long axis	Focal lesion (cyst, tumor, calculi), hydronephrosis, obstructive uropathy, ectopic kidney, perirenal fluid collection
Bladder	P21	Sagittal/axial	Focal lesion (tumor, calculi), obstruction, diverticula
Prostate	P21	Sagittal/axial	Tumor, BPH
Uterus	P21	Sagittal/axial	Mass (endometriosis, leiomyomata, tumor), endometrial hypertrophy, hematocolpos

CIMT, carotid Intima-medial thickness; *LVH,* left ventricular hypertrophy; *AAA,* abdominal aortic aneurysm; *BPH,* benign prostatic hypertrophy
*Carotid intima-media thickness measured as stated by the Mannheim CIMT Consensus Report and American Society of Echocardiography Consensus.

views of the gallbladder, an axial view of the abdominal aorta, short and long axis views of the kidneys, sagittal and axial views of the urinary bladder, and sagittal and axial views of prostate or uterus transabdominally with a P21 probe (Table).

Following the hands-on session, the students were asked to perform a timed USEFUL on 2-3 healthy 18-25 year-old standardized subjects that the student had not previously scanned. The standardized subjects were scanned and confirmed to be devoid of any pathology by the ultrasound fellows prior to the beginning of the study. With exception of the CIMT, which was to be recorded, the students were only instructed to document whether each organ was grossly normal or abnormal, with the understanding that an official detailed exam would be performed if any abnormality were to be found. The table highlights many of the abnormalities evaluated for by the students. All images were evaluated in real time by two ultrasound fellows receiving commensurate training at the UCISOM. All data was collected and stored for evaluation. A Student's t-test was used for statistical analysis.

RESULTS

Of the 9 students who participated, 8 performed the USEFUL on 3 human models while one student performed the USEFUL on 2 human models. All ultrasound examinations were completed and deemed adequate by the ultrasound fellows evaluating the students in real time. No abnormalities were discovered. While the average time spent between all classes per USEFUL was 11 minutes and 19 seconds, the average time spent by Group 1 (n=2; no previous ultrasound experience) was 14 minutes and 9 seconds between six examinations. The average time spent by Group 2 (n=7; previous ultrasound training) was 10 minutes and 27 seconds between twenty examinations. Thus, the students from Group 2 who had received some of the integrated ultrasound curriculum performed the USEFUL significantly faster ($p<0.0025$).

Between all students, the time it took to complete the USEFUL ranged from 6 minutes and 32 seconds to 17 minutes and zero seconds, and it was found that student times, regardless of training, improved with each USEFUL. The average time spent completing the USEFUL on the first standardized patient between all students was 13 minutes and 20 seconds, while 11 minutes and 2 seconds, and 9 minutes and 20 seconds were spent performing the exam on the second and third patient, respectively. The improvement was significant between the first and second attempts ($p<0.0452$), and the first and third attempts ($p<0.0029$) but not between the second and third attempts ($p<0.086$).

DISCUSSION

The primary goals of this study were to determine if students were first capable of performing all of the various scans required of our USEFUL and a realistic assessment of the time required given different training levels and exam repetition. The students were able to complete all aspects of the USEFUL correctly, although it was observed that obtaining scans of the CIMT and gallbladder proved to be the most difficult and slowed the exam down significantly. Our data also shows that the time spent performing the USEFUL is inversely proportional to the amount of ultrasound training the students have received and that students have the potential to perform the exam more efficiently and attain our future goal of performing the USEFUL in six minutes. After only a 30 minute practice session, 4 of the 26 examinations were performed in

less than 7 minutes and 42 seconds, with the fastest being 6 minutes and 27 seconds. While it was not measured as part of our study, it is informally noted that the emergency medicine fellows were able to complete the USEFUL in 6 minutes. As the USEFUL is designed to be a supplement to the standardized physical exam, we chose 6 minutes as an acceptable length of time to add to an annual physical exam without impeding the flow of a busy primary care clinic. While the medical students were not able to perform the USEFUL in less than six minutes, it seems plausible that with additional practice, this would become a realistic result.

When designing the USEFUL, we structured it in the fashion of a standard physical exam and included scans of all the major organ systems evaluated by a primary care physician in an annual evaluation. In a thorough literature review, we were able to find only one study by Siepel et al[5] that discussed the addition of ultrasound into the physical exam. In this small study of 72 patients who were evaluated with an exam resembling our USEFUL performed by community-based physicians, 31% had abnormalities not identified by a traditional physical exam. Seven percent had serious conditions requiring treatment including endometrial carcinoma, abdominal aortic aneurysm, carotid stenosis, hydronephrosis, and urinary retention.[5] To further evaluate the utility of scanning each organ evaluated in the USEFUL, we reviewed the literature specific to the thyroid, carotids, heart, aorta, abdomen, and pelvis.

Ultrasound has been widely and successfully used as a screening tool for those at high risk for thyroid malignancies, and for further evaluation of patients with thyroid nodules or symptomatic thyroid dysfunction.[6,7] Conversely, screening of asymptomatic patients without an increased malignancy risk leads to the identification of mostly benign and clinically unimportant findings making thyroid ultrasound screening a costly procedure with a poor yield.[6,8] Given this convincing evidence, we would remove ultrasound evaluation of the thyroid gland from our USEFUL unless clinically indicated in an individual with a family history of thyroid neoplasms, symptomatic presentation, or a palpable nodule.

Evaluation of the internal carotid arteries by ultrasound to screen for carotid stenosis has been a topic of debate for several years given the high incidence of vascular disease and stroke. The most recent joint guidelines state that carotid duplex ultrasonography is justifiable in asymptomatic patients with known or suspected carotid stenosis, carotid bruits, peripheral arterial disease, coronary artery disease, atherosclerotic aortic aneurysm, or in patients with multiple cardiovascular risk factors.[9] While more conclusive studies need to be performed with regards to screening symptomatic and asymptomatic patients, sonographic screening may be clinically justifiable in many patients, and is an important component of our USEFUL. With annual CIMT measurements, the carotid arteries of many primary care patients can be monitored for stenosis over time.

In patients 65 years or older, multiple ultrasound cardiac findings including aortic stenosis, abnormal left ventricular ejection fraction, and stenosis of internal carotid arteries were found to be significantly and independently associated with an increased five-year mortality.[10] Evaluating these factors annually through a USEFUL, may improve management of these cardiovascular conditions and ultimately decrease mortality. In small preliminary studies, portable cardiac ultrasound has been found to significantly change the management strategy, provide time and cost savings by identifying cardiac disease missed by physical exam, and has the potential to be an effective screening tool for hypertrophic cardiomyopathy.[11-13] While more data is needed to determine the effectiveness of screening cardiac ultrasounds for conditions such as left ventricular hypertrophy, atrial hypertrophy, valvular abnormalities, hypertrophic cardiomyopathies, and pericardial effusions, it seems clear that evaluation of the heart using portable ultrasound is effective at recognizing basic cardiac conditions that are not necessarily identifiable by the standard physical exam and may deserve further work up and management.

Evaluation of the aorta using abdominal palpation has been found to only be moderately sensitive for detecting abdominal aortic aneurysms (AAA).[14] This has led to the 2010 guidelines published by multiple radiology societies suggesting screening abdominal ultrasounds to assess for AAA. Ultrasound examination for AAA is warranted in men over 64 years of age, women over the 64 years of age who have cardiovascular risk factors, and patients over 50 years of age with a history of aortic or peripheral vascular aneurismal disease.[15] Large AAA screening programs have shown that AAAs can be effectively diagnosed using portable ultrasound.[16-20]

Studies examining the abdomen using ultrasound as a general screening tool have been performed in Japan, Russia, and the United States. Abnormalities were detected in 18-44% of patients,[21-23] and required management in 3% of patients in the American study.[23] It is noted that while many of these abnormalities are benign, some severe pathologic findings such as renal cell carcinoma or carcinoma of the gallbladder are typically diagnosed incidentally.[24-25] However, while questions remain regarding the usefulness and cost-effectiveness of screening abdominal ultrasound exams in adults, one study screening infants for congenital kidney and urinary tract anomalies found screening to not be justifiable.[26] More research needs to be done to evaluate the utility of abdominal ultrasound screening, but as a component of our USEFUL, it may be helpful in identifying many benign and treatable abdominal pathologies.

Use of ultrasound to assess the pelvic region has long been utilized by obstetrics, gynecology, and urology as an important tool for evaluating the uterus, ovaries, prostate, and bladder. The American Institute of Ultrasound Medicine (AIUM) 2010 guidelines recommends a pelvic ultrasound

for women with 18 distinct conditions or symptoms, but does not discuss asymptomatic screening.[27] Studies seeking to determine the utility of ultrasound for endometrial and bladder cancer in asymptomatic patients have shown that its use as a screening tool is not yet validated.[28-29] While ultrasound is effective at identifying these cancers, the incidence of these conditions, like most cancers, are so low that questions of cost-benefit again arise. For our USEFUL, more research is needed to determine the utility of pelvic ultrasound screening for bladder, prostate, and uterine masses, and other more benign conditions like bladder diverticula and endometrial hypertrophy as components of an annual physical exam.

For the last few thousand years, the standard physical examination has been limited to use of the eyes, ears, and hands of the physician. With exception of the thermometer, ophthalmoscope, and digital stethoscope, using technological advances to increase the sensitivity of the annual physical exam as a screening tool has been largely excluded. However, we are not naïve to the complex realities of recommending a novel use of a medical tool. A review of the literature makes it clear that controversy exists about the utility of a widespread ultrasound screening exam. Clear evidence exists to reject screening exams of the thyroid. All other organ systems may benefit from sonographic evaluation, but there is not enough evidence currently to make this determination. The evidence is clearer when making recommendations for targeted bedside ultrasound examinations based on clinical suspicion rather than broad screening exams of all patients presenting for their routine physical examination.

There are also other challenges such as the initial investment. Though bedside ultrasounds have become more affordable, it still requires a large commitment and there are many questions about reimbursement for exams. We are also unable to assess the financial hardship to the health care system and the individual patient when finding incidental and possibly benign findings. To date, there is minimal epidemiologic data providing a cost-effectiveness analysis of using ultrasound to identify and treat early stage disease compared to the cost incurred for further work up and imaging of benign findings. But in an era of expensive and time-consuming imaging modalities such as computed tomography and magnetic resonance imaging, perhaps expanding the use of ultrasound might decrease the overall burden of imaging on the patient and the medical system. As an extreme example amongst a barren field of research, we have noted that using "quick-screen" methods of bedside ultrasound similar to our study may even be more cost-effective than the conventional duplex ultrasound examinations for patients at risk for an abdominal aortic aneurysm.[30]

Other concerns exist as well. One is that ultrasound is highly user dependent and a primary care physician would have to attain a basic skill set in order to reliably scan a patient in an environment were no official accreditation exists. AIUM produces standards and guidelines for the accreditation of ultrasound practices in various specialties wherein they recommend that a physician attain a minimum volume of 60-300 ultrasounds depending upon the type of accreditation.[31] For example, they also officially recognized the American College of Emergency Physicians (ACEP) recommendation requiring a minimum of 150 total emergency ultrasound examinations (with a range of 150-250 cases) for general emergency ultrasound competency.[32] However, no such accreditation exists for primary care physicians performing ultrasound. Additionally, there is also concern about the emotional stress felt by patients when an abnormal result is obtained as well as the potential for a false sense of security following a normal scan.

It is our hope that with this pilot study we have formulated a useful ultrasound-assisted physical exam structure that will exclude scanning of the thyroid gland in the future, and shed some light on its feasibility. We also believe we have demonstrated that the exam can be done in a modest amount of time so that it may be integrated into an outpatient clinical setting. While we are aware that our study had a limited number of participants and leaves more questions than answers, we hope that it sparks a discussion about the role of ultrasound in primary care. Meanwhile, we plan to next assess the feasibility and outcomes of the USEFUL in clinical practice, investigate its effect on the doctor-patient relationship, and report the impact a Family Medicine Ultrasound Elective could have on medical education.

LIMITATIONS

Several limitations exist in our study as discussed above. This was a proof-of-concept pilot study, with a limited number of students and examinations performed, decreasing the generalizability of the study. Additionally, one student could not complete the study after examining two patients secondary to personal reasons, which further decreases the number of examinations involved. Another important limitation is the fact that all of the examinations performed during the hands-on practice session and actual study were completed on healthy 18-25 year-old standardized subjects. However, we believe that given the novelty of the concept, it is a meaningful starting point for examining the role of ultrasound in primary care. This also means that there were limited resources and publications to review when discussing this study.

CONCLUSION

In this pilot study we found that all medical students, regardless of previous ultrasound training, were in fact able to correctly examine all organs featured in our USEFUL after a 25-minute demonstration by board eligible emergency medicine ultrasound fellows and a 30-minute hands-on practice session on standardized patients. Further, we found that students who have been a part of the integrated ultrasound in medicine curriculum performed the USEFUL significantly

faster than students who had not, and that all students were able to significantly improve upon the time it took them to complete the USEFUL with successive attempts. With this manuscript we have also outlined our primary ultrasound assessment as detailed in Table 1 for use in future studies and for those interested in medical education. Future endpoints are aimed at assessing the feasibility and outcomes of an ultrasound-assisted physical exam in a primary care setting and the exam's effect on doctor-patient satisfaction.

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Does Prolonged Length of Stay in the Emergency Department Affect Outcome for Stroke Patients?

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Introduction: Conflicting data exist regarding the association between the length of stay (LOS) of critically ill patients in the emergency department (ED) and their subsequent outcome. However, such patients are an overall heterogeneous group, and we therefore sought to study the association between EDLOS and outcomes in a specific subgroup of critically ill patients, namely those with acute ischemic stroke/transient ischemic attack (AIS/TIA).

Methods: This was a retrospective review of adult patients with a discharge diagnosis of AIS/TIA presenting to an ED between July 2009 and February 2010. We collected demographics, EDLOS, arrival stroke severity (National Institutes of Health Stroke Scale - NIHSS), intravenous tissue plasminogen activator (IV tPA) use, functional outcome at discharge, discharge destination and hospital-LOS. We analyzed relationship between EDLOS, outcomes and discharge destination after controlling for confounders.

Results: 190 patients were included in the cohort. Median EDLOS was 332 minutes (Inter-Quartile Range -IQR: 250.3–557.8). There was a significant inverse linear association between EDLOS and hospital-LOS ($p=0.049$). Patients who received IV tPA had a shorter median EDLOS (238 minutes, IQR: 194–299) than patients who did not (median: 387 minutes, IQR: 285–588 minutes; $p<0.0001$). There was no significant association between EDLOS and poor outcome ($p=0.40$), discharge destination ($p=0.20$), or death ($p=0.44$). This remained true even after controlling for IV tPA use, NIHSS and hospital-LOS; and did not change even when analysis was restricted to AIS patients alone.

Conclusion: There was no significant association between prolonged EDLOS and outcome for AIS/TIA patients at our institution. We therefore suggest that EDLOS alone is an insufficient indicator of stroke care in the ED, and that the ED can provide appropriate acute care for AIS/TIA patients. [West J Emerg Med. 2014;15(3):267–275.]

INTRODUCTION

Acute ischemic stroke (AIS) is a clinical emergency that requires immediate and aggressive treatment, from prompt identification of symptoms in the emergency department (ED) through rapid investigations and treatment to hospital discharge. Bench-marked timelines have been mandated for every step in the process,[1] leading to the creation of Primary Stroke Centers to standardize care delivery. In particular, as per the recommendations of the National Institute of Neurological Disorders and Stroke (NINDS) guidelines, transferring a stroke

patient to an inpatient setting should be achieved within 3 hours of arrival.[2] However, the limited availability of inpatient beds often results in access block, leading to an increase in the ED length of stay (EDLOS) for patients with stroke and transient ischemic attack (TIA).[3–5] Studies have reported the median EDLOS for stroke patients to be approximately 5 hours.[6,7] This can place an additional stress on the already overburdened ED, requiring personnel to not only provide emergent care but also devote time and resources for ongoing supportive care to stroke patients before transitioning to other areas of care within the hospital.

Numerous studies have evaluated the effects of prolonged LOS on the outcome of critically ill patients, with conflicting results.[6,8–11] Rincon et al[6] reported that critically ill stroke subjects waiting to be transitioned to intensive care unit (ICU) had a worse outcome when the EDLOS was $>$ 5 hrs. Contrary to this, Saukkonen and his colleagues in a similar study with a diverse population of 1,675 critically ill patients concluded that mortality rate for patients with EDLOS beyond 24 hours was not significantly different than those with a shorter EDLOS.[10] Elmer et al[7] found no association between EDLOS and functional outcome in patients with hemorrhagic stroke. However, the effect of EDLOS on outcome of patients with ischemic stroke or TIA (representing more than 85% of stroke patients)[12] remains largely unexamined.

Rapid patient transfer from ED is believed to prevent crowding, provide more streamlined care to the patients, and promote efficient hospital operation and improved patient satisfaction.[13] However, early discharge/transfer from the ED on the assumption that a prolonged LOS worsens outcome/mortality could promote inappropriately early transfers before the patient is stabilized and/or the recipient patient care unit is ready. Time criteria (such as that proposed by the NINDS) may be difficult to meet in busy tertiary care hospitals. Such perceived time pressures among providers can also lead to increased patient and family anxiety during this process.

Our aim in this study was to evaluate the effect of EDLOS on outcomes for patients presenting with AIS/TIA at our tertiary care academic center, after adjusting for common confounders such as initial stroke severity (National Institutes of Health Stroke Scale - NIHSS) and delivery of time-sensitive intravenous tissue plasminogen activator (IV tPA).

METHODS

Study Design and Data Sources

This was an institutional review board-approved retrospective record review of consecutive adult stroke/TIA patients presenting to our tertiary care center from July 2009 to February 2010. Our institution is a large academic primary stroke care center in upstate New York, with an annual turnover of nearly 600 acute ischemic stroke/TIA patients. Of these, approximately, half of them per year present within 12 hours of symptom onset. A flow chart is presented in Figure 1. Our protocol for management of AIS/TIA patients includes investigations (blood glucose, serum electrolytes, ECG, cardiac ischemia markers, PT, INR, aPTT, oxygen saturation) along with multi-modal CT imaging (plain CT, CT angiography & perfusion CT imaging). We reviewed medical records to identify all adult patients ($>$18 years age) with a final discharge diagnosis of AIS/TIA who presented within 12 hours since last seen normal and had documented completion of per-protocol multimodal CT, initial stroke severity, time of ED registration, and time of departure from the ED. We collected data on patient demographics, time since last seen normal, EDLOS, initial stroke severity (NIHSS), past medical history, hospital LOS, functional outcome as measured by modified Rankin scale (mRS) at discharge, discharge destination [home, home with services, skilled nursing facility (SNF), or acute rehabilitation unit (ARU)] and mortality at discharge. The EDLOS was documented from time of registration (time of arrival at ED) to time of departure from the ED. Functional outcome at discharge was dichotomized and mRS $\geq$3 was considered as poor outcome. To improve uniformity of the cohort under investigation, we excluded from this study pediatric patients, patients with hemorrhagic strokes, and patients who did not receive all protocol mandated investigations or imaging studies.

Data Collection

To improve accuracy and reduce errors/inconsistencies in abstracted data, we followed the guidelines stated by Lowenstein et al[14] during data collection process. All records were reviewed by a trained ED physician and a research fellow. Variables were explicitly defined and data was extracted from a standardized electronic medical record system. We resolved any discrepancy in the data by a common consensus between the abstractors. We calculated modified Rankin score at discharge based on occupational therapy and physical therapy notes. Inter-rater agreement was assessed for this parameter by having a sample of charts independently reviewed by the 2 data abstractors. Data was collected in MS Excel, then re-reviewed and cleaned before transfer into JMP statistical software by SAS Institute, Inc, for further analysis.

Statistical Analysis

We reported median and inter-quartile range (IQR) of continuous variables. We performed a bivariate Spearman's Rank correlation between EDLOS and age, time since last seen normal, initial stroke severity and hospital LOS. Spearman's ρ, 95% CI (Fisher's Z transformed) and p values were calculated for each correlation. We performed Wilcoxon/Kruskal Wallis tests to compare the association between EDLOS and administration of IV tPA and past history of comorbidities. A logistic fit was done to test the association between increasing EDLOS and poor outcome (mRS $\geq$3), death at discharge, discharge to SNF/death/ARU, and the association between hospital LOS and outcome. Finally, we performed a logistic regression to analyze the association between EDLOS on outcome, and discharge destination, after controlling for

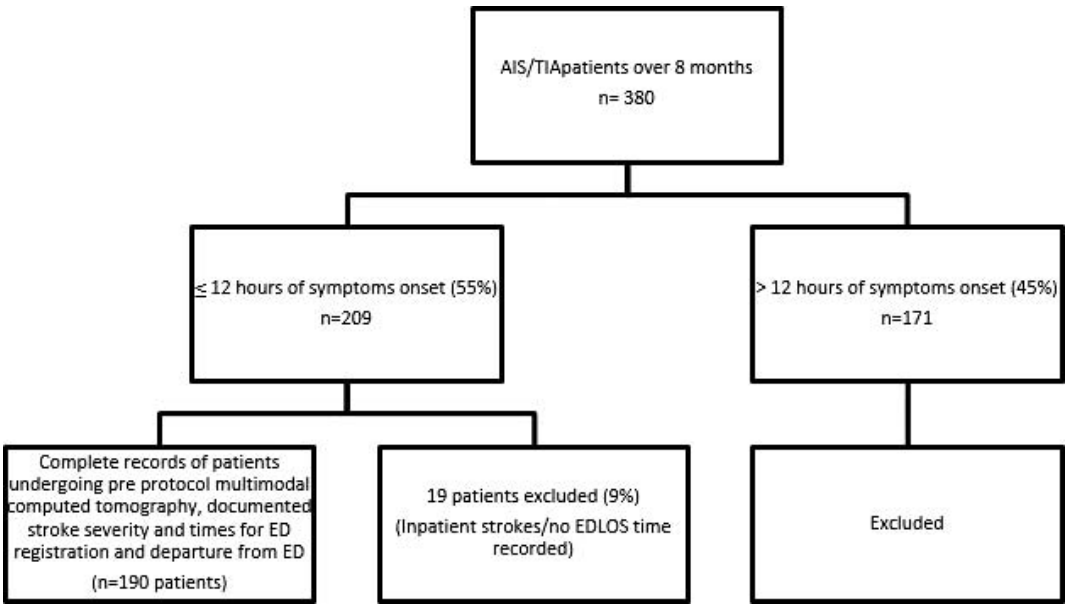

Figure 1. Flow chart indicating the final cohort of patients. This flow chart indicates that our hospital managed about 380 acute ischemic stroke (AIS) or transient ischemic stroke (TIA) patients from July 2009 to February 2010, of which 55% presented within 12 hours of symptom onset. Of these 209 patients, 19 (9%) patients were ineligible as they were either in hospital admissions/ did not have emergency department length of stay documented, leaving a final cohort of 190 patients).

administration of IV tPA, initial stroke severity and hospital LOS. This was done because high initial stroke severity, non-thrombolysis and prolonged hospital LOS are usually associated with poor outcome[15–18]. We repeated the above analysis for a sub cohort with only AIS patients, excluding patients with a final discharge diagnosis of TIA.

We performed all contingency analysis and multivariate analysis using JMP 9.0® and SAS 9.2® statistical software. The level of significant association was predetermined at $p<0.05$ for all analyses.

RESULTS

Patient Demographics

A total of 209 patients were eligible for this study. Complete data were available for 190 (91%) of these patients (Figure 1). Of these, 138 (72.6%) patients had a discharge diagnosis of AIS and the remaining 52 (27.4%) had a discharge diagnosis of TIA. The characteristics of patients are described in Table 1.

EDLOS and Outcome in Patients with AIS or TIA

There were no statistically significant associations between EDLOS and age, time since last seen normal, or various stroke risk factors, such as past history of stroke/TIA (p=0.25), CAD (p=0.18), dyslipidemia (p=0.63), hypertension (p=0.85), diabetes mellitus (p=0.22), smoking (p=0.09) or atrial fibrillation (AF) (p=0.19) (Table 2). Lower EDLOS was associated with higher initial stroke severity (p=0.0005) and increased hospital LOS (p=0.0497). There was no significant association between EDLOS and functional outcome/mRS ≥3 (Figure 2) (p=0.40), discharge destination (Figure 3) (SNF/death/ARU, p=0.20) or death at discharge (p=0.44).

Patients with poor outcome had a significantly longer hospital LOS (median 6 days, IQR 4–9) as compared to those with a good outcome (median hospital LOS 2 days, IQR 1–4 days; $p<0.0001$). Patients who received IV tPA had a significantly lower median EDLOS (238 minutes, IQR 194 – 299) as compared to patients who did not receive IV tPA (median EDLOS 387 minutes, IQR 285 – 588; $p<0.0001$).

We performed a logistic regression to assess the effect of EDLOS on outcomes (mRS at discharge ≥3 and discharge destination other than home) after adjusting for the above confounders - IV tPA, initial stroke severity and hospital LOS. This odds ratio and 95% CI are shown in Table 3. After controlling for the above variables, the association between EDLOS and poor outcome (p=0.695), and discharge destination other than home (p=0. 5019) remained statistically insignificant.

EDLOS and Outcome in Patients with AIS Alone

Restricting the analysis to only AIS patients revealed similar results, with no statistically significant associations between EDLOS and age, and stroke risk factors [past history of stroke/TIA (p=0.36), CAD (p=0.44), dyslipidemia (p=0.95), hypertension (p=0.46), diabetes mellitus (p=0.16), smoking (p=0.23) and AF (p=0.28)] (Table 4). There was a significant association between lower EDLOS and higher initial stroke severity (p=0.001). Although the trend between EDLOS and hospital LOS was similar as for all AIS/TIA patients, the association did not remain significant for the AIS-only cohort

Table 1. Characteristics of patients presenting with acute ischemic stroke or transient ischemic attack.

Variable	AIS/TIA (n=190) (n, %)	AIS (n=138) (n, %)
Age (Median, IQR)	71 (60–80)	69 (60–82)
Female gender	88 (46.3)	46 (42.6)
Time since last seen normal (Median, IQR)	138.5 (69–367.5)	155 (68 – 528)
NIHSS (Median, IQR)	4 (1–11)	6 (3–13)
Past history of comorbidities		
Stroke/TIA	61 (32.1)	41 (29.7)
Coronary artery disease	45 (23.7)	37 (26.8)
Dyslipidemia	85 (44.7)	58 (42.0)
Hypertension	142 (74.7)	106 (76.8)
Diabetes mellitus	45 (23.7)	39 (28.3)
Smoking	63 (33.2)	52 (37.7)
Atrial fibrillation	37 (19.5)	26 (18.8)
EDLOS (Median, IQR)	332 (250.3–557.8)	315 (232.5–561.8)
Thrombolysis	35 (18.4)	33 (23.9)
Poor outcome on discharge (mRS $\geq$ 3)	56 (29.5)	55 (39.9)
Hospital LOS	3 (2–6)	4 (2–7.3)
Discharge destination		
Home	92 (48.4)	53 (38.4)
Home with services	24 (12.6)	18 (13.0)
SNF	41 (21.6)	36 (26.1)
ARU	19 (10.0)	17 (12.3)
Mortality at discharge	14 (7.4)	14 (10.1)

AIS, acute ischemic stroke; *TIA,* transient ischemic attack; *IQR,* interquartile range; *NIHSS,* National Institutes of Health stroke scale; *ED*, emergency department; *LOS,* length of stay; *mRS,* modified Rankin score; *SNF,* skilled nursing facility; *ARU,* acute rehabilitation unit

(p=0.13). There was no association between EDLOS and poor outcome or discharge destination in this more narrowly defined cohort (Figures 4–5). Specifically, we found no statistically significant association between EDLOS and poor outcome (mRS $\geq$3) (p=0.41), discharge to SNF/ARU/death (p=0.20) or death at discharge (p=0.44) in AIS patients.

Patients with a poor outcome had a significantly longer hospital LOS (median 6 days, IQR 4–9) as compared to patients

Table 2. Emergency department length of stay and outcome in patients with acute ischemic stroke or transient ischemic attack.

Variable	Association with EDLOS	95% CI	p value
Age	$\rho = -0.12$	-0.26 to 0.02	0.10
Time since last seen normal	$\rho = 0.14$	-0.002 to 0.276	0.06
NIHSS	$\rho = -0.25$	-0.38 to -0.11	0.0005*
Hospital LOS	$\rho = -0.14$	-0.28 to 0.002	0.0497*
Poor outcome (mRS $\geq$ 3)	OR = 0.99	0.99 to 1.00	0.40
Discharge destination			
Home/Home with services	OR = 1.00	0.99 to 1.00	0.20
SNF/death	OR = 0.99	0.99 to 1.00	0.54
ARU	OR = 0.99	0.99 to 1.00	0.19
Mortality at discharge	OR = 0.99	0.99 to 1.00	0.44

mRS, modified Rankin score, *SNF,* skilled nursing facility, *ARU,* acute rehabilitation unit, *OR,* odds ratio, *CI,* confidence intervals; ρ, Spearman's correlation coefficient

* A statistically significant inverse correlation was found between EDLOS and only initial stroke severity (NIHSS) and hospital LOS for patients presenting with AIS or TIA.

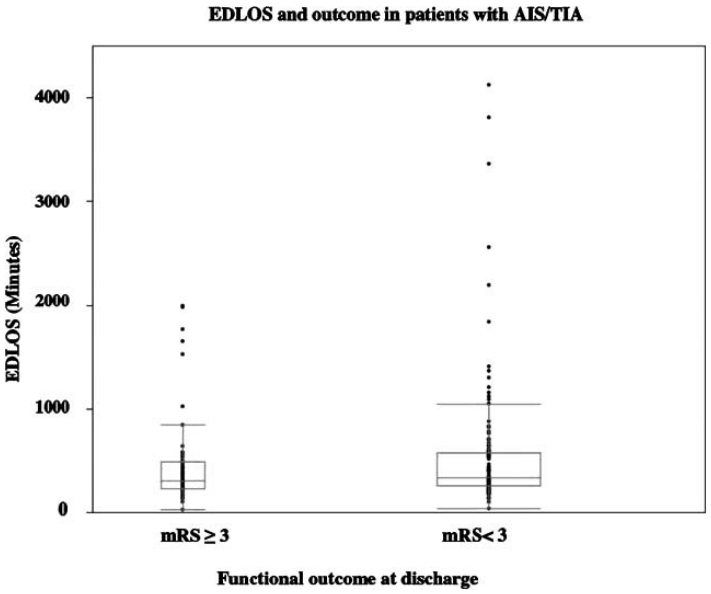

Figure 2. Emergency department length of stay and outcome in patients with acute ischemic stroke or transient ischemic attack. There was no significant difference in median emergency department length of stay of patients with poor outcome (modified Rankin score [mRS] ≥ 3) (307.5 min, interquartile range [IQR] 228.3.3–492.3) versus patients with good outcome (337 min, IQR 257.8–577.3; p=0.15).

with good outcome (median hospital LOS 3 days, IQR 2–5 days; p<0.0001). In the AIS group, patients who received IV tPA (n=33) had a significantly shorter median EDLOS (238 minutes, IQR 195.5 – 292) as compared to patients who did not receive IV tPA (median EDLOS 399 minutes, IQR 280.5 – 623; p<0.0001).

After adjusting for potential confounders (differences in IV tPA administration rates, initial stroke severity and hospital LOS), we did not find any statistically significant association between EDLOS and poor outcome (p=0.98), or discharge destination other than home (p=0.70) in patients with AIS alone. This is shown in Table 5.

DISCUSSION

We chose to focus our study on patients with AIS/TIA because of strict guidelines and compliance mandated by the Joint Commission and the State Department of Health for Primary Stroke Centers with respect to this patient population. Our data suggest that there is no significant impact of increased EDLOS on outcome of AIS/TIA patients, even after controlling for presenting stroke severity, IV tPA delivery and total hospital LOS at our tertiary care academic center. In contrast, when examining all stroke subtypes, Rincon et al[6] found that of 519 stroke patients, EDLOS adversely affected outcome in 75 patients who were admitted to a neurointensive care unit. Despite adjusting for presenting NIHSS, we did not find this association in our subpopulation of AIS/TIA patients. Our data parallel the findings by Elmer et al,[7] which showed no association between EDLOS and functional outcome in patients with hemorrhagic stroke. In a broader population, Varon et al[19] studied 50 consecutive patients admitted to ICU from the ED and found similar survival rates in patients who received critical care procedures in the ED versus patients who received similar interventions in an ICU setting.

We found no difference in mortality or discharge destination with respect to EDLOS in our patients. Similarly, Saukkonen et al[10] looked at a broader critically ill patient population, including patients with neurological diseases, and reported that EDLOS (>24 hours) was not associated with hospital mortality or quality of life at 6 months post discharge. Using a similar >24 hour cut-off point for EDLOS, a study of 443 critically ill patients in 2001–2002 found that mortality rate for stroke patients was unaffected by EDLOS.[11] However, at our institute (and many others in the U.S. today) patient stays in the ED>24 hours are considered as "sentinel events" (only 5.8% subjects in our study population had EDLOS >24 hours), with strict protocols designed to prevent such an occurrence. The results of prior studies may therefore be less applicable in the environment that exists today. Data from our study suggest that even with current protocols mandating early transfer to in-patient units or ICU, increased EDLOS does not affect functional outcomes or mortality in AIS/TIA patients.

With changing Medicare and Medicaid reimbursements, there has been an increasing focus on reduction of overall length of stay in the hospital. Studies have shown that

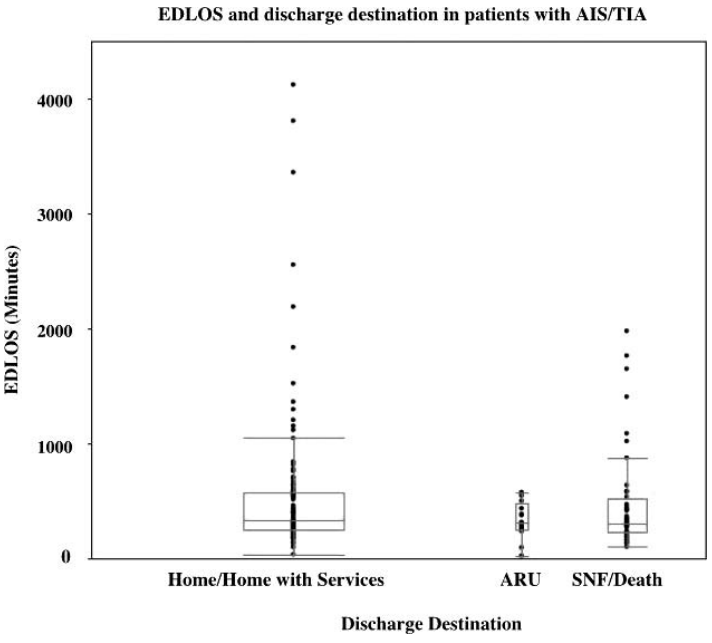

Figure 3. Emergency department length of stay and discharge destination in patients with acute ischemic stroke (AIS) or transient ischemic attack (TIA). There was no significant association between EDLOS and discharge destination, with median EDLOS (IQR) of 337 (254–574), 312 (253.5–483.3), and 301 (228.3–519.3) minutes for discharge to home/home with services, acute rehabilitation unit (ARU) or skilled nursing facility (SNF)/death, respectively.

Table 3. Logistic regression output for association between emergency department length of stay and outcome in acute ischemic stroke and transient ischemic attack patients.

Variable	OR	95% CI	P
Poor outcome (mRS ≥3)			
EDLOS	1	0.999 – 1.000	0.8179
Initial stroke severity (NIHSS)	1.20	1.13 – 1.29	<0.0001
Thrombolysis	0.61	0.21 – 1.63	0.3392
Hospital LOS	1.02	0.98 – 1.10	0.4178
Discharge destination other than home			
EDLOS	1	0.999 – 1.000	0.5019
Initial stroke severity (NIHSS)	1.19	1.12 – 1.28	<0.0001
Thrombolysis	0.68	0.24 – 1.82	0.4546
Hospital LOS	1.17	1.05 – 1.32	0.006

mRS, modified Rankin score, *NIHSS*: National Institutes of Health stroke scale; *OR*, odds ratio; *CI*, confidence intervals

prolonged EDLOS contributes to longer hospital LOS, which is considered a surrogate marker for poor outcome or inefficient care.[20] In contrast, we found that a shorter EDLOS at our institution was paradoxically associated with increased hospital LOS, although this may be due to the association between shorter EDLOS and higher initial stroke severity in our cohort. Overall, we found no significant association between EDLOS and poor outcome, suggesting that delivery of care in the ED can be efficient and congruent with the care delivered in subsequent hospital settings for this patient subgroup.

Some authors have explained the association of long EDLOS to poor outcome by linking it to triage preferences, suggesting that patients with good prognosis might be treated, triaged and/or transferred early from the ED at the expense of patients with worse prognosis and/or comfort care order.[9] By only analyzing AIS/TIA patients who had uniformly completed all investigations and imaging studies, as well as adjusting for time dependent IV tPA delivery and initial stroke severity, we attempted to avoid such limitations in our analysis.

Out data shows that EDLOS does not affect outcome, but does not indicate why. It is possible that outcome after AIS/TIA is mostly dependent upon factors such as initial stroke severity, thrombolysis and time from onset, none of which are affected by EDLOS. (Thrombolysis usually occurs within the ED setting). Yet even after adjusting for the above factors, there was no significant association between EDLOS and outcome. Differences in EDLOS may reflect practical availability of beds elsewhere in the hospital, and overall minor variations in EDLOS (measured in hours rather than days) may be unlikely to affect the overall outcome of AIS/TIA. This of course assumes that the ED is capable of providing the appropriate acute/critical care needed within the first few hours of AIS/TIA, which we believe holds at most institutions, including our own. The above reasons, while speculative, do call into question the

Table 4. Emergency department length of stay and outcome in patients with acute ischemic stroke alone.

Variable	Association with EDLOS	95% CI	p value
Age	$\rho = -0.11$	−0.27 to 0.06	0.18
Time since last seen normal	$\rho = 0.19$	0.02 to 0.35	0.03*
NIHSS	$\rho = -0.27$	−0.42 to −0.11	0.001*
Hospital LOS	$\rho = -0.13$	−0.29 to 0.04	0.13
Poor outcome (mRS ≥ 3)	OR = 0.999	0.998 to 1.00	0.41
Discharge destination			
Home/Home with services	OR = 1.00	0.99 to 1.00	0.20
SNF/death	OR = 0.99	0.99 to 1.00	0.59
ARU	OR = 0.99	0.99 to 1.00	0.19
Mortality at discharge	OR = 0.999	0.996 to 1.00	0.44

NIHSS, National Institutes of Health stroke scale; *mRS,* modified Rankin score; *SNF,* skilled nursing facility; *ARU,* acute rehabilitation unit; *OR,* odds ratio; *CI,* confidence intervals; ρ, Spearman's correlation coefficient

* Considering the subgroup of patients presenting with AIS alone, a statistically significant inverse correlation was found between EDLOS and only initial stroke severity (NIHSS).

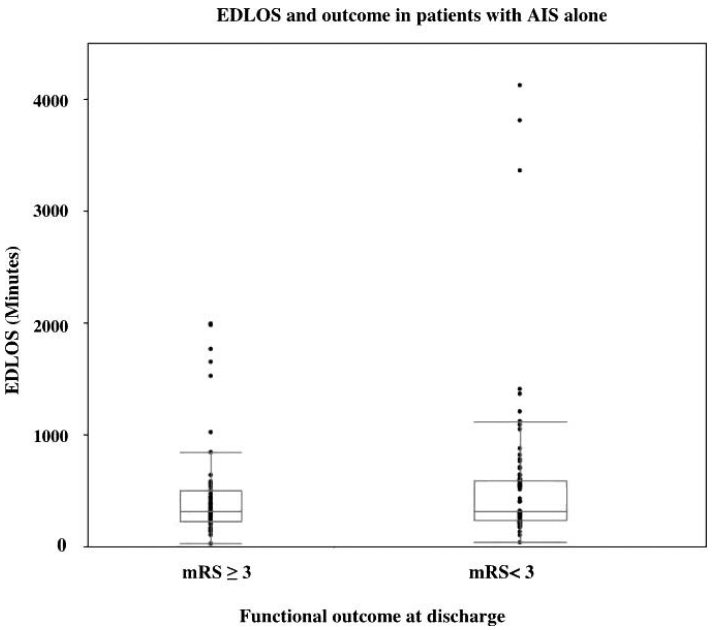

Figure 4. Emergency department length of stay and outcome in patients with acute ischemic stroke (AIS) alone. There was no significant difference in median EDLOS of AIS patients with poor outcome (modified Rankin score [mRS] $\geq$ 3) (309 min, interquartile range [IQR] 229–499) versus patients with good outcome (316 min, IQR 233–592; p=0.38).

focus on EDLOS as a measure of quality of care, if no direct correlation can be found between EDLOS and eventual patient outcomes.

We emphasize that our study does not provide data regarding the benefits of transferring AIS/TIA patients from ED to higher levels of care, and believe that transferring appropriate patients early helps operational efficiency in the ED by decreasing crowding and resource utilization. We only suggest that focusing on EDLOS as the sole or key indicator of quality of stroke care in the ED may be inaccurate, as increased EDLOS alone does not seem to bear upon outcomes of patients with AIS/TIA.

LIMITATIONS

There were several limitations identified during our study. The primary outcome was mRS at discharge. Some have argued that mRS and death may not be the best outcome measures to study the effect of EDLOS, and have proposed looking at other surrogate markers, such as quality adherence and time to antibiotics, as they are less patient specific.[22,23] However, the inability of surrogate markers to produce consistent results is well documented, and we felt it more reasonable to use mRS, which is a routinely used functional outcome score for stroke patients.[24,25] In addition to this, we reported outcomes at discharge. While prospective large-scale stroke trials have typically assessed outcome at 3 months, we were unable to do so due to the retrospective nature of our study and the availability of data within the existing records. We hope to address this limitation in a future prospective study.

We were also not able to do a formal power calculation for this study, since this was not a prospective comparison of 2 groups with a pre-specified EDLOS cutoff. Rather, our study retrospectively analyzed patient outcome in relation to EDLOS as a continuous variable, and used multivariate regression to adjust for confounders in this analysis.

Our study was conducted at a single center and the conclusions should be cautiously generalized to other hospitals due to variability in the geographic location, level of care offered, patient management and outcome metrics of other institutes. The study was conducted at a tertiary academic teaching center, which is a certified Primary Stroke Center, with a 24×7 availability of in-house neurologists/neurosurgeons providing immediate care to stroke patients. Thus, there is simultaneous involvement of multiple specialties – ED, Neurology, and Neurosurgery within the ED itself to coordinate and deliver care. This could also limit the generalizability of our results to other institutions without a similar structural and functional setup.

CONCLUSION

Our study concluded that there was no significant association between ED length of stay and mRS, mortality, or

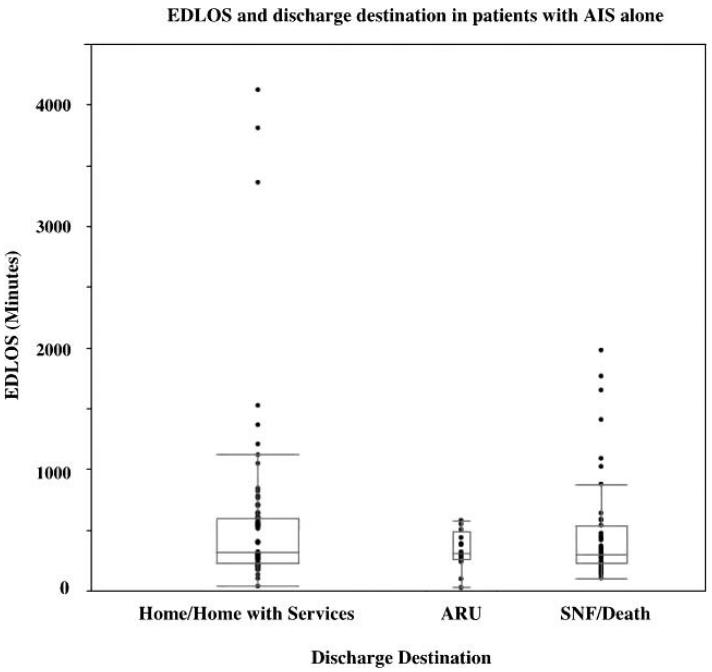

Figure 5. Emergency department length of stay (EDLOS) and discharge destination in patients with acute ischemic stroke (AIS) alone. There was no significant association between EDLOS and discharge destination, with median EDLOS (IQR) of 317.5 minutes (229–600.3), 312 minutes (253.5–483.3), and 301 (228.8–535.5) minutes for discharge to home/home with services, acute rehabilitation unit (ARU), or skilled nursing facility (SNF)/death, respectively.

Table 5. Logistic regression output for association between emergency department length of stay and outcome in acute ischemic stroke patients only.

Variable	OR	95% CI	P
Poor outcome (mRS $\geq$3)			
EDLOS	1	0.99 – 1.003	0.9839
Initial stroke severity (NIHSS)	1.18	1.11 – 1.27	<0.0001*
Thrombolysis	0.63	0.23 – 1.65	0.3581
Hospital LOS	1.01	0.97 – 1.1	0.6176
Discharge destination other than home			
EDLOS	1	0.999 – 1.004	0.7001
Initial stroke severity (NIHSS)	1.18	1.10 – 1.28	<0.0001*
Thrombolysis	0.71	0.25 – 1.92	0.5076
Hospital LOS	1.10	1.00 – 1.25	0.094

mRS, modified Rankin score, *NIHSS,* National Institutes of Health stroke scale; *SNF,* skilled nursing facility, *ARU,* acute rehabilitation unit, *OR,* odds ratio; *CI,* confidence intervals

discharge destination for acute ischemic stroke or TIA patients presenting to a tertiary care academic ED.

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Follow Up for Emergency Department Patients After Intravenous Contrast and Risk of Nephropathy

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Introduction: Contrast-induced nephropathy (CIN), defined as an increase in serum creatinine (SCr) greater than 25% or ≥0.5 mg/dL within 3 days of intravenous (IV) contrast administration in the absence of an alternative cause, is the third most common cause of new acute renal failure in hospitalized patients. It is known to increase in-hospital mortality up to 27%. The purpose of this study was to investigate the rate of outpatient follow up and the occurrence of CIN in patients who presented to the emergency department (ED) and were discharged home after computed tomography (CT) of the abdomen and pelvis (AP) with IV contrast.

Methods: We conducted a single center retrospective review of charts for patients who required CT of AP with IV contrast and who were discharged home. Patients' clinical data included the presence of diabetes mellitus, hypertension, chronic kidney disease (CKD) and congestive heart failure (CHF).

Results: Five hundred and thirty six patients underwent CT of AP with IV contrast in 2011 and were discharged home. Diabetes mellitus was documented in 96 patients (18%). Hypertension was present in 141 patients (26.3%), and 82 patients (15.3%) were on angiotensin-converting-enzyme inhibitors (ACEI). Five patients (0.9%) had documented CHF and all of them were taking furosemide. Seventy patients (13%) had a baseline SCr >1.2 mg/dL. One hundred fifty patients (28%) followed up in one of the clinics or the ED within one week after discharge, but only 40 patients (7.5%) had laboratory workup. Out of 40 patients who followed up within 1 week after discharge, 9 patients (22.5%) developed CIN. One hundred ninety patients (35.4%) followed up in one of the clinics or the ED after 7 days and within 1 month after discharge, but only 71 patients (13.2%) had laboratory workup completed. Out of 71 patients who followed up within 1 month, 11 patients (15%) developed CIN. The overall incidence of CIN was 15.3% (17 out of 111 patients).

Conclusion: There was a poor outpatient follow up after CT of AP with IV contrast and biochemically CIN appears to be present in some patients. Unlike previous reports that CKD is the major risk factor for CIN, our results demonstrated that risk factors such as advanced age, DM and hypertension seem to predispose patients to CIN rather than abnormal baseline SCr. [West J Emerg Med. 2014;15(3):276–281.]

INTRODUCTION

Contrast-induced nephropathy (CIN), defined as an increase in serum creatinine (SCr) greater than 25% or ≥0.5 mg/dL within 3 days of IV contrast administration in the absence of an alternative cause, is the third most common cause of new acute renal failure in hospitalized patients.[1-3] Usually CIN is diagnosed by serial laboratory examination in hospitalized patients.[4-7] The SCr level returns within 1 to 3 weeks to baseline or a new baseline on serial follow up, and CIN is believed to resolve within 3 weeks.[8] The overall incidence of CIN is estimated to be 4.96% even if it varied based on the presence of various risk factors.[9,10] In general, CIN is known to increase in-hospital mortality up to 27%.[1,5] Hospitalized patients are subjected to serial laboratory examination, and once they develop CIN specialists such as nephrologists evaluate and advise on the management. In addition, nephrotoxic drugs are withheld and the patients' fluid status is monitored and adjusted. To monitor for development of CIN some authorities recommend measuring the SCr repeatedly for more than 48 hours after administration of intravenous (IV) contrast.[11] Patients that are discharged from the ED following the administration of IV contrast for computed tomography (CT) of abdomen and pelvis (AP) are not subjected to serial laboratory examination, including SCr. Hence, the incidence and outcomes of CIN in these patients are unknown. Moreover, the fluid intake and medication compliance in these patients are not regulated or monitored after discharge.

The incidence of CIN in an outpatient setting has been studied prospectively by Mitchell et al.[12] Their study ensured regular follow up with a team that followed patients for the purpose of the study. Our study focused on a population with low socio-economic status, no regular primary care physician, and poor clinic follow up.

We investigated the rate of outpatient follow up and incidence of CIN in patients who had been discharged from the ED after undergoing CT of AP with administration of IV contrast. The purpose of this retrospective study was to investigate the rate of outpatient follow up and the incidence of CIN in patients who presented to the ED, received CT of AP with IV contrast and were discharged home. Particularly noted were patients with underlying congestive heart failure (CHF), hypertension and diabetes mellitus (DM). These conditions were considered as risk factors and were used as data collection elements with a plan to test to see if they contributed to the development of CIN in our population.

METHODS

We conducted a retrospective review of charts from patients who presented to our ED with conditions requiring CT of AP with IV contrast and who were discharged home from January 1, 2011, to December 31, 2011. This review was approved by the institutional review board. We conducted the study in a single urban academic center with annual visit approximately 70,000 patients. Patients were identified using current procedural terminology (CPT) codes for CT of AP with IV contrast. All patients who received CT in the ED and were subsequently discharged were selected for the study. We reviewed the electronic patient charts for demographics, number of CTs, laboratory results, disposition, clinic follow up, medication use and co-morbidities. Two independent groups reviewed the charts and adjusted missing or conflicting data as needed. Patients who had conflicting or missing data were removed from the study. Records were reviewed to see whether these patients followed up in one of the specialty clinics, the medical clinic or the ED within 1 week and after 1 week, but within 1 month from discharge after undergoing CT of AP with IV contrast in the ED. We noted baseline kidney function on the day of their ED visit and results on subsequent visits. We defined CIN as an increase in Scr greater than 25% or ≥0.5 mg/dL from the base line as it was accepted in the literature.[9]

Our institution uses two types of IV contrast medium: [Omnipaque (Iohexol) for patients with SCr less than 1.5 mg/dl and Visipaque (Iodixanol) for those with SCr 1.5-2.0 mg/dl)].The bolus dose of the contrast medium is either 120 ml or 150 ml of the corresponding contrast agent, depending on the weight of the patient. Patients who weigh >210 pounds (lbs) or approximately 95 kilograms (Kg) receive 150 ml and patients who weigh 180 lbs (81 Kg)-210 lbs (95 Kg) receive 120 ml. Patients who weigh less than 180 lbs (81Kg) receive 1.5 ml/Kg.

Finally, we analyzed the results using descriptive statistics Software SPSS 13. Chi square analysis was used to evaluate the proportion of patients that developed CIN after the use of IV contrast.

RESULTS

Five hundred thirty-six patients underwent CT of AP with IV contrast in 2011 and were discharged home. Two hundred ninety-seven patients (55.4%) were females and 239 (44.6%) were males. In the prospective study by Mitchell et al the mean age for developed CIN was 54 years.[12] We arbitrarily chose the age of 50 as the threshold to stratify age as a risk factor for developing CIN. Three hundred and eighteen of the patients (59.3%) were younger than 50 years old and 218 (40.7%) were older than 50. Diabetes mellitus was documented in 96 patients (18%). Hypertension was present in 141 patients (26.3%) and 82 patients (15.3%) were on angiotensin-converting-enzyme inhibitors (ACEI). Five patients (0.9%) had documented CHF and all of them were taking furosemide. Four hundred sixty-six patients (87%) had a baseline Scr <1.2 mg/dL and 70 (13%) had a baseline SCr >1.2 mg/dL. Sixty-one patients (11%) had an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m² of which 49 (80.3%) had a Scr <1.5 mg/dL. Eighty-seven patients (16.2%) underwent 2 or more CT AP with IV contrast within 1 year. Forty nine patients (9.1%) had a hemoglobin A1C (HbA1C) level >7% as a marker of poorly

Table 1. Demographics and clinical data of all patients.

Demographics and clinical data	Number of patients (n=536)	%
Female	297	55.4
Male	239	44.6
Diabetes mellitus	96	17.9
Hypertension	141	26.3
ACEI use	82	15.3
HbA1C >7%	49	9.1
Baseline SCr >1.2 mg/dL	70	13.1
Two or more CT of AP with IV contrast	87	16.2

ACEI, angiotensin-converting-enzyme inhibitor; *CHF,* congestive heart failure; *HbA1C,* hemoglobin A1C; *SCr,* serum creatinine; *CT,* computed tomography; *AP,* abdomen and pelvis

controlled DM.

One hundred fifty patients (28%) followed up in one of the clinics or the ED within 1 week after discharge, but only 40 patients (7.5%) had laboratory workup. Out of 40 patients who followed up within one week after discharge, 9 patients (22.5%) developed CIN. One hundred ninety patients (35.4%) followed up in one of the clinics or the ED after 1 week and within 1 month after discharge, but only 71 patients (13.2%) had laboratory workup completed. Out of 71 patients who followed up after 1 week and within 1 month, 11 patients (15%) developed CIN. Of all patients who had laboratory tests on follow up visits, 17/111 patients (15.3%) patients were found to have an elevated SCr. Of the 9 CIN patients who followed up within 1 week after discharge 4 patients (44.4%) came back to the clinic within 1 month. Three of them (75%) continued to have CIN biochemically. One of them (25%) had worsening of the renal function (from 18% on 1 week follow up to 55% on 1 month follow up) and the renal function of the second patient stayed reduced at 25%. Two other patients (50%) improved their renal function. One of them improved from 88% to 13% and the other one from 200% to 150%, but remained to have CIN biochemically.

Demographics and clinical data of patients are listed in Tables 1 and 2.

DISCUSSION

The incidence of CIN has been studied in hospital patients with underlying medical conditions.[4,13-16] Admitted patients are usually subjected to serial laboratory examination, fluid input and output monitoring, and care is taken to not expose them to medications that could cause kidney injury. The same might not be true for discharged patients, as their fluid intake is not regulated and they may potentially resume nephrotoxic medication, such as certain antibiotics or non-steroidal anti-inflammatory drugs (NSAIDs), either by not following instructions or for lack of proper instruction.

The exact mechanism leading to CIN is not clear, but combinations of toxic and ischemic injury to tubular cells are suggested as contributory factors. The proposed mechanism for contrast-induced nephropathy include increased fluid viscosity secondary to the contrast agent concentration due to medullar hyperosmolar environment, which leads to decreased flow in the medullary tubules and vessels.[17-21] The reduced flow leads to increased contact time of contrast medium and tubular cells and subsequent production of radical oxygen species resulting in cytotoxic damage.[22,23] Direct cytotoxic effect of contrast medium on tubular cells is also one of the mechanisms suspected to cause tubular cell injury.[19] In addition, medullary vasoconstriction causes hypoxic cellular injury.[20,24,25] The presence of risk factors is likely to contribute to and/or augment the kidney injury.[18,26] The effects and incidence of CIN were studied prospectively in the ED setting in patients who underwent CT of the chest with IV contrast.[12,27-29] These studies revealed a rate of CIN up to 12%. Hospitalized patients who undergo CT of AP may receive pre-procedural hydration for up to 12 hours when needed. In emergency situations there is not much time to hydrate patients for 12 hours prior to obtaining CT. This puts discharged ED patients at greater risk for developing CIN after receiving IV contrast for CT of AP, particularly in patients with underlying medical conditions such as DM and hypertension. The majority of patients in our area have no primary care physician and they rarely use the medical clinic for follow up.

The best strategy for management of CIN is to avoid its occurrence. Therefore, it is of paramount importance to

Table 2. Clinical data and number of patients who had laboratory test and developed contrast-induced nephropathy (CIN) at follow-up visits.

Clinical data	Number of patients (n=536)	SCr within 7 days (n=40)	CIN within 7 days (n=9)	SCr after 7 days to 1 month (n=71)	CIN after 7 days to 1 month (n=11)
Age ≥50 years old	218 (40.7%)	21 (52.5%)	5 (55.6%)	36 (50.7%)	9 (81.9%)
Diabetes mellitus	96 (17.9%)	13 (32.5%)	3 (33.6%)	25 (35.2%)	7 (63.6%)
Hypertension	142 (26.5%)	18 (45.0%)	4 (4.4%)	30 (42.3%)	7(63.6%)
CHF	5 (0.9%)	2 (5.0%)	0	2 (2.8%)	0
Diuretics use	5 (0.9%)	0	0	2 (2.8%)	0
HbA1C >7%	49 (9.1%)	8 (2.0%)	1 (11.1%)	13 (18.3%)	3 (27.3%)
SCr ≥1.2 mg/dL	70 (13.1%)	5 (12.5%)	0	9 (12.7%)	0

ACEI, angiotensin-converting-enzyme inhibitor; *CHF,* congestive heart failure; *HbA1C,* hemoglobin A1C; *SCr,* serum creatinine

identify patients at risk using a simple questionnaire regarding underlying medical conditions and nephrotoxic drug usage. Scoring systems have been developed to predict the risk for developing CIN [30,31] These scoring systems may be used to identify patients at risk for developing CIN in the ED. The likelihood of developing CIN can be estimated by the number of risk factors present before the administration of IV contrast. Patient-related risk factors are divided into major (preexisting renal disease and DM) and minor (advanced age, female gender, hypertension and nephrotoxic drugs).[11] Although the incidence of CIN is low in patients with normal renal function, the incidence may be as high as 25% in patients with preexisting renal impairment or other risk factors, such as DM, CHF, advanced age, and concurrent use of nephrotoxic drugs.[2]

The risk assessment for developing CIN can be made qualitatively based on the risk factors and quantitatively with blood urea nitrogen (BUN) and SCr. The risk of CIN increases with the number of risk factors. Preexisting renal impairment is an independent risk factor and risk predictor for CIN.[32-34] In addition to preexisting renal impairment other risk factors for developing CIN are thought to be advanced age, CHF, DM and dehydration.[32,35-37]

It has been shown in 1 model that the risk of developing CIN was relatively constant at baseline SCr level <1.1 mg/dL, but increased sharply at levels >1.2 mg/dL.[13] According to the CIN Consensus Working Panel the risk of CIN is elevated and becomes clinically important when the baseline SCr level is ≥1.3 mg/dL in men and ≥1.0 in women, equivalent to estimated eGFR <60 mL/min per 1.75 m².[8,33] Unfortunately SCr lacks the sensitivity to identify clinically significant CIN and some recommend using eGFR as a better marker to identify CIN.[6] A recent study demonstrated that the commonly used SCr cutoff of 1.5 mg/dL for IV contrast administration fails to identify up to 40% of the ED patients at risk for CIN.[38] In addition, important measures to minimize CIN are volume expansion before the procedure, adequate fluid intake after the procedure, avoidance of nephrotoxic drug use and early follow up to assess renal function in high risk patients.

Outpatient clinic follow up is an essential part of patient management and continuity of care. Noncompliance with follow up in the outpatient clinic is a well-known problem worldwide. Both patient and hospital-related factors, such as transport constraints and crowding, play a role in delayed or absence of outpatient follow up.[39-43] Close follow up is very important in high risk patients in order to identify complications at early stages and treat them appropriately. Failure to follow up can have serious consequences particularly in patients with underlying medical conditions, such as preexisting renal insufficiency, CHF, DM and hypertension.[39]

Our retrospective study showed that a significant portion of patients in our community did not follow up for evaluation and blood testing after discharge from the ED. The overall incidence of CIN after CT of AP with IV contrast was 15.3% (17 patients out of 111). We had 2 groups (follow up within a week and follow up after a week until 1 month after discharge). The second group was to see if the CIN had resolved or progressed. The true incidence is unknown due to poor follow up, inclusion of patients with only CT of AP with IV contrast and missing data from patients who followed up outside of our hospital. It is not obvious whether the biochemical changes as reflected in worsening SCr have any clinical significance. A mortality from CIN was reported in the Mitchell et al study.[27,28] In our study relevant clinical information, such as vomiting, nausea, altered mental status or uremia, was not recorded at the clinic visit. Eighty-seven patients (16.2%) had 2 or more CT of AP with IV contrast within 1 year. Of these 87 patients, 5 (5.7%) developed CIN within 1 week and 6 additional patients (6.9%) developed CIN within a 1-month period. Thirty three percent of the patients who developed CIN in both follow ups were older than 50, had DM and received 2 or more CT of AP with IV contrast within 1 year. The likelihood of developing CIN increases with the number of risk factors.

This retrospective study highlights that a fair number of patients with risk factors for developing CIN were discharged from the ED after receiving CT of AP with IV contrast. Only a few followed up in the clinic, and some developed CIN (at least biochemically, Tables 1 and 2). Without long term follow up with SCr, or better with eGFR measurements and clinical evaluation of discharged patents, it is difficult to estimate the true incidence and the outcomes of CIN. A prospective study with long term follow up with SCr and clinical evaluation of high risk patients may guide the future approach regarding CIN in patients undergoing CT of AP with IV contrast in the ED.

The likelihood of developing CIN increases with the number of risk factors.[32,33,44,45] Patients can be stratified for risk of developing CIN based on the number of risk factors they have at the first ED visit. Further management recommendations should be made based on preexisting risk factors, the laboratory results and clinical evaluation at the first follow up visit.

A prospective study assessing both clinical parameters and biochemical changes may give a better picture of CIN in patients discharged from ED after CT of AP with IV contrast. In addition, information with regard to the amount of fluid intake and whether or not they have stopped taking nephrotoxic drugs should be obtained.

One possible intervention would be to identify high risk patients based on a scoring system in the ED and develop a callback system to ensure these patients return to either the ED or to one of our hospitals' clinics for follow up and laboratory testing to assess kidney function on days 2 or 3. Patients should receive clear instruction about the need to follow up after receiving CT of AP with IV contrast.

LIMITATIONS

The study is limited by small sample size due to lack of follow up. It is a single center retrospective study with lack of some relevant information due to lack of documentation. In addition, our study focused on CT of AP and did not include patients who had CT of other parts of the body, such as the chest and head, and we did not track whether patients had other nephrotoxins or CT of other organ systems during the study period that may have accounted for CIN without our knowledge. We followed up patients just for 1 month. The results of the short-term follow up might not reflect the natural course of CIN. Furthermore, the laboratory results of patients who followed up in their primary care physicians' office or other hospitals were not included in our study. It was not clear from the chart review whether or not hypotensive episodes were present in patients with CIN as well as the amount of fluid intake after discharge. The role of other potential causes of nephropathy, such as CHF and nephrotoxic drugs especially long term, could not be studied in this setting. Moreover, patients received 2 different types of contrast based on their baseline SCr and different doses based on their bodyweight. The effect of contrast medium amount and contrast medium type used on pathogenesis of CIN is largely unknown in this cohort.

CONCLUSION

Biochemical CIN appears to be present after CT of AP with IV contrast in some patients who followed up. It was not obvious whether the biochemical changes caused clinically significant symptoms in these patients. Unlike previous reports that chronic kidney disease is the major risk factor for CIN, our results demonstrated that risk factors such as advanced age, DM and hypertension seem to predispose patients to CIN rather than abnormal baseline SCr. In order to make meaningful conclusions a multi-center prospective study with larger sample size is necessary.

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Survey of Publications and the H-index of Academic Emergency Medicine Professors

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Introduction: The number of publications and how often these have been cited play a role in academic promotion. Bibliometrics that attempt to quantify the relative impact of scholarly work have been proposed. The h-index is defined as the number (h) of publications for an individual that have been cited at least h times. We calculated the h-index and number of publications for academic emergency physicians at the rank of professor.

Methods: We accessed the Society for Academic Emergency Medicine professor list in January of 2012. We calculated the number of publications through Web of Science and PubMed and the h-index using Google scholar and Web of Science.

Results: We identified 299 professors of emergency medicine. The number of professors per institution ranged from 1 to 13. Median h-index in Web of Science was 11 (interquartile range [IQR] 6-17, range 0-51), in Google Scholar median h-index was 14 (IQR 9-22, range 0-63) The median number of publications reported in Web of Science was 36 (IQR 18-73, range 0-359. Total number of publications had a high correlation with the h-index (r=0.884).

Conclusion: The h-index is only a partial measure of academic productivity. As a measure of the impact of an individual's publications it can provide a simple way to compare and measure academic progress and provide a metric that can be used when evaluating a person for academic promotion. Calculation of the h-index can provide a way to track academic progress and impact. [West J Emerg Med. 2014;15(3):282–284.]

INTRODUCTION

The number of publications and how often these have been cited play a role in academic promotion. However, looking only at the number of publications may not provide an accurate measure of the impact or quality of a researcher's work. Bibliometrics that attempt to quantify the relative impact of scholarly work have been proposed. Of these alternative metrics, the h-index is the most widely used and studied.[1] The h-index is defined as the number (h) of publications for an individual that have been cited at least h times.[1] This attempts to take into account not only the publication output for an individual but also the impact of the publications as measured by the times they have been cited. For example, an individual with an h-index of 10 has ten publications that have each been cited at least 10 times. The h-index for academic physicians in several different medical subspecialties has been published and may start being incorporated as a metric for academic promotion.[2-7] The h-index calculation includes all publications regardless of the author position on a particular paper.

METHODS

We accessed the Society for Academic Emergency Medicine (SAEM) professor list (http://stage.saem.org/full-

Table. Publications and h-index reported for a number of specialties

Specialty	Source	# of professors used in calculation	H-Index (Median)	H-index (Mean)	# of publications (Median)	# of publications (Mean)	Ref
Emergency medicine	Web of Science	299	11	12.8	36	57.5	
Emergency medicine	Google Scholar	299	14	16	**	**	
Neurosurgery (2)	Google Scholar	**	19	**	**	**	2
Anesthesia (3)	Scopus	245	**	9	46	**	3
Urology (4)	Scopus	103	**	22	**	165.4	4
CT anesthesia (5)	Scopus	63	**	12	**	59	5
Radiology (6)	Scopus	163	**	12.5	**	105	6
ENT (7)	Scopus	**	**	15.6	**	**	7

** Not reported

professor-list) in January of 2012. SAEM is the main society for academic emergency physicians in the United States. SAEM keeps a list of emergency physicians at the rank of professor in the United States and Canada and the institution to which they belong. The list contains 312 names from 120 institutions. Three persons were listed twice. Six individuals had names that prevented reliable filtering to ensure accurate publication and h-index calculations and three individuals were deceased. One individual was listed as an assistant professor. For the remaining 299 individuals we calculated the number of publications through Web of Science (http://wokinfo.com) and the h-index using Google scholar (http://scholar.google.com) and Web of Science.

We utilized the author's last name, and first and middle initial as the initial search strategy. This was sometimes combined with a search strategy that did not include a middle initial, as a number of authors did not consistently use their middle initial on their publications. We utilized the Web of Science (WOS) filter functions to restrict the author search to life sciences research and to particular institutions when necessary to refine the search. We used the citation report for WOS, which calculates the h-index and reports the number of publications ascribed to the author and used for the calculation. For google scholar we utilized the same author name strategy. This returned a list of publications with citations by publication. We manually counted publications until reaching the h-index threshold (when publication number equaled citation number).

Data was entered and stored into a Microsoft Excel (Redmond, WA) file. Descriptive statistics were calculated using JMP (SAS Institute Inc., Cary, NC). No institutional review board approval was obtained as this is not a human research study.

RESULTS

We identified 299 professors of emergency medicine. The number of professors per institution ranged from 1 (54 institutions) to 13 (one institution). Median h-index in Web of Science (WOS) was 11 (interquartile range [IQR] 6-17, range 0-51), in Google Scholar median h-index was 14 (IQR 9-22, range 0-63) The median number of publications reported in Web of Science was 36 (IQR 18-73, range 0-359). Total number of publications had a high correlation with the h-index (r=0.884).

The table shows the h-index and number of citations reported for professors of other specialties. A number of the manuscripts reviewed reported mean and not median values. As the values are not normally distributed we think median values and interquartile ranges are a more accurate representation of these values. For comparison with some of the values in the table, the mean h-index for our list of professors was 16.2 in Google Scholar and 12.8 in WOS. The mean number of citations was 57.5 in WOS.

DISCUSSION

Articles from other specialties have looked at the number of publications and h-index for different academic ranks. Although different authors have used different databases and report their numbers in different ways (means v medians) the general conclusion from all these articles is that there is an association between h-index and academic rank. The use of different databases may return different numbers of citations and calculate different h indexes for individuals.[8] Different citation counts are returned with Scopus, Google Scholar and Web of Science.[8] Both Scopus and Web of Science require a paid subscription. Scopus only includes citations since 1996. Google Scholar is free. We utilized the Web of Science

database as it is the database available and licensed for use at our institution and is the database that was utilized for the original h-index calculations by Hirsch.[1] We cross referenced this database with Google Scholar for the h-index calculation and PubMed for number of publications to verify that the datasets for a particular author appeared generally concordant and to see if there was a significant difference in the counts returned.

Comparing h-index across specialties may not be reliable as there are factors such as the number of investigators and citations within a field that will influence the number of times a particular article is cited.[9] Svider et al found differences in the h-index of a sample of chairpersons of different specialties which they partially ascribe to the size of specialties and the resultant number of specialty journals and size of the audience for the publications.[7] The h-index may be more useful to compare individuals in the same field than across fields.[2] Hirsch, who proposed the h-index as a measure of scientific output, found it to be a better predictor of future achievement than total citation count and total number of publications.[10] When used in this way it can give individuals and institutions an idea of how influential a person's publications are relative to others in the field. The h-index will be affected by how long articles have been published, as time will allow for the accumulation of a greater number of citations.[1,2,10]

LIMITATIONS

The use of databases to search for an individual's publications may miss articles that should be credited to a specific person. This will in turn affect h-index calculations. Any missed citations will tend to underestimate both the h-index and the total number of publications for an individual. We do not have access to the methodology used by various services to acquire publications and citations or to determine their accuracy. We only looked at the professor rank. We do not know how the h-index affects promotion and tenure and did not correlate these metrics with funding, tenure, age or geography.

We used the SAEM professor list. Academic emergency physicians that are professors but were not included in the list did not form part of our calculations. We do not know how many professors the list misses and how inclusion of these individuals would affect overall calculations.

CONCLUSIONS

The h-index is only a partial measure of academic productivity. It does not take into account other elements that play a role in academic promotion such as education, administration, lecturing and service to the institution. As a measure of the impact of an individual's publications it can provide a simple way to compare and measure academic progress and provide a metric that can be used when evaluating a person for academic promotion. Calculation of the h-index can give both individuals and institutions a way to track academic progress and impact. For academic emergency physicians at the rank of associate professor thinking about promotion this may provide them with a way to compare their academic productivity with those already at the rank of professor.

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Skin Infections and Antibiotic Stewardship: Analysis of Emergency Department Prescribing Practices, 2007-2010

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Introduction: National guidelines suggest that most skin abscesses do not require antibiotics, and that cellulitis antibiotics should target streptococci, not community-associated MRSA (CA-MRSA). The objective of this study is to describe antimicrobial treatment of skin infections in U.S. emergency departments (EDs) and analyze potential quality measures.

Methods: The National Hospital Ambulatory Medical Care Survey (NHAMCS) is a 4-stage probability sample of all non-federal U.S. ED visits. In 2007 NHAMCS started recording whether incision and drainage was performed at ED visits. We conducted a retrospective analysis, pooling 2007-2010 data, identified skin infections using diagnostic codes, and identified abscesses by performance of incision and drainage. We generated national estimates and 95% confidence intervals using weighted analyses; quantified frequencies and proportions; and evaluated antibiotic prescribing practices. We evaluated 4 parameters that might serve as quality measures of antibiotic stewardship, and present 2 of them as potentially robust enough for implementation.

Results: Of all ED visits, 3.2% (95% confidence interval 3.1-3.4%) were for skin infection, and 2.7% (2.6-2.9%) were first visits for skin infection, with no increase over time (p=0.80). However, anti-CA-MRSA antibiotic use increased, from 61% (56-66%) to 74% (71-78%) of antibiotic regimens (p<0.001). Twenty-two percent of visits were for abscess, with a non-significant increase (p=0.06). Potential quality measures: Among discharged abscess patients, 87% were prescribed antibiotics (84-90%, overuse). Among antibiotic regimens for abscess patients, 84% included anti-CA-MRSA agents (81-89%, underuse).

Conclusion: From 2007-2010, use of anti-CA-MRSA agents for skin infections increased significantly, despite stable visit frequencies. Antibiotics were over-used for discharged abscess cases, and CA-MRSA-active antibiotics were underused among regimens when antibiotics were used for abscess. [West J Emerg Med. 2014;15(3):285–292.]

INTRODUCTION

Skin infections are among the most common reasons for seeking medical care. Community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) was first described in the mid-1990s. An epidemic of skin infections followed, and emergency department (ED) visits for skin infection nearly tripled from 1993 to 2005. In 2005, skin infections were diagnosed at 3.4 million ED visits and 7.7 million physician office visits in the United States (U.S.).[1,2] CA-MRSA became the most common pathogen isolated from purulent skin infections.[3]

Surveillance has been limited by the absence of large studies capable of differentiating abscess from cellulitis. Most epidemiological studies have relied on diagnostic codes from the International Classification of Diseases, Clinical Modification, 9th Edition (ICD9), which unfortunately groups these 2 conditions within a single category labeled "Cellulitis and Abscess."[1,2] For example, ICD9 code 681

indicates "Cellulitis and abscess of finger, toe, or digit." In 2007, the National Hospital Ambulatory Medical Care Survey (NHAMCS) started tracking whether incision and drainage (I&D) was performed during an ED visit, allowing us to analyze nationwide antibiotic prescribing practices for abscess and cellulitis separately.

Distinguishing abscess from cellulitis is clinically important because they are treated differently. Evidence-based guidelines recommend that most abscesses be treated with I&D, without antibiotics, and that most cases of cellulitis be treated with antibiotics targeting streptococci, not CA-MRSA.[4] The implication is that only a minority of skin infection patients treated as outpatients require coverage for CA-MRSA. Despite this, use of such antibiotics in this group has increased, reaching 38% of all antibiotic regimens among ED patients with skin infection by 2005.[1] Overuse of antibiotics is an important public health and quality issue because it causes antimicrobial resistance, and adverse events such as *Clostridium difficile* colitis.[5]

We analyzed NHAMCS data from 2007-2010, in order to describe antibiotic use at U.S. ED visits for abscess and cellulitis. We analyze 4 potential measures of quality of care regarding antibiotic use in skin infection cases.

METHODS

We conducted a retrospective analysis of NHAMCS data. NHAMCS is a 4-stage probability-weighted sample of ED visits in all 50 states and the District of Columbia, excluding federal, military, and Veterans Administration hospitals. Its methods have been detailed previously.[6] In brief, trained abstractors collect data on structured data entry forms. Data are subsequently validated and cleaned by staff at the Centers for Disease Control (CDC) and by outside consultants. Further details are available in CDC publications.[6] Since 2007, a specific data field indicates performance of I&D. Another field indicates whether the visit was the first visit for the complaint or a repeat visit. For this analysis, we pooled ED data from 2007-2010. We included all observations in the database, without exclusions based on age, demographic characteristics or other characteristics.

Skin infection visits were identified by the same ICD9 diagnostic codes used in prior investigations, i.e. cellulitis and abscess of finger (681.00); cellulitis and abscess of toe (681.10); other cellulitis and abscess (682.00-682.99, which includes head, neck, trunk, limbs, and buttocks); cellulitis digit NOS (681.90); felon (681.01); impetigo (684); hidradenitis (705.83); other specified diseases of the hair and hair follicle (i.e. folliculitis, 704.8); neonatal infective mastitis (771.5); nonpurulent mastitis (675.2); breast abscess (675.1); or carbuncle and furuncle (680.00-680.99). We did not include: onychia, dental abscess, Bartholin's abscess, and pilonidal abscess, following prior investigations.[1] If the ED visit was not the first one for the index condition (i.e. was a follow-up visit), we excluded it from analysis. If I&D was performed, we classified the skin infection as an abscess. We classified antibiotics according to whether they were agents typically active against CA-MRSA (trimethoprim-sulfamethoxazole, clindamycin, tetracyclines, rifampin, linezolid, or vancomycin).[3] We classified ED disposition as discharged or admitted (to intensive care unit, floor, operating room, observation unit, or to another hospital in transfer), and excluded patients who died in the ED or left before being seen or against medical advice. For individual years, 2007-2010, we report descriptive information on the frequency of visits and antibiotic prescribing practices. We also report the results for all years, stratified by region.

We evaluated 4 potential quality measures: 1) Use of any antibiotic for discharged abscess patients, a measure of overuse.[4] 2) Non-inclusion of agents with activity against CA-MRSA in antibiotic regimens for abscess patients, a measure of underuse.[4] We tested whether this measure would be affected by inclusion of fluoroquinolones in the definition of agents typically active against CA-MRSA, since they often do have such activity and might be chosen due to allergy to other agents, tolerability, desire for co-coverage of Gram-negative bacteria, or for other reasons. 3) Use of CA-MRSA-active agents for discharged cellulitis patients, a measure of overuse. Guidelines suggest that non-purulent cellulitis be treated with agents effective against streptococci, not CA-MRSA, and purulent cellulitis is uncommon.[3,4] 4) Use of trimethoprim-sulfamethoxazole monotherapy for cellulitis patients, a measure of misuse. This is relevant because there is doubt about this antibiotic's effectiveness for streptococcal infections.[4] We conducted stratified analyses to determine whether any of the following factors were associated with adherence to these measures: age, sex, or geographic region.

We used SAS 9.2 (SAS Institute, Cary, NC) for all analyses, analyzing data using recommended NHAMCS procedures.[6] For comparisons of proportions, we report relative risks and their 95% confidence intervals, and χ^2 testing. To assess trends over time and adjust for independent variables of interest, we used logistic regression, and report odds ratios and their 95% CIs. This study was exempted from review by our IRB.

RESULTS

Of all U.S. ED visits during 2007-2010, 3.2% included a diagnosis of skin infection (95% CI 3.1-3.4%). After exclusion of repeat skin infection visits, skin infection was diagnosed at 2.7% of all visits (Table 1). Repeat skin infection visits are excluded from further analyses.

The frequency of skin infection visits relative to all other diagnoses did not change year to year (p=0.80). Among skin infection visits, I&D was noted at 22%, with a non-significant year-to-year increase (p=0.06). Antibiotics were prescribed at 83% of skin infection visits, without year-to-year change (p=0.66). An agent typically active against CA-MRSA was included in 68% of regimens when antibiotics were

Table 1. Skin infection visits, incision and drainage procedures, and antibiotic use, in United States emergency departments, by year, 2007-2010.

Size of sample and national visit estimates	2007	2008	2009	2010	2007-2010	P for trend
Number of observations in sample	35,490	34,134	34,942	34,936	139,502	n/a
Estimated number of visits nationwide (thousands)	116,802	123,761	136,072	129,843	506,479	0.20
95% confidence interval	101,283-132,322	110,602-136,920	118,114-154,029	115,716-143,970	460,219-552,738	
Skin infection visits (excluding repeat skin infection visits)						
Estimated skin infection visits nationwide (thousands)	3,234	3,437	3,344	3,798	13,812	0.20
95% confidence interval	2,729-3,738	2,975-3,898	2,735-3,953	3,211-4,385	12,231-15,393	
Skin infection visits as proportion of all visits nationwide (%)	2.8	2.8	2.5	2.9	2.7	0.80
95% confidence interval	2.5-3.0	2.5-3.0	2.2-2.8	2.7-3.2	2.6-2.9	
% of skin infection visits with any antibiotic nationwide	82.0	84.0	82.7	81.4	82.5	0.66
95% confidence interval	78.5-85.5	81.0-87.0	79.2-86.2	77.8-85.0	80.6-84.4	
% of these antibiotic regimens covering CA-MRSA	61.0	68.2	67.0	74.2	67.9	<0.001
95% confidence interval	56.3-65.6	64.1-72.2	62.4-71.6	70.7-77.8	65.7-70.0	
% of antibiotic regimens with trimethoprim-sulfamethoxazole monotherapy	28.0	27.2	26.2	30.1	27.9	0.40
95% confidence interval	23.8-32.3	23.4-31.0	22.0-30.5	26.0-34.1	25.5-30.4	
% of new skin infection visits with incision & drainage	18.8	24.0	21.9	24.3	22.4	0.06
95% confidence interval	15.3-22.3	19.3-28.7	17.5-26.4	20.5-28.1	19.7-25.0	
Skin infection visits with incision & drainage (excluding repeat skin infection visits)						
% of these visits with any antibiotic nationwide	89.1	80.9	87.6	88.7	86.4	0.47
95% confidence interval	83.7-94.4	74.4-87.2	81.2-93.9	83.1-94.4	83.5-89.3	
% of these antibiotic regimens covering CA-MRSA	81.6	79.8	83.3	90.9	84.4	0.06
95% confidence interval	72.9-90.2	71.9-87.7	75.3-91.3	85.6-96.3	80.6-88.2	
% of antibiotic regimens with trimethoprim-sulfamethoxazole monotherapy	47.7	51.5	45.0	55.7	50.4	0.40
95% confidence interval	35.8-59.6	40.2-62.8	34.1-55.8	47.0-64.4	44.8-56.1	

prescribed. From 2007 to 2010, there was a 13% increase in use of regimens active against CA-MRSA (61% in 2007 versus 74% in 2010, p for trend <0.001). Such an agent was used at 56% (95% confidence interval [CI] 54-58%) of all skin infection visits (as distinct from 68% of antibiotic regimens when antibiotics were prescribed).

Table 2 shows results by region. All of the nationwide findings described above were accentuated in the South. Skin infections were more common, at 3.2% of all visits, versus 2.3-2.7 in the other regions. I&D was performed at a higher proportion of skin infection visits (26% versus 11-22%), and antibiotics and anti-CA-MRSA antibiotics were used more often. (See Table 2).

Our first quality analysis considered the use of antibiotics among visits with outpatient surgical treatment of abscess. Measure adherence was 13%, because antibiotics were used at 87% of these visits (Table 3). Among the covariates analyzed, this practice varied only by region, with the lowest adherence (i.e. most overuse) in the South, as detailed in Table 2.

Our second analysis explored the underuse of agents effective against CA-MRSA among antibiotic regimens for abscess visits. As expected, among visits at which at least one antibiotic was prescribed, the probability of an antibiotic regimen containing an agent typically active against CA-MRSA was higher among abscess versus non-abscess visits (relative risk 2.39, 95% CI 1.85-3.08). However, among abscess patients, only 84% of antibiotic regimens included an agent typically active against CA-MRSA (95% CI 81-88%); i.e. nearly 16% of regimens were guideline-non-concordant. When quinolones were included as CA-MRSA-active agents, this percentage was similar, at 86% (95% CI 82-89%). Among the potential covariates, only geographic region demonstrated heterogeneity, with the highest adherence in the South (i.e. least underuse), as detailed in Table 2.

Our third analysis examined the use of CA-MRSA-active regimens among discharged patients with cellulitis, a measure of overuse. Among cellulitis visits, 63% of antibiotic regimens included an agent typically active against CA-MRSA (95% CI 60-65%).This increased from 56% (95% CI 50-61%) in 2007 to 68% (95% CI 63-73%) in 2010 (p=0.008). Among discharged cellulitis cases, 63% of regimens included such an agent (95% CI 60-66%). This was similar among admitted cases (62%, 95% CI 56-68%). Among the potential covariates, only geographic region demonstrated heterogeneity, with the most overuse in the South (Table 2).

In our fourth analysis, we studied monotherapy with

Table 2. Skin infection visits, incision and drainage procedures, and antibiotic use, in emergency departments, by United States region, 2007-2010.

Skin infection visits (excluding repeat skin infection visits)	Northeast	Midwest	South	West	p-value*
Estimated skin infection visits (thousands)	2,113	2,552	6,554	2,593	<0.0001
95% confidence interval	1,840-2,386	1,879-3,226	5,281-7,827	2,000-3,185	
Skin infection visits as proportion of all visits (%)	2.3	2.3	3.2	2.7	<0.0001
95% confidence interval	2.1-2.4	2.1-2.5	2.9-3.5	2.4-3.0	
% of skin infection visits with any antibiotic	77.6	83.2	84.9	80.0	0.04
95% confidence interval	72.5-82.7	79.5-86.8	82.2-87.5	74.9-85.0	
% of these antibiotic regimens covering CA-MRSA	45.6	57.7	77.3	69.7	<0.0001
95% confidence interval	40.1-51.0	51.3-64.0	75.1-79.5	64.6-74.8	
% of antibiotic regimens with TS monotherapy	16.1	28.5	42.4	30.6	<0.0001
95% confidence interval	12.8-19.5	23.2-33.8	38.4-46.3	25.3-35.9	
% of new skin infection visits with incision & drainage	11.2	21.5	26.4	22.2	<0.0001
95% confidence interval	8.1-14.4	16.9-26.0	21.8-31.0	18.1-26.2	
Skin infection visits with incision & drainage (excluding repeat skin infection visits)					
% of these visits with any antibiotic nationwide	72.4	87.7	90.2	79.4	0.002
95% confidence interval	61.8-83.7	81.6-93.7	88.6-93.9	70.3-88.5	
% of these antibiotic regimens covering CA-MRSA	70.3	77.1	88.4	81.5	0.03
95% confidence interval	56.5-84.2	65.3-88.9	84.5-92.4	70.4-92.6	
% of antibiotic regimens with TS monotherapy	39.9	55.5	54.8	34.1	0.01
95% confidence interval	25.4-54.3	41.5-69.5	48.1-61.6	21.9-46.2	

CA-MRSA; community-associated methicillin-resistant *Staphylococcus aureus; TS,* trimethoprim-sulfamethoxazole
*p-values are from chi-squared testing, and assess heterogeneity among the four geographic regions.

trimethoprim-sulfamethoxazole among cellulitis patients. Trimethoprim-sulfamethoxazole was used as the sole antibiotic at 23% of cellulitis visits (95% CI 21-26%), versus 44% of abscess visits (95% CI 39-49%), and in 29% of antibiotic regimens for cellulitis (95% CI 26-31%), versus 50% (95% CI 45-56%) of regimens for abscess. There was no association with patient age. The use of trimethoprim-sulfamethoxazole monotherapy also varied regionally, with the most frequent misuse in the South, as detailed in Table 2.

DISCUSSION

Skin infection was diagnosed at 3.2% of U.S. ED visits during 2007-2010, with no increase during the period. A prior report found that 3.0% of ED visits were for skin infection in 2005.[1] This echoes prior findings suggesting that the epidemic may have reached a plateau.[7]

When we excluded repeat visits from the analysis, we found that skin infection was diagnosed at 2.7% of visits during 2007-2010, without an increase over time. We observed that 22% of new skin infection visits were for abscess (i.e. were treated with I&D). This is consistent with the results of a single-center study which also found that I&D was performed at 22% of skin infection visits.[8] Our analysis reveals substantial regional variation in the frequency of skin infection relative to other diagnoses, in the frequency of abscess among skin infection, and the likelihood of use of anti-CA-MRSA antibiotics, with the effects of the CA-MRSA epidemic most apparent in the South (Table 2).

We have presented 4 potential metrics for assessment of quality of care, which we derived from evidence-based guidelines (Table 3).[4] We believe that 2 of them, one focusing on overuse and another on underuse, might be appropriate

Table 3. Proposed quality measures of antibiotic use for skin infections, and performance in United States emergency departments (ED), 2007-2010.

Metric name	Measure description (domain)	Numerator	Denominator	Level of evidence[x]	Performance % (95% CI)
Measures with sufficient evidentiary support for implementation					
Use of antibiotics for outpatient treatment of abscesses	Proportion of discharged ED visits for skin infection undergoing I&D where antibiotics were prescribed (Efficiency; Overuse)	Denominator visits where antibiotics are given	ED initial visits for skin infection where I&D was performed and patient was discharged home	I.A.	87 (84-90)†
Inclusion of CA-MRSA coverage* when using antibiotics for abscess treatment	Proportion of ED visits for skin infection undergoing I&D where antibiotics were prescribed, but did not include a CA-MRSA active antibiotic* (Effectiveness; Underuse).	Denominator visits where CA-MRSA active antibiotics* were given	ED initial visits for skin infection where I&D was performed and antibiotics were prescribed	III.A.	84 (81-88)‡
Measures requiring further research					
Use of CA-MRSA active antibiotics* for outpatient treatment of cellulitis	Proportion of discharged ED visits for skin infection not undergoing I&D and receiving antibiotics where CA-MRSA active antibiotics* were used. (Efficiency; Overuse)	Denominator visits where CA-MRSA-active* antibiotics were given	ED initial visits for skin infection where I&D was not performed, antibiotics were prescribed, and patient was discharged home	III.C.	63 (60-66)†
Use of trimethoprim-sulfamethoxazole as the only antibiotic for treatment of cellulitis	Proportion of cellulitis patients who receive trimethoprim-sulfamethoxazole and no other antibiotic (Effectiveness; Misuse)	Denominator visits where trimethoprim-sulfamethoxazole was the only antibiotic used	ED initial visits for skin infection where I&D was not performed, trimethoprim-sulfamethoxazole was prescribed	II.C.	23 (21-26)†

CA-MRSA; community-associated methicillin-resistant *Staphylococcus aureus*; *I&D,* incision and drainage
*Antibiotics with CA-MRSA activity are defined here as: trimethoprim-sulfamethoxazole, clindamycin, tetracyclines, rifampin, linezolid, or vancomycin. However, fluoroquinolones often have such activity.
†As measures of overuse or misuse, lower performance is better.
‡As a measure of underuse, a higher proportion is better.
[x]Evidence grading classification detailed in reference [4]. Letter grades indicate strength of recommendation, with A indicating strong evidence, B indicating moderate evidence, and C indicating poor evidence. Roman numerals indicate quality of evidence, with I indicating ≥1 properly randomized trial, II indicating high-quality controlled observational studies or non-randomized trials, and III indicating expert opinion and case series.

measures for implementation in national quality programs, such as Medicare's Physician Quality Reporting System.[9]

Our first proposed measure calculates the proportion of abscess visits ending in discharge at which an antibiotic is used. Multiple studies have shown that routine use of antibiotics for uncomplicated abscesses is not beneficial.[4] We suggest implementing this measure by designating as "overuse" any use of antibiotics for abscess treated with I&D and discharged from the ED or clinic, while providing an exception that allows the clinician to specify a reason for antibiotic use (such as immunosuppression, large area of surrounding cellulitis, or area difficult to drain).[4] We emphasize that it would never be correct to consider all antibiotic use inappropriate among discharged abscess patients, since there are accepted indications, as listed above. We suggest that this measure of overuse might be valuable as a relative measure, rather than an absolute measure. We found that 87% of discharged abscess patients were treated with antibiotics, suggesting widespread overuse of antibiotics for this common problem. This was most pronounced in the South, at 90%.

Our second potential quality measure assesses failure to use agents active against CA-MRSA when using antibiotics to treat abscess patients. Although antibiotics are usually not indicated in the outpatient treatment of skin abscesses, when antibiotics are used, they should cover CA-MRSA.[3,4] We found that nearly 16% of antibiotic regimens prescribed at abscess visits did not include an agent typically active against CA-MRSA. This problem was least common in the South, at 12%. As discussed below, all aspects of performance in the South seem to be directed toward more CA-MRSA coverage, leading to more overuse and less underuse. This is interesting, given our observation that the epidemic appears to be affecting the South disproportionately.

Our third analysis examined use of CA-MRSA-active antibiotics for outpatient treatment of cellulitis. We found that 63% of antibiotic regimens for cellulitis treated on the outpatient basis included an agent typically active against CA-MRSA (Table 3). This is not consistent with current IDSA guidelines, which suggest that non-purulent cellulitis be treated with antibiotics targeting streptococci, not CA-MRSA.[4] Purulent cellulitis is uncommon, accounting for only 8% of purulent skin infections.[3] Here again, the proper implementation of the quality measure would probably be to view use of anti-CA-MRSA antibiotics as overuse while allowing exceptions (such as failure of prior therapy or presence of purulence).[4]

This and prior studies reveal that antibiotics targeting CA-MRSA are being used much more frequently, despite lack of evidence and guidelines that recommend otherwise.[1,4] Specifically, most cases of abscess do not require antibiotics at all, and most cases of cellulitis should be treated with agents targeting streptococci, not CA-MRSA. We suspect that as clinicians have seen a dramatic rise in the cases of CA-MRSA skin infections (i.e. abscesses), they have assumed that the same organism was responsible for other skin infections (i.e. cellulitis). Additionally, the presence of screening for MRSA carriage and computerized ED dashboards that display a patient's MRSA status, may lead clinicians to prescribe these antibiotics. However, while this national trend indicates an inappropriate response to the epidemic, there is a problem with applying this criterion to the practice of an individual clinician: clindamycin is a good first-line agent for CA-MRSA-associated infections, and is also a good first-line agent for non-purulent cellulitis, given its coverage of streptococci.[4] While many might view a beta lactam as a preferred first-line agent for non-purulent cellulitis, use of clindamycin would not rise to the level of "poor quality" care. Therefore, we consider monitoring of the use of anti-CA-MRSA agents for cellulitis to be a topic of epidemiological interest, but not sufficiently robust for evaluation of the quality of healthcare on a case-by-case basis. It also bears mentioning that providers may be skeptical of the IDSA guidelines' recommendations for treatment of cellulitis, since they are not based on evidence from clinical trials and since microbiological proof of the etiology of cellulitis is usually impossible to obtain.[4,10]

Lastly, we analyzed trimethoprim-sulfamethoxazole monotherapy among cellulitis patients as a potential quality measure. The inappropriateness of this practice would lie in the widely held belief that this antibiotic is not effective for streptococcal infections, leading to recommendations that all non-purulent skin infections be covered with beta lactams or other anti-streptococcal agents.[4] However, the evidence that this antibiotic is not effective for streptococcal infections is from small clinical trials that were done many years ago, and from in vitro studies that may have been influenced by inappropriately high concentrations of thymidine in culture media.[11] One clinical trial that uses trimethoprim-sulfamethoxazole monotherapy for cellulitis is under way, and should shed light on this question (NCT00730028). Pending its publication, it remains prudent to recommend against trimethoprim-sulfamethoxazole monotherapy for streptococcal infections, but we believe that deeming such a practice "poor quality" would be inaccurate, and do not propose this as a quality measure at this time.

In summary, we identified 2 reasonable measures for quality assessment: overuse of antibiotics among abscess patients treated as outpatients with I&D, and use of antibiotic regimens that fail to cover CA-MRSA when using antibiotics for treatment of abscesses. We present the last 2 of our 4 measures as important objects of further study. Evidence for or against the use of anti-CA-MRSA antibiotics in the treatment of cellulitis will come from three ongoing clinical trials (NCT00676130, NCT00729937, NCT00730028).

Our regional analyses reveal interesting patterns of disease occurrence and medical practice. CA-MRSA appears to be causing more abscesses in the South, and prescribers in that region are responding by using more anti-CA-MRSA

agents. This includes both more overuse, and less underuse. This may be viewed as a well-intentioned but exaggerated response to the CA-MRSA epidemic. These findings mirror prior analyses of regional variation in appropriateness of antibiotic use in Medicare data, which found evidence of inappropriate use in the South.[12]

Overall, these results provide clear evidence that the emergence of CA-MRSA continues to have a major impact on prescribing practices for skin infection patients in US EDs, while at the same time providing evidence that the epidemic may have reached a plateau. Before 2001, emergency clinicians almost never used anti-CA-MRSA regimens when treating skin infection patients.[1] But by 2005, 38% of antibiotic regimens for these patients included an agent typically active against CA-MRSA, and the current data show that by 2010, 74% of antibiotic regimens for skin infection patients targeted this organism. This dramatic increase is not justified by current evidence or national guidelines.

LIMITATIONS

The main limitations of our study are those common to all NHAMCS investigations.[13] Prior research has revealed that when analysis of NHAMCS data provides evidence of errors of omission in medical practice, such evidence should be viewed skeptically, because the data collectors sometimes miss data.[14] A case in point is our observation that only 81% of cellulitis patients received antibiotics. We are skeptical about this, and we assume that the true proportions were higher. We can only assume that many of the discharged patients got prescriptions that the NHAMCS data collectors did not see, or sought care after already receiving antibiotics from another provider. With regard to admitted patients, some of them may have received their antibiotics after they were sent from the ED to the ward. On the other hand, NHAMCS data are probably valid when they reveal errors of commission; there is no known mechanism by which errors of commission could erroneously appear.[14] All retrospective uncontrolled studies are vulnerable to information bias and other unknown threats to validity.

A limitation particular to our study is use of I&D as a proxy for the diagnosis of abscess. Some procedures may not have been captured, and in some cases patients with cellulitis may have had I&D without identification of pus. Our prior research has suggested that billing data are specific but not sensitive for positive identification of abscesses among all skin infections.[8]

Our first measure, overuse of antibiotics for discharged abscess patients, is caveated by the fact that in the present investigation we were unable to account for chronic co-morbidities such as diabetes and immunosuppression. While there is no evidence that patients with these conditions benefit from antibiotics for uncomplicated skin abscesses, current guidelines do recommend that they receive antibiotic treatment as an adjunct to I&D.[4] Our second measure evaluated failure to include anti-CA-MRSA activity in antibiotic regimens for abscess patients. We found that about 16% of such regimens failed to include such agents. While it is conceivable that some of the 16% were data collection errors, our finding of statistically significant regional diversity, which was consistent with the other regional variations we observed, suggests that the data may be a valid measure of underuse—we can think of no reason that NHAMCS data collectors would be less likely to miss anti-CA-MRSA antibiotics in the South.

CONCLUSION

While ED visit rates for skin infection increased from 1993-2005, this study suggests that the epidemic stabilized during 2007-2010. The CA-MRSA epidemic has prompted major changes in antibiotic choices for these common infections, and use of anti-CA-MRSA agents continues to increase, despite lack of evidence to support their use in this setting. When treating abscesses, clinicians are using antibiotics too much. This is an appropriate target for quality improvement efforts and national quality metrics aimed at antimicrobial stewardship. When they do use antibiotics to treat abscesses, clinicians are often failing to include anti-CA-MRSA antibiotics. This is a reasonable target in efforts to improve care. When treating cellulitis, use of antibiotics effective against CA-MRSA is rising, despite lack of evidence and despite national guidelines. This may be a reasonable target for efforts to promote stewardship, with the caveats given above.

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Study of Medical Students' Malpractice Fear and Defensive Medicine: A "Hidden Curriculum?"

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Introduction: Defensive medicine is a medical practice in which health care providers' primary intent is to avoid criticism and lawsuits, rather than providing for patients' medical needs. The purpose of this study was to characterize medical students' exposure to defensive medicine during medical school rotations.

Methods: We performed a cross- sectional survey study of medical students at the beginning of their third year. We gave students Likert scale questionnaires, and their responses were tabulated as a percent with 95% confidence interval (CI).

Results: Of the 124 eligible third-year students,102 (82%) responded. Most stated they rarely worried about being sued (85.3% [95% CI=77.1% to 90.9%]). A majority felt that faculty were concerned about malpractice (55.9% [95% CI=46.2% to 65.1%]), and a smaller percentage stated that faculty taught defensive medicine (32.4% [95% CI=24.1% to 41.9%]). Many students believed their satisfaction would be decreased by MC and lawsuits (51.0% [95% CI=41.4% to 60.5%]). Some believed their choice of medical specialty would be influenced by MC (21.6% [95% CI=14.7% to 30.5%]), and a modest number felt their enjoyment of learning medicine was lessened by MC (23.5% [95% CI=16.4% to 32.6%]). Finally, a minority of students worried about practicing and learning procedures because of MC (16.7% [95% CI=10.7% to 25.1%]).

Conclusion: Although third-year medical students have little concern about being sued, they are exposed to malpractice concerns and taught considerable defensive medicine from faculty. Most students believe that fear of lawsuits will decrease their future enjoyment of medicine. However, less than a quarter of students felt their specialty choice would be influenced by malpractice worries and that malpractice concerns lessened their enjoyment of learning medicine. [West J Emerg Med. 2014;15(3):293–298.]

INTRODUCTION

The ballooning cost of malpractice claims and insurance has ignited considerable healthcare policy debate and has generated the phenomenon known as defensive medicine (DM), defined as medical practices in which healthcare providers' primary intent is to avoid criticism and lawsuits, rather than providing for patients' medical needs.[1,2] Although DM practice is difficult to precisely quantify, investigators have determined that approximately 5-10% of diagnostic tests and therapeutic interventions are performed because of litigation concerns,[3,4] and experts have estimated the cost of DM in the United States (U.S.) at $9 to $18 billion annually, consuming approximately 1-2% of U.S. healthcare dollars.[5,6,7]

DM can take either a negative or positive form, depending

on the direction of deviation from accepted best clinical practices.[2] Negative DM, sometimes referred to as avoidance behaviors, consists of avoiding high-risk medical tests and procedures, as well as patients who are considered to be high risk or litigious. Conversely, positive DM, sometimes referred to as assurance behavior, involves the ordering of unnecessary or excessive diagnostic tests, procedures and referrals.[2,8] In a 2009 American Medical Association sponsored survey of 1,231 primary care physicians, surgical specialists, and non-surgical specialists, 91.0% agreed that physicians order more tests and procedures than needed to protect themselves from malpractice suits. There were no statistical differences in responses across geography, type of practice, or professional society affiliation.[9]

In a previous longitudinal study, we evaluated emergency medicine (EM) interns within 3 months of beginning their internship and EM residents within 3 months of completion of residency. We found that interns start with a moderate amount of DM exposure and malpractice concern (MC), and that MC decreased slightly by the end of residency.[10] Given this early appearance of DM and MC, we postulated that much of this DM and MC may arise during medical school, and that there may be a "hidden curriculum" as described by other investigators.[11,12,13] The purpose of this study was to characterize medical students' exposure to defensive medicine during medical school rotations, i.e., determine whether a hidden curriculum of DM exists. Specifically, we sought to determine level of students' DM and MC exposure at the beginning of medical school year three. We hypothesized that medical students are exposed to considerable DM and MC at the beginning of their third-year clinical rotations long before the transition to residency.

METHODS

Study Design and Population

During June 2008, we conducted a cross-sectional survey study at a San Francisco medical school and associated hospital rotation sites, surveying students at the beginning of medical school year three. Query of clerkship directors determined that none of the rotations had lectures specific to legal or defensive medicine. The school's Committee on Human Research approved this study.

Medical Student Defensive Medicine (MSDefMed) Survey Instrument

In a previous study of EM residents, we adapted an instrument developed and validated by the U.S. Congress Office of Technology Assessment to assess DM practices and attitudes toward malpractice of cardiologists, internists, general surgeons and obstetrician-gynecologists.[10] We adjusted this survey to make it applicable to medical students, creating the MSDefMed instrument (Appendix). We randomly sorted 13 DM and MC questions among 18 other questions evaluating attitudes regarding specialty satisfaction, cost containment, and medical uncertainty. To decrease the effect of reflex responses, we also phrased questions in both negative terms ("As a medical student, I rarely worry about being sued") and positive terms ("I worry about malpractice when I do not know a patient's diagnosis"). Answer choices were: 1 strongly agree, 2 agree, 3 neither agree nor disagree, 4 disagree, and 5 strongly disagree. We pilot tested this final instrument on 4 medical students to assure question clarity and answer consistency.

Beginning Year Three Evaluation

At an orientation session for third-year clinical rotations in June 2008, medical students were asked to complete the MSDefMed survey. We emphasized that this survey was anonymous and strictly voluntary, and we did not tell them the purpose of the study. We instructed those students participating to complete it without consulting other students or outside sources.

Data Analysis

We entered and analyzed data in Microsoft Excel 2007(Microsoft Crop., Redmond, WA). Frequency percents with 95% confidence intervals (CIs) were calculated.

RESULTS

Of the approximately 160 students in the class, 124 students were present at the third-year orientation session, 102 (82%) of the students present completed the voluntary MSDefMed survey. Some students were working rotations in other locations or otherwise unavailable during the time that the survey was administered while some chose not to complete it.

Most students stated that they rarely worried about being sued as students [85.3% (95% CI=77.1% to 90.9%)]. A modest number of students felt their enjoyment of learning medicine was lessened by MC [23.5% (95% CI=16.4% to 32.6%)]. A minority of students worried about practicing and learning procedures because of MC [16.7% (95% CI=10.7% to 25.1%)], and less than a quarter of students believed that their choice of medical specialty would be influenced by malpractice worries [21.6% (95% CI=14.7% to 30.5%)]. See Figure 1.

Many students agreed that if they were to care for a patient who had previously sued a physician, they would worry more [49.0% (95% CI=39.5% to 58.6%)], and they anticipated their satisfaction as physicians would be decreased by concerns about malpractice and lawsuits [51.0% (95% CI=41.4% to 60.5%)]. Additionally, a majority of students felt that faculty they had worked with were concerned about malpractice [55.9% (95% CI=46.2% to 65.1%)]. A smaller percentage of students stated that faculty taught DM [32.4% (95% CI=24.1% to 41.9%)]. See Figure 2.

Some students felt that the nurses [20.6% (95% CI=13.9% to 29.4%)] were concerned about malpractice, while nearly half of students noted residents were concerned [45.1% (95%

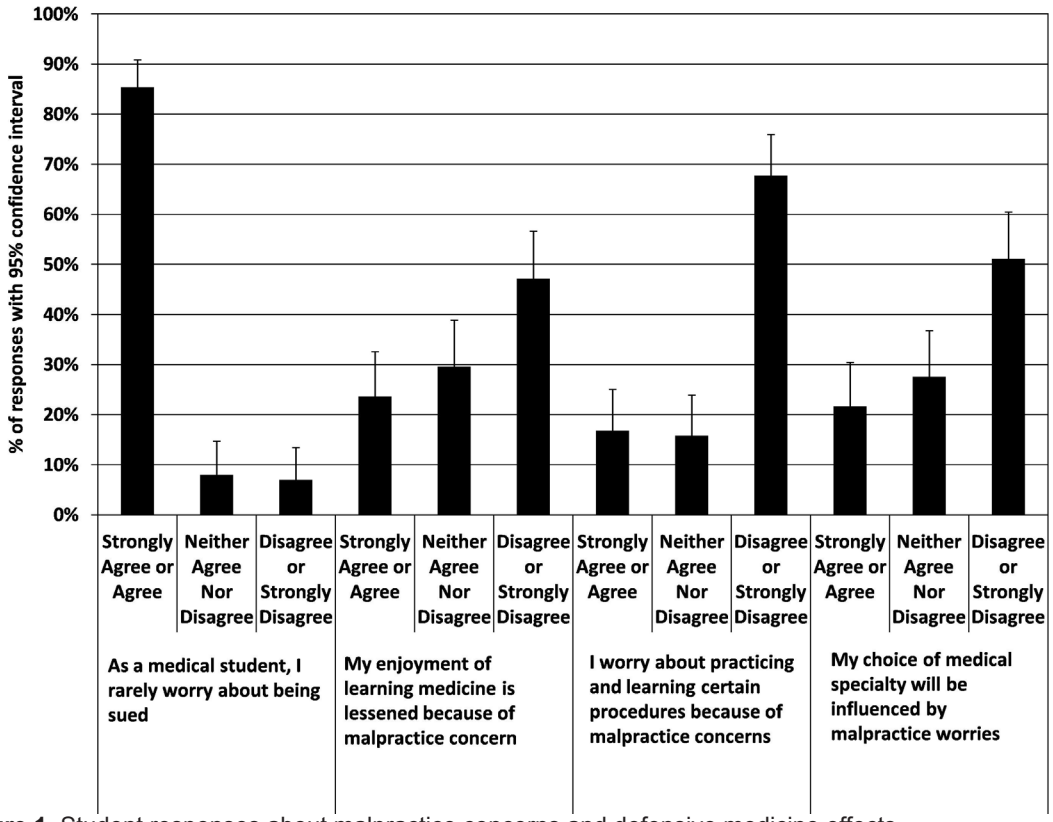

Figure 1. Student responses about malpractice concerns and defensive medicine effects.

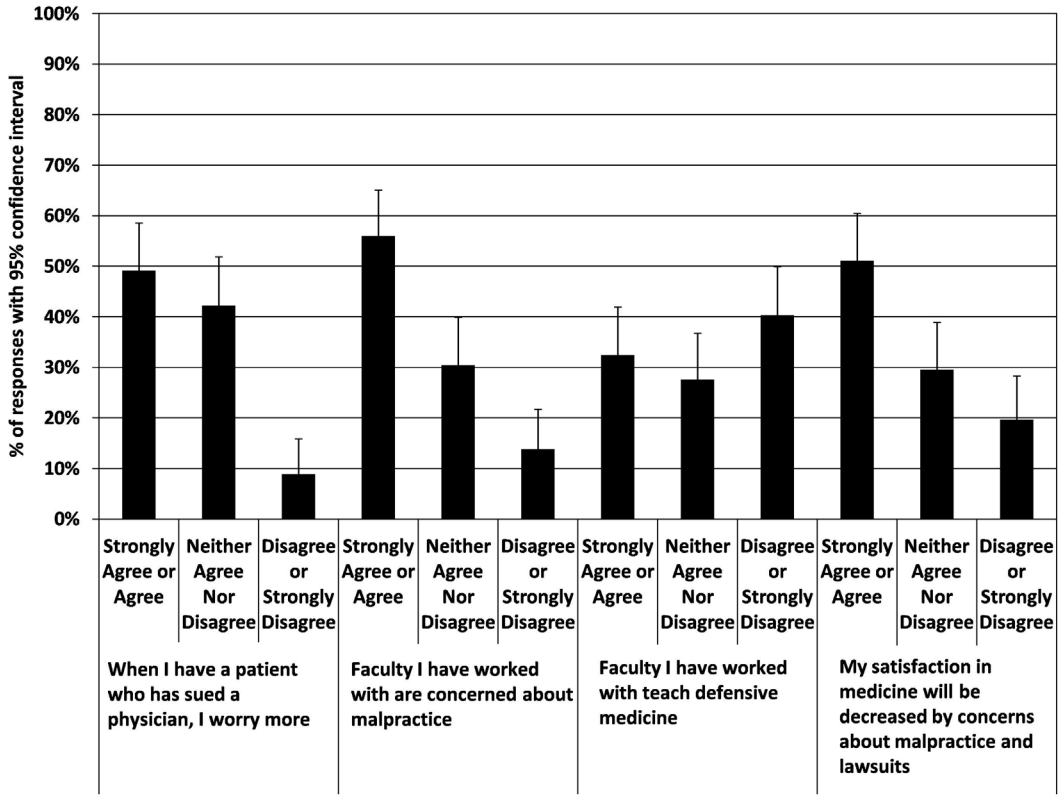

Figure 2. Student responses about malpractice concerns and defensive medicine effects.

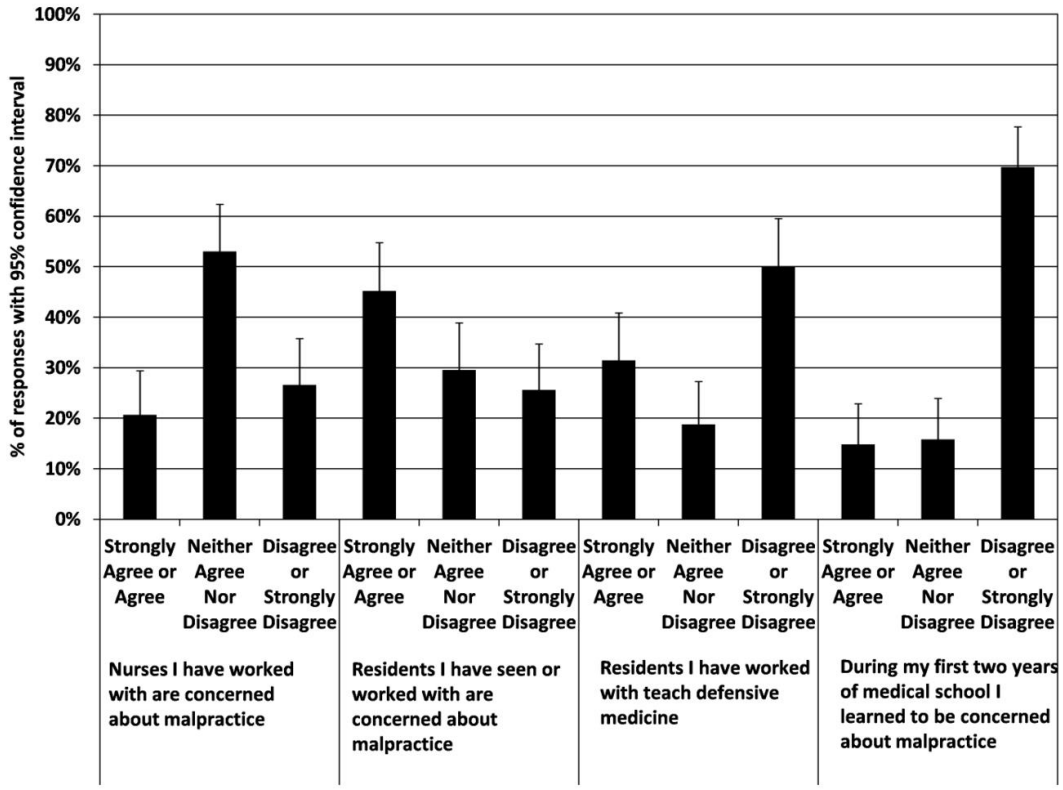

Figure 3. Student responses about malpractice concerns and defensive medicine effects.

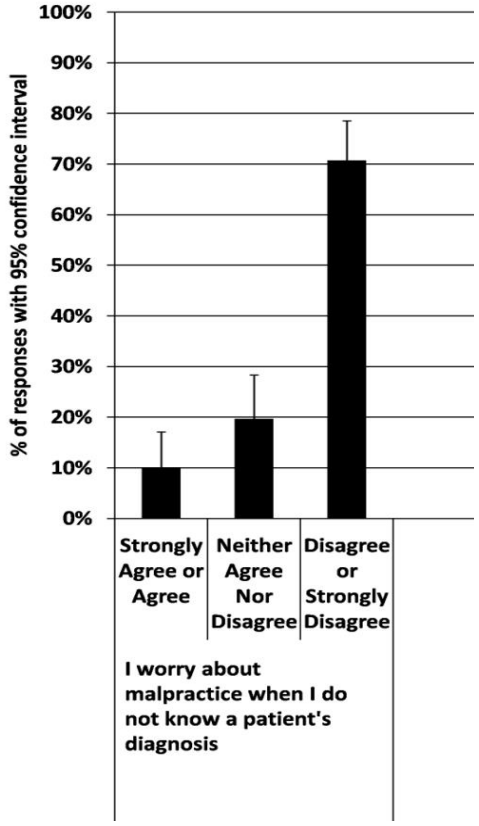

Figure 4. Student responses about malpractice concerns and defensive medicine effects.

CI=35.8% to 54.8%)]. However, slightly fewer students noted residents teach DM [31.4% (95% CI=23.2% to 40.9%)]. Few students indicated they learned to be concerned about malpractice during the first two years of medical school [14.7% (95% CI=9.1% to 22.9%)]. See Figure 3. Less than 10% of students expressed worry about malpractice when "I do not know a patient's diagnosis" [9.8% (95% CI=5.4% to 17.1%)]. See Figure 4.

DISCUSSION

"We need the CT scan for legal reasons." This faculty quote noted by one of the students in this study group illustrates what may be perceived as DM during clinical rotations. In this study we found evidence of a hidden curriculum with considerable reported exposure to DM and MC. Our findings are in line with those reported by O'Leary et al[8], who noted substantial experiences with DM by medical students and residents. Although students rarely worry about being sued, most noted that faculty and residents are concerned about malpractice, and most students believed that their future enjoyment of the medical practice would be lessened by MC.

Comparing our results in this medical student study with results from our study of EM interns and residents, we noted that students are much less concerned about being sued—an expected finding given their much lower level of

patient responsibility. While over 70% of interns stated that their enjoyment of medicine was lessened by MC, only 23% of medical students noted decreased enjoyment of medicine due to MC. Similar to the responses of interns and residents, however, MC had only moderate detrimental effects on students' learning of procedures (16.7%) and choice of medical specialty (21.6%). This lack of effect on choice of medical field is notable, given the exposure to DM and MC during rotations.

While the effect of DM on health care costs may be impossible to quantify, its impact on healthcare costs is undeniably real. Although some authorities have proposed that DM leads to better or more conscientious care,[14] there is no evidence that it leads to better outcomes and there is strong evidence that it increases costs.[15] Dekay and Asch[16] argue that while a few select patients may experience improved health outcomes from DM, DM-diagnostic testing leads to an overall worsening of clinical outcomes due to unnecessary, harmful procedures performed in response to incidental findings and false positive diagnostic tests. Even "non-invasive" tests like CT are now recognized to carry significant risks with as many 2% of all cancers attributed to ionizing radiation from this imaging modality.[17]

The first step in addressing DM is to identify where it originates. In our previous study, we found that EM residents enter internship with a moderate amount of DM and MC, which led us to hypothesize that DM and MC may arise in a hidden curriculum during medical school. We identified considerable DM exposure even before the majority of clinical rotations, perhaps from preclinical medical school or before. However, the levels of our study are much less than the levels of DM exposure and MC we noted in EM interns.[10] It is possible that MC arises during years 3 and 4 of medical school. The relatively abrupt increase in patient care responsibility and legal exposure that occurs upon starting internship likely intensifies malpractice awareness and defensive medicine concerns.

LIMITATIONS

Our study is subject to all of the well-described limitations inherent in the convenience sampling method. Additionally, further DM and MC that occurs during the third and fourth year of medical school may not be captured by our early third-year sampling. Another limitation of our study may be the Hawthorne Effect, the change in behavior of subjects when they know they are being studied. However, our questions about DM and MC were mixed with a similar number of other unrelated questions to obscure our study objectives and minimize this effect. Social desirability bias against divulging a DM hidden curriculum may have also impeded students' willingness to report episodes of DM. Additionally, while we noted both exposure to physician DM and MC actions, and students' own malpractice concerns, the influence of the former on the latter is not known.

Although our survey was based on a well-validated instrument, the malpractice fear that students may experience in real patient encounters may be more dramatic. Finally, we implemented our study at a medical school with most rotations in county and public university hospitals in a state with a $250,000 limit on malpractice awards for pain and suffering (noneconomic) damages. The levels of DM and MC observed by medical students rotating at private hospitals or in states without capitations may be higher.

CONCLUSIONS

Although third-year medical students have little concern about being sued, they are exposed to malpractice concerns and taught a considerable amount of defensive medicine from faculty and residents, less so from nurses. Most students believe that fear of lawsuits will decrease their future enjoyment of the practice of medicine. However, less than a quarter of students felt that their choice of specialty would be influenced by malpractice worries, and a modest number of students felt that malpractice concerns lessened their enjoyment of learning medicine.

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Scholar Quest: A Residency Research Program Aligned with Faculty Goals

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Introduction: The ACGME requires that residents perform scholarly activities prior to graduation, but this is difficult to complete and challenging to support. We describe a residency research program, taking advantage of environmental change aligning resident and faculty goals, to become a contributor to departmental cultural change and research development.

Methods: A research program, Scholar Quest (SQ), was developed as a part of an Information Mastery program. The goal of SQ is for residents to gain understanding of scholarly activity through a mentor-directed experience in original research. This curriculum is facilitated by providing residents protected time for didactics, seed grants and statistical/staff support. We evaluated total scholarly activity and resident/faculty involvement before and after implementation (PRE-SQ; 2003-2005 and POST-SQ; 2007-2009).

Results: Scholarly activity was greater POST-SQ versus PRE-SQ (123 versus 27) ($p<0.05$) with an incidence rate ratio (IRR)=2.35. Resident and faculty involvement in scholarly activity also increased PRE-SQ to POST-SQ (22 to 98 residents; 10 to 39 faculty, $p<0.05$) with an IRR=2.87 and 2.69, respectively.

Conclusion: Implementation of a program using department environmental change promoting a resident longitudinal research curriculum yielded increased resident and faculty scholarly involvement, as well as an increase in total scholarly activity. [West J Emerg Med. 2014;15(3):299–305.]

INTRODUCTION

The Accreditation Council for Graduate Medical Education (ACGME) program requirements for emergency medicine (EM) call for programs to support and document resident scholarly activity prior to graduation. This requirement may be fulfilled through performance of a number of different activities, including review papers, case reports, textbook chapters, non-publishable projects, and participation in a research project or implementation of original research.[1-3]

This requirement is often difficult to fulfill for residents, and studies have revealed significant variance in the quality and quantity of scholarly activity accomplished.[3-7] While the majority of EM residents state that they plan to conduct original research during their residency, only a minority complete this goal.[4] However, residents who do complete research are provided funding and are supported to present their research at scientific meetings; they are also more likely to choose a career in academic medicine[8-11] For residents not headed toward an academic career, exposure to research experiences might increase their awareness and receptiveness to new clinical research findings, the need to practice evidence-based medicine, and the need for society to support healthcare research to address gaps in knowledge and healthcare disparities.[12-14]
In 2003, the Institute of Medicine's Clinical Research

Roundtable recommended that a clinical research curriculum be fundamental to all residency training requirements as one strategy to improve the provision of healthcare in the future.[14]

In a recent report in *JAMA*, Rothberg evaluated the obstacles to conducting research during residency and found that the barriers are multifactorial.[7] The barriers on the resident level include a lack of resident interest in research coupled with a lack of residency time dedicated to conducting research and developing resident research skills. Barriers on the faculty side include difficulty in finding appropriate mentorship for projects along with faculty time to assist with research skills and project development.[7] Both of these aspects are linked through the common lack of research infrastructure and funding to support research activities.[7] However, Rothberg does note that these barriers may be overcome through "an intentional approach that addresses specific barriers, beginning with a commitment to change the underlying culture of the institution to create an atmosphere of inquiry and the financial investment to build the necessary infrastructure."[7]

In this program evaluation and descriptive review, we describe a single-department residency research program whose goal is to provide an original research experience integrated with their EM curriculum. Development of this program took advantage of environmental change in the department to completely rethink the curriculum, align resident, faculty and department goals, and thus become a major contributor to the cultural change in an established academic department of emergency medicine.

METHODS

Residency Research Pre-Intervention

The University of Arizona Department of Emergency Medicine (DEM) had a distinguished history of scholarly work by an experienced faculty but had not produced a large portfolio of funded grants. The Arizona Emergency Medicine Research Center (AEMRC), the research arm of the DEM, was established and had the potential to become more active. The department head, Dr. Harvey Meislin, made the decision in 2003 to promote a change in the research culture of the ED. This required changes across the entire research system. Realigning the resident research experience was an important component, as it had the potential to become a source of future faculty members with strong academic interests and experiences and would also provide a platform to recruit future residents and faculty with academic experience and career trajectories.

Prior to 2005, the University of Arizona/UMC (UA/UMC) EM residency program expected scholarly activity by their residents to complete the program. This scholarly activity took many forms, including case studies, textbook chapters, non-peer reviewed publications, review articles, abstracts, peer-reviewed publications, posters or oral presentations. During those years, there was no requirement for original research.

The residents' scholarly activities were supported by a small core set of faculty mentors through informal mentorship. Annually, the residents received 4 hours of formal training in basic research methodologies, statistical analysis and critical analysis of the medical literature. The experience was not supported by dedicated funding and was not explicitly aligned with faculty research interests.

Although the scholarly activity satisfied the ACGME requirements, it was noted by Dr. Meislin that it did not help foster a department environment dedicated to research. The new stated departmental vision included a cultural change focused on an alignment of faculty and resident research efforts. In this way, a strong mentor/mentee relationship between residents and faculty could be formed with advantages to both.

Early in the development process of this concept, he identified and assembled key individuals who could refine and implement the vision. Key individuals in the planning stages included the department head, residency program director, research director, and vice directors of the AEMRC. The concepts discussed required the integration of resident learning, faculty goals for professional development, and the projected long-term research focus areas of the department.

Scholar Quest Evolution

Planning

The development of Scholar Quest (SQ) started with an identification of the resident learning needs that could be obtained from a research program. The goals of the new program would fundamentally need to satisfy ACGME program requirements. On an individual level, resident needs vary significantly. Future careers can range from working in the private sector with no research expectations to entering traditional academic pathways. The fundamental goal of the program was to provide an original research experience that would benefit all residents by providing a mentor-directed experience, preparing residents for both academic and/or private industry pursuits, with the vision to improve the provision of healthcare in the future.

The planning committee believed that the curriculum should be integrated into other existing experiences to support the overall cultural change. The program was designed to combine didactic lectures in theory and methodology education, a team-based original hypothesis-driven proposal, direct faculty mentoring to guide residents through the experience, and finally the development of an original research end product for presentation/publication. This design was aligned with an existing curriculum of evidence-based medicine and a rigorous critical-appraisal journal club.

Support

During the planning phases, the planning committee completed an assessment of the needed resources to be allocated for program success. They divided the resources

estimated into 3 key areas: research core staffing, faculty mentors, and possible research funding to conduct the projects. Staffing needs predicted included 0.25 FTE research office staff for assistance with IRB submissions and manuscript preparation, 0.25 FTE epidemiologist/biostatistician to assist with teaching methodology to residents and assisting with statistical evaluation for projects, and lastly 0.25 FTE for a program coordinator for overall curriculum direction and monitoring the progress of resident research.

Mentors. The committee deemed significant faculty mentoring involvement to be essential. To promote this, a new incentive structure for faculty involvement was developed, which rewarded faculty time in conference, conducting research with residents, and performing lectures. Faculty could earn this "citizenship incentive" ($4,000 annual) for their involvement and at the same time gain access to research collaborators/assistants to improve personal academic productivity.

Funding

Research funding for projects was determined to be an important aspect of the program to support the research effort of the residents and faculty. The committee determined this to be best supported through a competitive seed grant process where residents and/or faculty submit applications for grants of up to $5,000. Evaluation of seed grants quality and funding was done through the existing departmental research committee.

Resident research was also supported through funding for presentation of findings at regional and national conferences. Residents who have abstracts accepted at these meetings are given a travel stipend to go to the meeting and present their findings.

Scholar Quest Curriculum

SQ is a key part of a highly structured 3-year EM Information Mastery program (IM) (Figure). The 3 components include an evidence-based medicine curriculum, Critical-Appraisal Journal Club, and the SQ program. The overall goals for participants of the IM program are 3-fold: (i) to better use information derived from valid medical literature sources for patient care, education and research, (ii) to improve the skills of critically appraising medical literature relevant to EM, and (iii) to acquire an understanding of scholarly activity through a directed experience in original research

SQ didactic sessions and mentored team meetings are scheduled during regular weekly conference time to insure access for all residents. Total conference time set aside per year toward research activities was 14 hours, not including optional external time with faculty mentors on research development or conducting studies. Scheduled sessions included research methodology lectures, hypothesis generation, meeting with epidemiologists/biostatisticians, interaction with faculty mentors, development of Institutional Review Board and Institutional Animal Care and Use Committee applications and preparations of publishable material.

At the completion of the research, each resident is required to present their research findings prior to graduation at the Annual Resident Research Forum. The Annual Resident Research Forum occurs during protected didactic time. The Forum is a venue for residents to present their research to all the faculty and residents in the department.

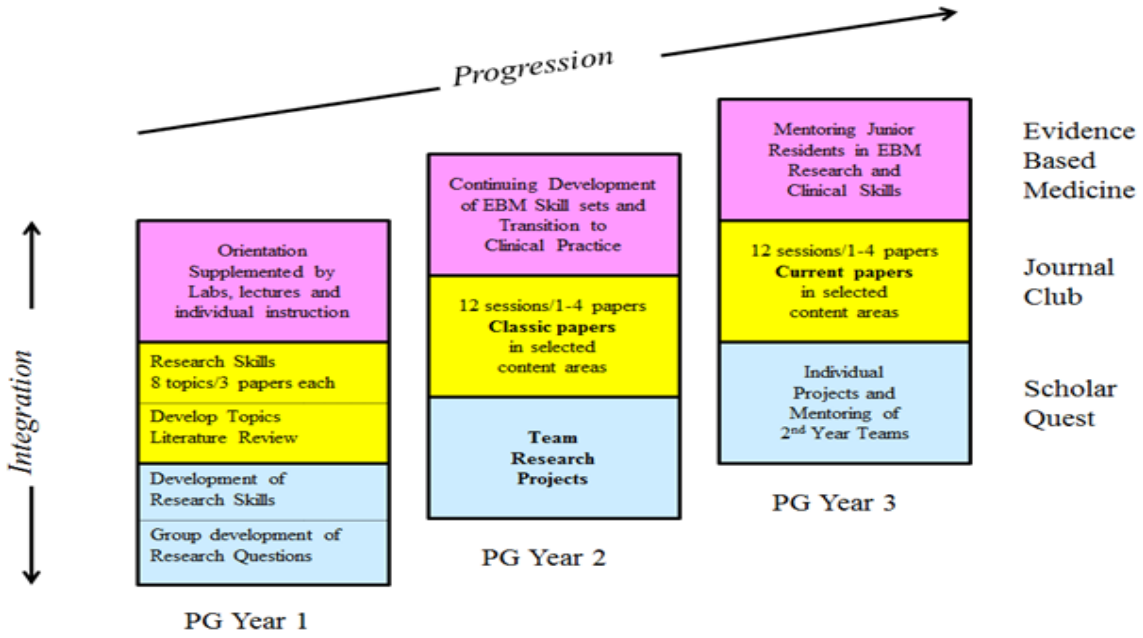

Figure. The Information Mastery program is a novel, integrated curriculum developed in the University of Arizona Department of Emergency Medicine. It comprises three complementary tracks: Evidence-Based Medicine (EBM), Scholar Quest, and Journal Club. *PG*, post graduate

Table 1. Scholarly activity for residents pre-intervention and post- intervention with Scholar Quest.
*p=0.05 for comparison of PRE-SQ (2002-2004) to POST-SQ (2007-2009).

Year	Peer-reviewed article	Abstracts	Poster presentation	Oral presentation	Non-peer reviewed articles	Total	p-value
2002	2	0	0	0	6	8	
2003	1	5	0	0	4	10	
2004	3	3	0	0	3	9	
Scholar Quest run in period							0.05*
2007	6	2	1	7	4	20	
2008	4	11	2	13	2	32	
2009	6	9	0	27	29	71	

Method of Program Evaluation

To ascertain the overall outcomes, we measured total completed scholarly activity along with resident and faculty involvement from 2003-2010, both pre-intervention (PRE-SQ) (2002-2004) and post-intervention (POST-SQ) (2007-2009). Scholarly activity can be fulfilled through performance of a number of different activities, including review papers, case reports, textbook chapters, non-publishable projects, and participation in a research project or implementation of original research.[1-3]

We did not include the program adoption period in analysis. Data were tabulated from a broad definition of scholarly activities that are typically accepted by residency programs and divided into categories including: peer-reviewed publications, poster presentations, published abstracts, oral presentations and non-peer reviewed material, including chapters, electric journals, and non-scholarly publications.

We collected data from information extracted from program files and de-identified in a collection spreadsheet. All residents who graduated during the study period were also contacted for updated CVs focusing on their research work during residency. We compared these and generated a master list. Overall, scholarly activity was identified in ~94% of residents who graduated from the residency program during the evaluation periods.

We performed statistical analysis using a Wilcoxon rank sum test comparing differences PRE-SQ and POST-SQ. This was followed by a negative binomial regression analysis for annual incidence rates and annual incidence rate ratios. Annual incidence rate is the ratio of the number of cases per year (i.e scholarly activity) to the time period of the program in question (i.e PRE-SQ). The annual incidence rates were measured to evaluate the number of residents and faculty involved over time and the total scholarly activity over the time period. We calculated the rate ratios to control for growth of the faculty and resident population and its effect on the annual incidence rates. Analysis was done using STATA version 11 software.

RESULTS

The SQ program was started in 2004 and was integrated into the curriculum and departmental culture over a 2-year period. During this time, there was also a coincident increase in the number of residents in the residency and recruited faculty members. From PRE-SQ to POST-SQ periods, the total resident numbers increased from 98 residents PRE-SQ to 152 total residents POST-SQ ($p<0.05$). The total faculty numbers similarly increased from 73 for the PRE-SQ period to 106 total faculty members during the POST-SQ period ($p<0.05$).

The total number of scholarly activities was tabulated PRE-SQ (2002-2004) and POST-SQ (2007-2009) (Table 1). Included in the tabulation are the different types of activities conducted along with the totals. There was an increase in the total number of scholarly activities in the PRE-SQ period versus the POST-SQ period of 27 to 123 ($p<0.05$).

During the study period, resident and faculty involvement also increased as noted in Table 2. Resident involvement significantly increased from PRE-SQ to POST-SQ (22 to 98 residents involved in scholarly activities) ($p<0.05$). Faculty involvement followed a similar trend increasing from 10 to 39 faculty involved in resident scholarly activities ($p<0.05$).

To further investigate this rate of change, and control for the growth of both the resident and faculty populations, we calculated annual incidence rates and ratios for total scholarly activities, resident involvement and faculty involvement (Table 3). Rate ratio for scholarly activities was 2.35 (CI 1.05 to 5.3) ($p<0.05$). Both resident involvement and faculty involvement demonstrated similar increased rate ratios of 2.87 (CI 1.79 to 4.60) ($p<0.05$) and 2.69 (CI 1.34 to 5.38) ($p<0.05$), respectively.

Table 2. Resident and faculty involvement pre-intervention and post-intervention with Scholar Quest.
*p<0.05 for comparison of PRE-SQ (2002-2004) to POST-SQ (2007-2009) for both resident and faculty involvement.

Year	Number of residents involved in scholarly activity	Number of faculty involved in scholarly activity	p-value
2002	6	2	
2003	7	3	
2004	9	5	
Scholar Quest run in period			0.05*
2007	26	10	
2008	27	12	
2009	45	17	

Table 3. Annual Incidence rates and ratios for resident scholarly activities, resident involvement and faculty involvement before and after the Scholar Quest (SQ) program initiation.

		Annual incidence rates	Annual rate ratio	95% confidence interval	p-value
Scholarly activity	PRE-SQ	0.329	Ref		
	POST-SQ	0.775	2.350	1.050 to 5.300	0.038
Resident involvement	PRE-SQ	0.225	Ref		
	POST-SQ	0.645	2.868	1.788 to 4.601	0.000
Faculty involvement	PRE-SQ	0.137	Ref		
	POST-SQ	0.368	2.686	1.341 to 5.380	0.005

Ref, referent

DISCUSSION

The development of a comprehensive original resident research experience is a significant challenge.[7] Other important but competing priorities during residency include learning core foundational medical knowledge concepts, gaining procedural competency and maintaining personal wellness. However, the benefits of having an experience like SQ stimulate residents to consider an academic career, increase their awareness and receptiveness to new clinical research findings, substantiate the need to practice evidence-based medicine, and demonstrate the need for society to support healthcare research to address gaps in knowledge and healthcare disparities.[12-14]

In this study, we demonstrate that the implementation of a longitudinal resident research curriculum with an original research experience at the core can be successful when aligned with faculty and departmental goals. The use of a global environmental change in the department towards research facilitated its success evidenced by a doubling of the annual rate of scholarly activities (annual incidence ratio=2.35) ($p<0.05$). Moreover, the growth of the departmental culture and link between residents and faculty was apparent in the doubling of the rate of both residents and faculty involvement in research over time (annual incidence ratios of 2.87 and 2.69, respectively) ($p<0.05$).

Following the implementation of SQ in the residency curriculum, there was a significant increase in resident and faculty involvement in research along with an increase in the total scholarly activity from the residents. The success of this program was not solely due to a new dedicated curriculum, but was accomplished by a complete dedication to change in the environment of the department to one that fosters and nurtures research at all levels of development.

The reason for the success of this program is probably multi-factorial. The contributors to the success of this program are noted on all levels of the infrastructure including: 1) the vision of the department head to impart a philosophical change; 2) dedication of the departmental leadership to implement this change across all faculty and resident programs; 3) integration of the SQ research program into a new Information

Mastery Program; 4) dedicated didactic time for research methodology and hypothesis generation; 5) development of departmental infrastructure to support research studies including epidemiologist/biostatistician and program coordinators; 6) monetary support for resident research projects through grants and also funding presentations at regional and national meeting; and 7) securing faculty involvement through monetary incentives.

The concept of an original research experience and its integration in resident education is one that has been difficult to implement due to many hurdles. SQ presents one department's efforts to produce an original research experience for their residents through the alignment of faculty and resident goals. Similar outcomes could likely be achieved at other programs by introducing key ingredients outlined in this article.

LIMITATIONS

The primary limitation of this study is that this is a single-site evaluation of the development and implementation of a longitudinal residency research curriculum. This makes it difficult to determine whether this program is generalizable to other sites. However, the fundamental effect of changing the culture and environment of a department to enhance the residency research experience is an important and unique finding supporting the recommendations noted by Rothberg.[7] This study demonstrates that it is feasible to implement departmental cultural change in the manner described. It is reasonable to expect that implementation of many of the key aspects of this program would achieve similar outcomes.

This study is also limited by being unable to determine which intervention was most responsible for the success of the program. The study design does not allow for the delineation of which specific factor is primarily responsible (i.e integration of the program into Information Mastery Curriculum, development of research infrastructure, monetary support, etc.) but instead presents the concept that a holistic cultural change on all levels of the infrastructure may be responsible for the positive outcome of this program.

Further, as a single-site program attempting to align residents and faculty, we may potentially constrain resident choice in research areas. Although the program is designed for residents to self-generate research questions and hypotheses with mentor guidance, residents may be drawn to choosing mentors who are in research areas that are well represented in the department. This may inadvertently constrain resident choices.

Lastly, a potential confounder is the type of faculty recruited and hired throughout the time period of this evaluation. This is a potential confounder since newly hired faculty could be research oriented, highly productive and affect the success of the program. With this in mind, we analyzed the data for all scholarly activity that was primarily mentored by newly recruited faculty during the POST-SQ period. Newly recruited faculty was defined as faculty hired following the PRE-SQ period. During this POST–SQ period, 93% of the scholarly activity was mentored by established faculty who were not newly hired.

CONCLUSION

Implementation of a program using departmental environmental change to promote a resident longitudinal research curriculum designed to facilitate resident involvement in original research yielded increased resident and faculty involvement. This was associated with increased total scholarly activity.

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Experience with Emergency Ultrasound Training by Canadian Emergency Medicine Residents

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Introduction: Starting in 2008, emergency ultrasound (EUS) was introduced as a core competency to the Royal College of Physicians and Surgeons of Canada (Royal College) emergency medicine (EM) training standards. The Royal College accredits postgraduate EM specialty training in Canada through 5-year residency programs. The objective of this study is to describe both the current experience with and the perceptions of EUS by Canadian Royal College EM senior residents.

Methods: This was a web-based survey conducted from January to March 2011 of all 39 Canadian Royal College postgraduate fifth-year (PGY-5) EM residents. Main outcome measures were characteristics of EUS training and perceptions of EUS.

Results: Survey response rate was 95% (37/39). EUS was part of the formal residency curriculum for 86% of respondents (32/37). Residents most commonly received training in focused assessment with sonography for trauma, intrauterine pregnancy, abdominal aortic aneurysm, cardiac, and procedural guidance. Although the most commonly provided instructional material (86% [32/37]) was an ultrasound course, 73% (27/37) of residents used educational resources outside of residency training to supplement their ultrasound knowledge. Most residents (95% [35/37]) made clinical decisions and patient dispositions based on their EUS interpretation without a consultative study by radiology. Residents had very favorable perceptions and opinions of EUS.

Conclusion: EUS training in Royal College EM programs was prevalent and perceived favorably by residents, but there was heterogeneity in resident training and practice of EUS. This suggests variability in both the level and quality of EUS training in Canadian Royal College EM residency programs. [West J Emerg Med. 2014;15(3):306–311.]

INTRODUCTION

Emergency ultrasound (EUS) in Canada has developed in a delayed fashion compared to the United States. The Canadian Association of Emergency Physicians (CAEP) initially issued a position statement in 1999 supporting the availability of focused ultrasound 24 hours per day in the emergency department (ED).[1] It has since undergone revisions in 2006 and most recently 2012.[2,3] The 2006 position statement was the first revision supporting the incorporation of EUS training into emergency medicine (EM) residency programs accredited by the Royal College of Physicians and Surgeons of Canada (Royal College).[2] The Royal College accredits postgraduate EM specialty training in Canada through 5-year residency programs. From 2008, EUS was

officially introduced as a core competency to the Royal College EM training standards.[4]

In the United States, the American College of Emergency Physicians (ACEP) first published a position statement supporting the use of ultrasound by emergency physicians in 1990.[5] Starting in 1996, the Accreditation Council for Graduate Medical Education (ACGME) EM core curriculum required EUS competence for residency graduation.[6] Furthermore, many prominent EM and non-EM organizations have endorsed the use of EUS, including ACEP, the Society for Academic Emergency Medicine (SAEM), the Council of Emergency Medicine Residency Directors (CORD), and the American Institute of Ultrasound in Medicine (AIUM).[7-10]

Although EUS training has been well described in the United States, there is only a paucity of data about the state of EUS training in Canadian Royal College EM residency programs.[11-13] There are currently no data about resident perceptions of EUS training in Canada, yet it is important to incorporate this feedback into training programs to optimize the resident educational experience with ultrasound. Both the Royal College and the ACGME include residents in the accreditation processes of their postgraduate medical programs, through direct participation in accreditation teams and through program evaluations or surveys.[14,15] The objective of this study is to describe both the current experience with and the perceptions of EUS by Canadian Royal College EM senior residents.

METHODS

Study Design

This was a web-based survey study approved by the Sunnybrook Health Sciences Research Ethics Board.

Study Setting and Population

All postgraduate fifth-year (PGY-5) Royal College EM residents (39 total residents in 13 residency programs) across Canada were invited to participate in this study. Resident names and contact information were acquired directly from residency program administrators whose contact information is published on the Canadian Resident Matching Service (CaRMS) website.[16]

Study Protocol

The study investigators designed a website-based survey instrument (Appendix) based on previously published survey studies focusing on EUS training.[11,13,17] Seven EM residents reviewed the survey for language and ease of use. Their comments were incorporated into the revision of this instrument. Potential resident participants were emailed a link to the website-based survey on Zoomerang (MarketTools

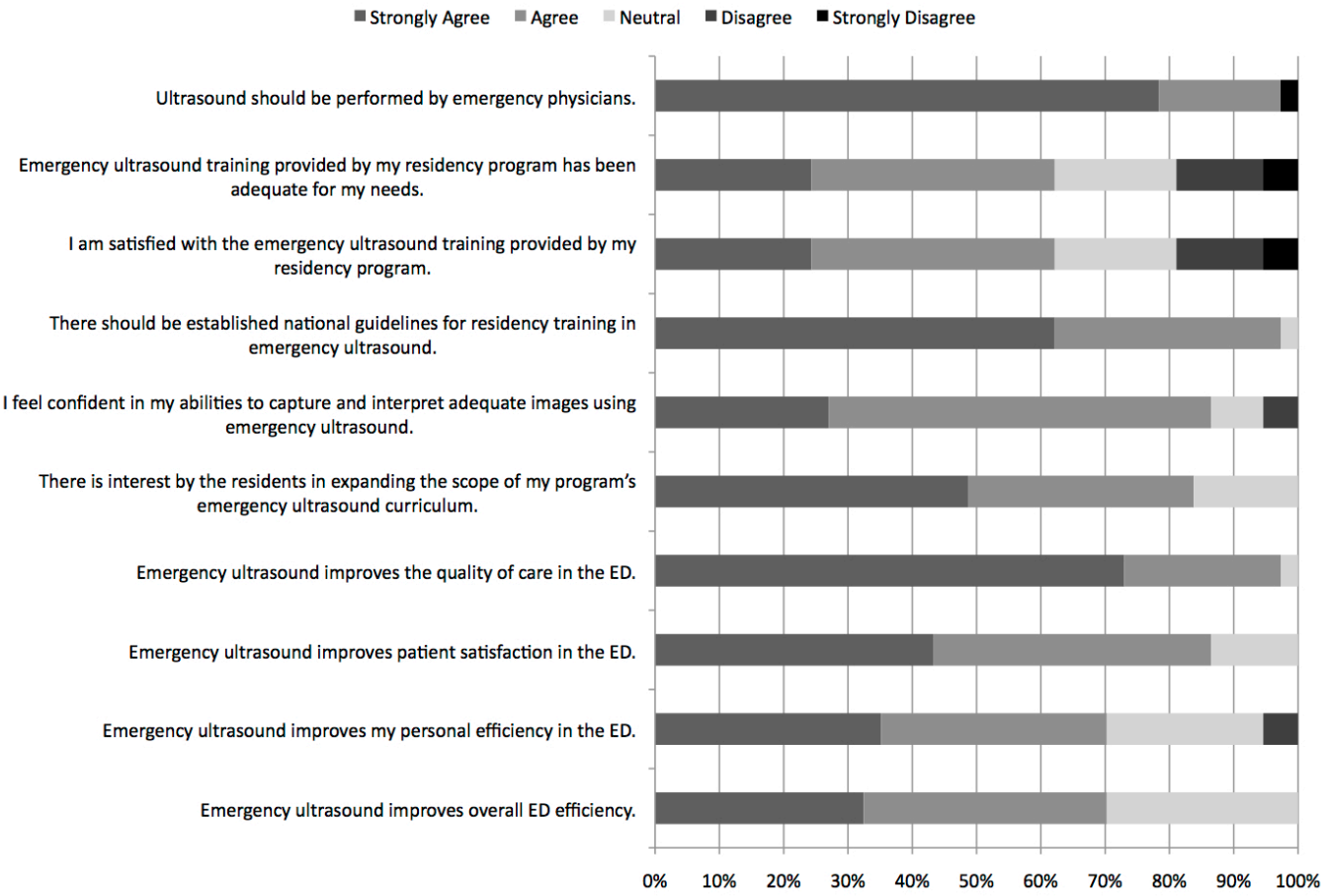

Figure 1. Likert responses to survey questions represented using stacked count data.

Table 1. Breakdown of ultrasound training received and ultrasound applications performed in clinical practice by Canadian Royal College emergency medicine residents.

Ultrasound applications	Training received n=37 No. (%)	Applications performed in practice n=37 No. (%)
None	0 (0)	0 (0)
Focused Assessment with Sonography for Trauma (FAST)	37 (100)	37 (100)
Intrauterine Pregnancy	32 (86)	31 (84)
Abdominal aortic aneurysm (AAA)	37 (100)	37 (100)
Cardiac	28 (76)	30 (81)
Biliary/Right upper quadrant	11 (30)	12 (32)
Renal/Urinary tract	12 (32)	10 (27)
Deep vein thrombosis (DVT)	11 (30)	9 (24)
Soft-tissue/Musculoskeletal	11 (30)	14 (38)
thoracic (pleural effusion, pneumothorax)	25 (68)	23 (62)
Ocular	12 (32)	13 (35)
Procedural guidance	34 (92)	32 (86)

Table 2. Breakdown of ultrasound-guided procedural training received and ultrasound-guided procedures performed in clinical practice by Canadian Royal College emergency medicine residents.

Ultrasound guided procedures	Training received n=37 No. (%)	Procedures performed in practice n=37 No. (%)
None	0 (0)	0 (0)
Arterial line placement	16 (43)	19 (51)
Arthrocentesis	10 (27)	11 (30)
Central line placement	37 (100)	37 (100)
Foreign body removal	15 (41)	19 (51)
Incision and drainage	19 (51)	24 (65)
Lumbar puncture	15 (41)	10 (27)
Paracentesis	20 (54)	23 (62)
Pericardiocentesis	16 (43)	10 (27)
Peripheral venous cannulation	21 (57)	21 (57)
Peritonsillar abscess incision and drainage	8 (22)	9 (24)
Thoracentesis	16 (43)	15 (41)
Transvenous pacemaker insertion	9 (24)	10 (27)

Co, San Francisco, California) in January 2011. The survey consisted of 23 mandatory close-ended questions assessing EUS training and perceptions. Questions assessing perceptions of EUS were answered on a 5-point Likert scale (1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree). Non-respondents were sent reminder emails at 2, 4, 6, and 8 weeks after the initial email. An incentive in the form of an iTunes (Apple Inc, Cupertino, California) email gift certificate in the amount of $10 was provided for successful survey completion. All respondents were immediately de-identified from their responses after completion of the survey.

Data Analysis

Data were downloaded directly from the web interface and imported into Microsoft Excel (Microsoft Co, Redmond, Washington). We reported descriptive statistics using number and proportion.

RESULTS

The survey response rate was 95% (37/39) of all PGY-5 residents. EUS was part of the formal residency curriculum for 86% (32/37) of respondents. All (100% [37/37]) residents had immediate access to an ultrasound machine in the ED. EUS training was described as minimal for 22% (8/37) of residents, moderate for 51% (19/37), and extensive for 27% (10/37).

Table 1 outlines EUS training received by residents as well as ultrasound applications performed by residents in their own clinical practice. Table 2 summarizes ultrasound-guided procedural training received and ultrasound-guided procedures performed in clinical practice. Table 3 details the different types of EUS instructional material provided by EM residency programs to their residents. The most commonly provided instructional material was an ultrasound course for 86% (32/37). The majority of residents (73% [27/37]) used other educational resources outside of residency training to supplement their EUS knowledge beyond that offered or required by their residency program. Table 3 also breaks down the different types of instructional material used by the 27 respondents who used supplementary educational resources.

Almost all respondents (95% [35/37]) make clinical decisions and patient dispositions based on their EUS interpretation without a consultative study by radiology. In this group, 89% (31/35) only apply this type of decision making for specific EUS applications. Table 4 describes these EUS applications. Figure 1 summarizes resident perceptions of EUS and EUS training.

DISCUSSION

Bedside ultrasound is a paradigm shift from traditional consultative imaging to the performance of a focused, dynamic study to allow direct correlation with a patient's signs and symptoms.[18] It has been shown to improve outcomes, decrease costs, and decrease complications.[19-21] The majority of EUS education in the United States occurs during EM

Table 3. Emergency ultrasound instructional material provided by Canadian Royal College emergency medicine residency programs, and alternative educational resources used by emergency medicine residents to supplement their emergency ultrasound knowledge.

Emergency ultrasound instructional material	Provided instructional material n=37 No. (%)	Supplementary educational resources n=27 No. (%)
No instructional material provided	2 (5)	NA
Animal model	0 (0)	1 (4)
Computer simulation	1 (3)	5 (19)
DVD/CD program	8 (22)	8 (30)
Journal articles	18 (49)	12 (44)
Mannequin or manufactured model	22 (59)	3 (11)
Online education resource	7 (19)	15 (56)
Textbook	16 (43)	14 (52)
Ultrasound course	32 (86)	14 (52)

NA, not applicable

Table 4. Ultrasound applications for which Canadian Royal College emergency medicine residents make clinical decisions and patient dispositions based on their emergency ultrasound interpretation without formal confirmation.

Ultrasound applications	n=31 No. (%)	
Abdominal aortic aneurysm (AAA)	30	(97)
Focused Assessment with Sonography for Trauma (FAST)	27	(87)
Procedural guidance	21	(68)
Intrauterine pregnancy	17	(55)
Cardiac	17	(55)
Thoracic (pleural effusion, pneumothorax)	15	(48)
Soft-tissue/Musculoskeletal	9	(29)
Ocular	5	(16)
Renal/Urinary tract	3	(10)
Biliary/Right upper quadrant	2	(6)
Deep vein thrombosis (DVT)	1	(3)

residency training, but there is only a paucity of corresponding data about the state of EUS training in Canadian Royal College EM programs and no information about resident perceptions of their EUS training.[11-13,17]

Our data demonstrate that the majority of Royal College EM residents receive training in EUS as part of their residency curriculum. While EUS training is prevalent, the scope of training is limited to focused assessment with sonography for trauma (FAST), intrauterine pregnancy, abdominal aortic aneurysm (AAA), cardiac, and procedural guidance. This scope satisfies the 2008 Royal College objectives of training in EM and reflects the applications listed in CAEP's 2006 position statement on EUS.[2,4] However, this is a smaller scope of practice compared to the 2008 ACEP EUS guidelines, which additionally list biliary, urinary tract, deep vein thrombosis (DVT), soft tissue/musculoskeletal, thoracic, and ocular as core EUS applications.[7] The 2012 CAEP position statement now includes these additional applications as advanced EUS applications.[3] There was no significant difference between the EUS applications for which residents received training and the EUS applications performed by residents in their own clinical practice.

Despite the seemingly focused scope of training, more than half of respondents reported using advanced EUS applications like thoracic ultrasound and ultrasound guidance for arterial line placement, foreign body removal, incision and drainage, paracentesis, and peripheral venous cannulation. However, a survey study of Royal College EM program directors in 2011 reported that less than half of all programs offer training in these specific advanced applications.[13] This discrepancy between residents and program directors has several possible explanations, including the under-reporting of training by program directors or the over-reporting of training by residents.

Our results provide another possible explanation. With 73% of residents using other educational resources outside of residency training, the use of advanced EUS applications may be driven by the residents themselves. The most commonly used supplementary educational resources were online educational resources (56%), textbooks (52%), and ultrasound courses (52%). Residents had very favorable perceptions and opinions of EUS, and most strongly believed that ultrasound should be performed by emergency physicians. Residents also believed that there was interest by their resident group in expanding the scope of their program's EUS curriculum. There is a high level of enthusiasm for training in EUS, and educators should be aware that a majority of residents are using supplementary educational resources. It is up to educators to direct residents to EUS resources that are accurate, effective, and evidence-based. We would also argue that educators need to ensure that their faculty continues to hone their skills in such advanced applications to provide appropriate supervision to their residents.

One potential measure of a successful ultrasound training program is whether decisions related to patient care and

disposition are made based on the EUS exam interpretation. Almost all respondents (95%) reported that they made clinical decisions and patient dispositions based on their EUS interpretation without a consultative study by radiology. This is surprising considering that only 86% of respondents reported that EUS is part of their formal residency curriculum. This suggests that there are residents who lack core EUS training yet make clinical decisions and dispositions based on their ultrasound exam. Of residents that apply this type of decision making, the majority (89%) make clinical decisions and dispositions only for specific ultrasound applications. The most commonly cited applications were AAA (97%), FAST (87%), and procedural guidance (68%). Respondents seemed uncomfortable in their own ultrasound interpretation of applications that are traditionally performed by radiology, such as biliary, urinary tract, and DVT. Additionally, data from 2011 collected concurrently at the same time as the data from this study reported that 69% of Royal College EM programs had no formal quality assurance process in place for the use of EUS, but in 100% of these programs EM residents and faculty made clinical decisions and patient dispositions based on their EUS interpretation.[13] This is concerning, given that both residents and faculty are making clinical decisions and patient dispositions without the safety net of a quality assurance program. The goals of a quality assurance process are to maximize patient safety, ensure accuracy, and improve physician performance. CAEP supports the principle of incorporating a quality improvement program for EUS into the overall ED quality assurance process.[2] ACEP states that quality assurance systems are an integral part of an EUS program.[7] The lack of quality assurance programs for the use of EUS seems to be a key deficiency in current Royal College EM residency programs that needs to be addressed urgently.

LIMITATIONS

This study specifically surveyed PGY-5 EM residents and reported their responses. As these responses are based on the perceptions of each resident, they may not reflect the actual reality of EUS training in their residency programs. It is also possible that the monetary incentive resulted in rapid and factitious completion of the survey simply to receive the incentive; however, given the small overall value of the incentive, the likelihood of this occurrence is low. Additionally, we did not observe any obvious patterns in the data to suggest such responses. The survey instrument was designed by the study investigators and is not a formally validated survey instrument. Finally, 4 respondents (11%) self-reported participation in an external EUS fellowship program during residency training, so these results may provide an overestimate of EUS training provided by Royal College EM residency programs.

CONCLUSION

EUS training in Royal College EM programs was prevalent and perceived favorably by residents, but there is heterogeneity in resident training and practice of EUS. This suggests variability in both the level and quality of EUS training. These results suggest a potential role for national guidelines to standardize ultrasound training for all Royal College EM programs. Additionally, the use of ultrasound for advanced applications is popular and prevalent among residents. Future research is needed to determine the best methods for delivering EUS education and training.

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Assessment of the Acute Psychiatric Patient in the Emergency Department: Legal Cases and Caveats

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INTRODUCTION

Assessment of the acute psychiatric emergency is challenging and fraught with error. This paper, using legal cases, will discuss the assessment of new onset psychiatric illness, exacerbation of chronic psychiatric disease, and the suicidal patient. We will share diagnostic caveats, medical clearance, and suicide assessment tools.

METHODS

The authors, who have significant medical legal experience, selectively chose illustrative legal cases to discuss caveats of assessment of acute psychiatric emergencies. We selected representative cases after reviewing legal journals and publications. Cases involving restraint and sedation were excluded as they were covered in a prior manuscript.

Assessing New Onset Psychiatric Disorders

Psychosis is a relatively common syndrome affecting 3% to 5% of the population at some point in life.[1,2] Encountering undiagnosed psychiatric conditions, such as psychosis or bipolar disorder, is commonplace for the emergency physician (EP). The following case illustrates the challenge and importance of the assessment of new onset psychiatric disorders.

In *Brown v Carolina Emergency Physician* (2001), Mr. Brown noted a gradual change in his wife's behavior as she became more lethargic and depressed. He presented to Greenville Memorial Hospital's emergency department (ED) on a Friday to obtain a physician's note that would excuse him from his 2-week National Guard annual training session. Dr. Benjamin Crumpler examined Mrs. Brown and diagnosed her with acute delusional psychosis. Based on his observations, he recommended that she be admitted to the hospital, but neither Mr. nor Mrs. Brown wanted her to be admitted. Mr. Brown assured Dr. Crumpler that he would care for his wife at home during the weekend and return to the ED if needed. Dr. Crumpler then obtained collateral information from a family friend regarding the couple. Satisfied by this conversation and Mr. Brown's assurances, he arranged for the required National Guard physician's note, provided referral to a mental health center the following Monday, and prescribed hydroxyzine for Mrs. Brown.

Initially, Mrs. Brown seemed better. However, by Sunday she was strangely energetic, racing around the family's home singing religious hymns. Mr. Brown physically restrained her and then carried her to their bedroom after she suddenly fell asleep in the midst of a struggle. She woke 30 minutes later very agitated. A verbal and physical confrontation with Mr. Brown ensued. She repeatedly hit him with a rod. Following another physical struggle, she again suddenly went limp and appeared to be asleep. Mr. Brown went to the kitchen to call 911. While he was on the phone, Mrs. Brown beat the couple's 16-month-old son to death.

At Mrs. Brown's criminal trial, psychiatric experts testified that she suffered from paranoid schizophrenia and was not guilty by reason of insanity. The family then filed a civil action against the hospital and Dr. Crumpler seeking damages. The Browns claimed that Dr. Crumpler's negligent failure to properly diagnose, treat, and hospitalize Mrs. Brown proximately caused the death of their son. The trial court granted summary judgment for the defendant hospital and physicians.

On appeal, the South Carolina Court of Appeals reversed and held that Dr. Crumpler's inadequate treatment of Mrs. Brown's psychosis in the ED was the proximate cause of her fatal assault on the couple's youngest son a few days later. The court was convinced by the plaintiff's expert witnesses who opined that Mrs. Brown's condition "warranted either a

psychological evaluation to be performed by a licensed psychologist or a psychiatric consultation to be performed by a licensed psychiatrist." The experts agreed that given Mrs. Brown's psychotic state as identified by Dr. Crumpler, hospitalization was the proper course of action. Failing to do this, Dr. Crumpler negligently failed to prescribe appropriate antipsychotic medication.[3]

In the above case the EP correctly diagnosed a psychiatric problem and developed the appropriate plan for admission. However, subsequently he discharged the patient home (in contrast to his initial plan) and prescribed medications to treat an acute psychiatric condition. At trial, the court verified that this is really outside of the scope of practice of an EP. Assessment and diagnosis of acute psychiatric conditions is complicated and involves a multitude of specific criteria. Psychiatrists require multiple years of training to develop these special skills. EPs should always consult a psychologist or psychiatrist when managing patients with a new significant psychiatric condition. This may involve transferring the patient to a regional referral center. Implementation of a legal hold status may be required depending on local custom and state law. Some states allow a physician to unilaterally make this decision while others require an independent acute crisis team to make the assessment. Physically detaining the patient until his safe decision-making capacity is established has been clearly supported by the U.S. Supreme Court.[4]

Assessing for Medical Clearance in the Acute Psychiatric Presentation

Jackson v East Bay Hospital, et al. (2001) Robert Jackson visited the Lake County Mental Health Department to see a psychiatrist. He had a history of a psychotic disorder, borderline intellectual functioning, and pedophilia. Lake County instructed Mr. Jackson to obtain medical clearance from the Redbud Hospital ED prior to returning for psychiatric treatment.

At Redbud's ED, Mr. Jackson presented with concerns of hallucinations, dizziness, and general unsteadiness. Dr. Schug evaluated Mr. Jackson and ordered several laboratory studies. Following this review and based largely on his examination, he diagnosed Mr. Jackson as suffering from acute psychosis.

No psychiatric care was provided at Redbud ED. Dr. Schug arranged for Lake County to follow up with Mr. Jackson as was intended originally. A Lake County employee evaluated him following his discharge.

Mr. Jackson returned to the Redbud ED 2 days later where he was evaluated by Dr. Miguel Ollada for concerns of a sore throat, pleuritic chest pain, and dry heaves. During the interview, it was recorded that Mr. Jackson was talking to himself. Dr. Ollada performed a complete physical exam and ordered a battery of tests (including an electrocardiogram, urine drug screen, and an arterial blood gas). The urine drug screen indicated that Mr. Jackson was taking his prescribed tricyclic antidepressant, Clomipramine. Following this evaluation, Mr. Jackson was diagnosed with chest contusions, hypertension, and psychosis. Dr. Ollada requested a psychiatric evaluation by Lake County Mental Health, which refused because he had been evaluated recently and found to not be suicidal. Dr. Ollada released Mr. Jackson and instructed him to follow up with Lake County Mental Health in the morning.

Mr. Jackson returned to the Redbud ED within several hours after his wife found him wandering in the middle of the road. Dr. Ollada, who still was on duty, performed another assessment. Although he found Mr. Jackson to be very agitated, he denied any other physical symptoms and had a regular heartbeat. Mr. Jackson was given haloperidol and diphenhydramine. Dr. Ollada then contacted Lake County and advised them of Mr. Jackson's condition.

Later that morning, a Lake County Mental Health crisis worker came to the ED and evaluated Mr. Jackson. The worker determined that he met criteria for inpatient involuntary psychiatric admission. Following Lake County's recommendation, Dr. Ollada then medically cleared Mr. Jackson for transfer to East Bay Hospital, which functioned almost exclusively as a psychiatric hospital.

Mr. Jackson was transferred to East Bay Hospital where he was evaluated by a psychiatrist, Dr. Steele, who performed a psychiatric assessment but not a physical exam. Dr. Steele prescribed more haloperidol for Mr. Jackson. Later that day Mr. Jackson went into cardiac arrest and staff began to perform CPR. He was transported to Brookside Hospital where despite resuscitation efforts, he was pronounced dead. An autopsy determined that Mr. Jackson had died from a lethal cardiac arrhythmia caused by a toxic level of Clomipramine.

Mr. Jackson's widow and daughter brought suit against the treating hospitals and physicians claiming EMTALA violations. The district court granted summary judgment for the defendant healthcare providers, and the family appealed. They also filed a state-based malpractice claim, the result of which is unknown.

In upholding the trial court's grant of summary judgment the appellate court noted that a screening exam does not have to be medically adequate to satisfy the statutory requirement. Mr. Jackson was seen by a triage nurse during each of his visits and was assessed by a physician who performed a physical exam and ordered tests. Accordingly, the court held his screening was similar to other patients presenting to the defendant hospitals, which satisfies the statutory requirement. Additionally, because the hospitals never detected the drug toxicity, under EMTALA they cannot be held liable for failure to stabilize this condition prior to transfer. The statutory requirement only applies to medical conditions actually discovered prior to transfer.[5]

This case is an excellent example of the danger of missing the diagnosis of delirium. Multiple physicians overlooked the possibility of delirium and the probability of clomipramine toxicity. In a confused known psychiatric patient one must always consider medication-related medical issues (neuroleptic malignant syndrome, serotonin syndrome, anticholinergic

poisoning, tricyclic antidepressant poisoning, lithium poisoning, etc.).

The EP often provides "medical clearance" for the psychiatric or combative patient. It must be recognized that "medical clearance" is a misnomer and that on completion of the ED evaluation the patient is not "cleared" of all possible medical conditions.[6,7] In one study by Tintinalli, 80% of patients documented as "medically clear" should have had a medical disease identified.[8] In addition, there is no standard process of providing what may be more accurately termed a "focused medical assessment."[9] As no standard exists, we would recommend documenting that no acute organic cause of the patient's current psychiatric illness has been identified at this time.

The incidence of organic disease in patients presenting with psychiatric complaints ranges from 24% to 63%.[6,8,10,11] The more relevant issue for the EP is to detect medical problems that are causing or contributing to the patient's agitated behavior. Misattribution of aberrant organic behavior in a patient with known psychiatric pathology is a common cause of litigation.[12]

Several historical features distinguish functional (psychiatric) from organic (medical) illness. Patients older than 40 years who have a new onset of psychiatric symptoms are more likely to have an organic cause.[10,13] Also, elders are at higher risk for organic delirium due to medical illness or adverse reactions to medications. Patients with a history of drug or ethanol abuse may exhibit violent behavior as a manifestation of an intoxication or withdrawal syndrome. The acute onset of agitated behavior, as well as behavior that waxes and wanes over short periods of time, hours to days, suggests an organic origin. Most psychiatric patients are alert and oriented and have an established psychiatric diagnosis.

Patients with persistently abnormal vital signs, a clouding of consciousness, or focal neurologic findings are more likely to suffer from organic disease and require further diagnostic evaluation. Agitated behavior often occurs in association with head trauma, hypoxia, hypoglycemia, electrolyte imbalance, infections (particularly herpes encephalitis), drug intoxication or withdrawal or adverse reaction, and metabolic and endocrine derangements.[14,15] In the ED setting, drug and ethanol intoxication or withdrawal are the most common diagnoses in combative patients.[16,17]

Diagnostic studies should be guided by the information obtained from the history and physical examination. Although some authors advocate a standardized panel of laboratory and radiographic studies for patients with psychiatric symptoms, most recommend tailoring diagnostic studies based on clinical findings.[6,9,10,18,19,20,21]

A rapid blood glucose determination and pulse oximetry should be obtained on all acute psychiatric patients. Patients younger than 40 years of age with a prior psychiatric history, a normal physical exam including vital signs, a calm demeanor, normal orientation, and no physical complaints likely require no further diagnostic testing.[19] Additional studies that may be useful in selected patients include serum electrolytes, blood and urine toxicology screening, serum ethanol, thyroid screening test if emergently available, and cranial imaging.[10,15,22,23] Specific medication levels may be determined when toxic levels would affect therapy. An ECG may be useful in elders and in the setting of a suggested intentional ingestion such as tricyclic antidepressant overdose. Patients who may have intentionally ingested a toxic substance should also have an acetaminophen level measurement, as this potentially fatal ingestion may be difficult to diagnose clinically and has an effective treatment.

An additional consideration in the diagnostic workup must be the concerns of the psychiatrist who will ultimately evaluate the patient. Although serum ethanol and toxicology screening may not significantly influence a patient's ED treatment, the psychiatrist may use them to assess the degree to which ethanol or drug use contributes to the patient's behavioral issues.[10,24,25,26] Ideally, an agreement on a diagnostic strategy should be reached between the psychiatrist and EP prior to referral. Unnecessary diagnostic testing may prolong ED length of stay thereby delaying definitive psychiatric care. Once the medical screening evaluation is completed the findings should be communicated to the consulting psychiatrist. The medical record should reflect that the evaluation showed no evidence that an acute medical condition caused or contributed to the patient's behavior. If the cause of the patient's violent behavior is drug or ethanol intoxication, the patient should be observed until he has reached the point where a therapeutic interview can be conducted by the psychiatrist. Alternatively, the patient may be transported to a facility where observation can occur until the effects of the intoxicants have abated. Rather than declaring the patient "medically clear," the EP should clearly document his or her findings and recommendations to the consulting psychiatrist.

Assessment of Suicide Risk

In Estate of Elizabeth Kitchen v. Michael Dargay, D.O., et al (2005), a 45-year-old woman was transported by ambulance after attempting to overdose on alprazolam and hydrocodone/acetaminophen. She claimed that the acute trigger for this event was a breakup with a boyfriend. In the ED the patient allegedly endorsed wanting to end her life to a nurse but then denied the same to both Dr. Dargay and the social worker that Dr. Dargay consulted. The patient was discharged. The next morning the patient threatened suicide to her adult daughter, who took no action. Later in the day, the patient was found by her minor son after she had hung herself. The plaintiff brought suit and claimed that the patient should have been admitted involuntarily. The defendant argued that the patient had denied any suicidal thoughts both to him and the social worker, and therefore discharge was reasonable. The defendant also argued that suicide may have been prevented if emergency services had

been called by the family on the day of the patient's death after she had threatened suicide. The jury rendered a verdict for the defense.[27]

In Garcia v. Lifemark Hospitals of Florida, (1999) Ramon Garcia was evaluated twice in the same ED by 2 different EPs. His first visit was for an overdose of over-the-counter pain medications. As Mr. Garcia had recently had orthopedic surgery, he was diagnosed with a non-life-threatening accidental overdose and discharged home. Two days later Mr. Garcia crashed his car into a concrete dividing wall and was transported to the ED. During his work-up, Mr. Garcia requested to be released against medical advice. After he signed the appropriate AMA paperwork, he left the ED and returned home. He killed himself shortly thereafter. Mr. Garcia's family members argued to the court that the ED physicians should have recognized and treated Mr. Garcia's psychiatric ailments in addition to his overdose and traumatic injuries. The court found that the EP's duty is to treat the emergent condition that brought the patient to the hospital and that expecting ED physicians to discover every one of a patient's conditions was like trying to "contend that there is a duty for an [ophthalmologist] to diagnose and treat the patient for hemorrhoids." The court stated that the "outward manifestations of infectious diseases lend themselves to accurate and reliable diagnoses . . . [however] the internal working of the human mind remain largely mysterious." As such, the verdict was for the defense.[28]

The above cases illustrate both the difficulty of recognizing suicidal tendencies and in establishing an accurate assessment of suicidal risk.[29] EPs have been shown to be more likely to assess a patient's risk for repeat self-injurious behavior as high.[30] However, there have been no well-established risk assessment tools validated for use by medical professionals.[31] Kaplan and Sadock's *Comprehensive Textbook of Psychiatry* agrees that "there are no psychological scales or tests that ensure prediction" of suicide.[32] Commonly used scoring systems, including the modified SAD PERSONS score, are inadequate to replace clinical judgement.[33] Additionally, recent research shows that EPs are adept at identifying patients who are at low risk for suicide but identification of those at high risk remains elusive.[34]

The modified SAD PERSONS score is easy to remember but can be cumbersome to use as different points are assigned to the elements of the scoring system (Table). With a sensitivity of 94% and a specificity of 71%, patients with a score of 5 or less and probably safe for discharge home with follow up and those individuals with a score of 6 or higher are likely in need of hospitalization.[35]

These few cases represent the majority of court rulings. The court recognizes that the assessing physician must rely on the history that the patient relays and that predicting future actions and unvoiced thoughts by a patient are near-impossible expectations. To assist with determining risk of suicide, the physician should also review nursing notes and collateral information from the patient's family. When a physician has made a thorough and good faith evaluation of a potentially suicidal patient, the fact that ensuing suicide is completed, does not often expose them to a plaintiff verdict.

When Assessment and/or Disposition Are Not Completed

In Jinkins v Evangelical Hospitals Corp., (2002) an adult male, George Jinkins, was evaluated at Christ Hospital after being discovered lying face down in a muddy puddle with his clothes partially removed and blood staining his underwear. While being evaluated in the ED, Mr. Jinkin's family reported that he had been intentionally walking in front of cars and talking about death, in addition to describing several examples of paranoid behavior. Notable in his evaluation were a blood alcohol level (BAL) of 0.203% and a positive urine screen for marijuana. The EP and social worker completed initial paperwork for involuntary psychiatric hospitalization. The patient was boarded in the ED while his BAL decreased and the patient was subsequently transferred to an outside psychiatric facility. A board-certified psychiatrist and a licensed professional counselor each interviewed the patient and his family. Mr. Jinkins and his family recanted their suicidal histories, and Mr. Jinkins was discharged with outpatient follow up for an alcohol-related disorder. Once he got home that evening, Mr. Jinkins shot himself in the head and died. Mr. Jinkins's widow sued the EP and the Christ Hospital ED claiming that their care was negligent in so far that the transfer to the psychiatric hospital was the proximate cause of Mr. Jinkins's death. The court found that the interview and the ensuing release of Mr. Jinkins was an intervening event and subsequently absolved the defendants of liability.[36]

Another illustrative case is Harvey v William Naber, M.D., et al. (2008). In this case, a 30-year-old female presented with her parents to the ED for evaluation of a psychiatric emergency. A nurse evaluated the patient and then called Dr. Naber into the bedside after the nurse was unable to determine whether the patient was suicidal. During Dr. Naber's evaluation he was called out of the room for a phone call. Court records indicate that Ms. Harvey believed she was discharged and left the room. She ran into the hospital garage with hospital personnel in chase. She either jumped or fell off an upper story of the parking garage and subsequently died. Plaintiff claims included negligence in so far that hospital staff failed to definitively determine that the patient was suicidal, that the parking garage was a dangerous design, and that hospital personnel giving chase were not trained security guards. Claims against Dr. Nader were for negligence because he allegedly failed to complete his evaluation and rule out suicidal tendencies before leaving the room. Dr Nader argued that the patient did not appear immediately suicidal and that he had a duty to take the interrupting phone call. The verdict in this case was for the defense.[37]

These 2 cases are reassuring to the EP and represent the

Table. The modified SAD PERSONS score.

Letter	Meaning	Number of points assigned
S	Sex: male	1
A	Age: < 19 or > 45 years	1
D	Depression or hopelessness	2
P	Previous attempts or psychiatric care	1
E	Excessive alcohol or drug use	1
R	Rational thinking loss	2
S	Separated/divorced/widowed	1
O	Organized or serious attempt	2
N	No social supports	1
S	Stated future intent	2

general trend. When suicidal patients escape, are unable to be assessed before departure, or have a disposition changed by others, the EP is not usually held liable.

DISCUSSION

We have reported several legal cases that illustrate pitfalls and general trends in assessing the acute psychiatric patient in the ED. It is clear in the literature that assessment of this population is difficult and fraught with error. EPs should have a low threshold for obtaining psychiatric specialty consultation, especially in new-onset disease.

The ED is universally used to provide medical clearance for psychiatric patients. The physician should have a systematic approach and a broad differential diagnosis when a behavioral emergency presents. Agitated behavior often occurs in association with head trauma, hypoxia, hypoglycemia, electrolyte imbalance, infections (particularly herpes encephalitis), drug intoxication or withdrawal or adverse reaction, and metabolic and endocrine derangements. The absence of these should be insured before psychiatric disposition occurs.

In assessing the risk of suicide, the courts have been lenient and sympathetic in recognizing the difficulty of predicting future suicide. It is imperative to gather as much history from the patient, family, authorities, and records, as well as optimally interview the patient. EPs should have comfort in realizing that after a good evaluation, they will not likely be held liable for a successful suicidal outcome.

Likewise, EPs often fear that a patient escape, or discharge from a subsequent facility, will expose them to liability. In the majority of cases, the hospital via the nursing staff is responsible for monitoring and prevention of escape, as well as successful transport to another facility if transfer occurs.

CONCLUSION

We have provided several court cases that illustrate general trends, pitfalls, and caveats when assessing the acute psychiatric patient. Being aware of these will decrease exposure to liability when assessing this patient population that frequently presents to the ED.

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Informed Consent Documentation for Lumbar Puncture in the Emergency Department

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Introduction: Informed consent is a required process for procedures performed in the emergency department (ED), though it is not clear how often or adequately it is obtained by emergency physicians. Incomplete performance and documentation of informed consent can lead to patient complaints, medico-legal risk, and inadequate education for the patient/guardian about the procedure. We undertook this study to quantify the incidence of informed consent documentation in the ED setting for lumbar puncture (LP) and to compare rates between pediatric (<18 years) and adult patients.

Methods: In this retrospective cohort study, we reviewed the ED electronic health records (EHR) for all patients who underwent successful LPs in 3 EDs between April 2010 and June 2012. Specific elements of informed consent documentation were reviewed. These elements included the presence of general ED and LP-specific consent forms, signatures of patient/guardian, witness, and physician, documentation of purpose, risks, benefits, alternatives, and explanation of the LP. We also reviewed the use of educational material about the LP and LP-specific discharge information.

Results: Our cohort included 937 patients; 179 (19.1%) were pediatric. A signed general ED consent form was present in the EHR for 809 (86%) patients. A consent form for the LP was present for 524 (56%) patients, with signatures from 519 (99%) patients/guardians, 327 (62%) witnesses, and 349 (67%) physicians. Documentation rates in the EHR were as follows: purpose (698; 74%), risks (742; 79%), benefits (605; 65%), alternatives (635; 68%), and explanation for the LP (57; 6%). Educational material about the LP was not documented as having been given to any of the patients and LP-specific discharge information was documented as given to 21 (2%) patients. No significant differences were observed in the documentation of informed consent elements between pediatric and adult patients.

Conclusion: General ED consent was obtained in the vast majority of patients, but use of a specific LP consent form and documentation of the elements of informed consent for LP in the ED were suboptimal, though comparable between pediatric and adult patients. There is significant opportunity for improvement in many aspects of documenting informed consent for LP in the ED. [West J Emerg Med. 2014;15(3):318–324.]

INTRODUCTION

Background

Consent for medical treatment has had an interesting history, from Hippocrates' advice to physicians to conceal medical information from their patients[1,2] to the current consensus that physicians have a legal and moral obligation to provide patients with all necessary information to make informed decisions.[3,4] Following the unethical experimentation

on prisoners by Nazis and the Nuremberg trials from World War II, simple consent to medical treatment became well-established in the United States.[5,6] A 1957 court decision in which a patient sued his physicians for their failure to inform him of the risk of paralysis after a translumbar arteriogram articulated the need for more comprehensive consent,[1–3,7–9] moving from simple consent, i.e., "did the patient agree to be treated?", to informed consent, i.e., "did the physician provide the patient with an adequate amount of information?"[10]

Informed consent consists of various basic features: the principle of autonomy (the patient's right to self-determination), disclosure of information through a process that is understandable (including diagnosis, purpose, risks/benefits, and alternatives), patient understanding of the information provided, an opportunity to ask questions, and voluntary decision-making such that a patient is not coerced into making a decision.[2,4,5,10–14]

Importance

The American Medical Association has published principles of medical ethics with guidelines for physicians to seek informed consent for specific medical interventions and to disclose all relevant medical information to their patients, which include risks and benefits of treatment options.[15–17] In efforts to comply with such guidelines, most hospitals have used consent forms, but there is no standardized approach to providing informed consent.

Informed consent has several benefits. Incorporating informed consent training for healthcare professionals upholds ethical and legal rights for patients.[18] Informed consent discussions can foster the patient's trust in the physician. The therapeutic value of obtaining informed consent can enhance satisfaction of both the physician and patient in the professional relationship.[11] An informed patient or guardian who actively participates in decision-making will also have a better appreciation of the strengths and limitations of their medical care.[19,20] Moreover, the improvements in relationship and knowledge can result in the reduction of liability occurrence.[21]

Goals of This Investigation

Though documentation of informed consent is recommended, compliance with the process of informed consent is inconsistent.[22,23] Most informed consent procedures are incomplete, with deficiencies in one or more of the various elements that are required for a complete informed consent process.[23] To evaluate our own informed consent compliance, we reviewed the electronic health records (EHR) of all patients who underwent successful lumbar puncture (LP) in 3 emergency departments (ED). Medical records for all 3 EDs are electronic, with no paper charting (consent forms are scanned into the EHR). Medical information is entered into the EHR in various ways by emergency physicians (EP), including free text, templates, and/or speech recognition software. Our primary objective was to compare the rates of documentation for various elements of informed consent for LP in pediatric and adult patients. The consent process differs for pediatric versus adult patients, as pediatric patients are not competent to provide consent and their parents/guardians have the responsibility to provide that consent.[20] When the welfare of a child is at stake, we suspected that physicians would be more attentive in explaining the procedure to allay fears of the parents/guardians and to answer their questions. We hypothesized that EPs would be more thorough in their documentation of the informed consent process when the procedure involved a child. We also wanted to ascertain how often a consent form for the LP was in the EHR and the rate at which signatures were obtained from the patient/guardian, physician, and witness. Finally, we sought to identify future opportunities to improve our informed consent process by assessing the educational resources that were used by our physicians in our current consent process.

MATERIALS AND METHODS

Study Design

This was a retrospective cohort study undertaken from April 2010 through June 2012.

Setting and Selection of Participants

We identified all pediatric (<18 years) and adult ED patients who underwent a successful LP through a laboratory database of cases undergoing cerebrospinal fluid (CSF) analysis. The study was performed at 3 hospitals within Kaiser Permanente (KP) Northern California, a large integrated healthcare delivery system serving approximately 3.4 million members at 21 hospitals and more than 160 medical offices. The 3 EDs are staffed by approximately 150 board-certified or board-prepared EPs along with emergency medicine residents (at 2 of the 3 EDs) and serve a broad spectrum of patients that includes pediatric and obstetric patients. While all EPs in this study belong to the same medical group, one subgroup covers 2 of the 3 EDs, while a separate subgroup staffs the third ED. Each ED had an annual census during the study period of approximately 75,000 patients. The Kaiser Permanente Northern California Health Services Institutional Review Board reviewed this study and granted it an exemption.

Methods of Measurement

Study investigators abstracted data from the index ED visit EHR using a structured computerized data collection tool. Multiple processes were instituted to enhance the accuracy and reliability of the data abstraction process, following methodologic standards for chart review.[24] We identified inclusion criteria in advance of the study. All abstractors received training on the content and coding of each data element, data handling and data transmission procedures, and protocols to handle possible questions or problems during the study. The principal investigator monitored day-to-day data collection activities and answered coding questions. Ambiguous

Table 1. Characteristics of patients receiving lumbar puncture in the emergency department (ED).

	Patients number	Median age years (IQR)	Sex (female) number (%)	ED CT or MRI of brain number (%)	Admissions to hospital number (%)
All	937	35 (21,49)	546 (58)	624 (67)	210 (22)
Adult	758	40 (29,53)	449 (59)	569 (75)	130 (17)
Pediatric	179	5.5 (0.25,14)	97 (54)	55 (31)	80 (45)

IQR, interquartile range; *CT*, computed tomography; *MRI*, magnetic resonance imaging.

results were arbitrated by discussion with the principal investigator. Two different investigators reviewed random cases to assess interrater reliability for each of the 26 variables measured. Finally, as each of our authors had discussed this research study, it was not feasible to blind our abstractors to the study hypotheses. However, none of the abstractors were invested in any particular outcome, other than to study and identify current practice for informed consent documentation.

Demographic and clinical variables included age, sex, computed tomography or magnetic resonance imaging done in the ED, and hospital admission rates for each of the EDs and groups of patients. Documentation of the elements of informed consent (yes/no) included the following: presence of generalized ED consent form, LP consent form (and signatures for the patient/guardian, physician, and witness), diagnostic purpose for LP (infection, bleeding, brain hypertension, other), risks (headache, bleeding, infection, pain, leg weakness, brain herniation, apnea in patients under 3 years of age, neurological problems), benefits, and alternatives. Physicians did not have to document the details of the risks (or other elements of informed consent or education provided) by listing them one by one to be given credit. Simply documenting that these elements were discussed with the patient/guardian was sufficient. Additional documentation variables included an explanation of the procedure, use of LP-specific educational material, use of LP-specific discharge information, and questions solicited and answered. Lastly, we noted the presence of an LP procedure note in the EHR.

Primary Data Analysis

Continuous variables are presented as medians with interquartile ranges. Categorical data are presented as frequencies and proportions. Descriptive statistics were performed with standard software (Microsoft Excel, version 14.0, 2010; Microsoft Corporation, Redmond, WA). We performed comparisons using the two-tailed Fisher's exact test (GraphPad Software, Inc., 2013 edition; La Jolla, CA). We considered a p-value of less than 0.05 to indicate statistical significance.

RESULTS

During the 27-month study period we identified 937 ED patients who underwent successful LP. Unsuccessful LPs in which CSF did not undergo laboratory analysis were not identified or included in this study. Of the total cohort, 179 (19.1%) were pediatric cases and 758 (80.9%) were adult cases. No patient underwent more than one successful LP in the ED during the study period.

The age range for the entire cohort was 2 days to 93 years. Demographics and resource utilization, both overall and per age-specific populations, are reported in Table 1. Documentation rates for each variable of the total cohort, as well as the age-specific populations, are reported in Table 2. Rates of documentation were not significantly different between pediatric and adult patients.

Interrater reliability was ascertained for 206 (22%) of the 937 cases. The mean percent agreement for the 26 separate variables was 98% (range 95% - 100%).

LIMITATIONS

Our study cohort of ED patients undergoing an LP is incomplete since we included only patients who had a successful LP and did not include patients whose LP did not yield CSF for analysis. We do not know exactly how many LPs during the study period had failed to obtain any CSF, the rate of which varies widely in the emergency medicine literature, generally from 2% to 15%,[25,26] and higher among medical students and residents.[27] We cannot say whether physicians with higher rates of unsuccessful LPs, more of whose cases were excluded from this study, might have different patterns of informed consent documentation than physicians with higher rates of procedural success. However, documentation of pre-procedural informed consent processes would not be significantly different in cases where the LP proved to be ultimately unsuccessful. Since the study did not focus on the LP procedure itself (successful or not successful), the nature of the pre-procedure consent would not be altered by the subsequent result of the LP procedure. Of note, inclusion criteria for EHR review were for all LPs done by EPs, excluding LPs that were subsequently performed successfully by other specialists.

Documentation of informed consent in the EHR may not accurately reflect the actual physician/patient conversation that preceded the procedure. Documentation could well err in both directions of under- and over-reporting. With regard to under-reporting, physicians may fail to document all the elements that were communicated in dialogue with patients and their parents/guardians. On the other hand, over-reporting is made easier with the availability of EHR templates. In either case, the documentation should reflect the details of the informed

Table 2. Documentation rates for specific elements of the informed consent process.

	Patients number	Completed number (%)	p-value*
General ED consent form			
Pediatric	179	155 (87)	
Adult	758	654 (86)	1.00
Total	937	809 (86)	
LP consent form			
Pediatric	179	109 (61)	
Adult	758	415 (55)	0.15
Total	937	524 (56)	
Signature of patient/ guardian			
Pediatric	109	109 (100)	
Adult	415	410 (99)	0.11
Total	524	519 (99)	
Signature of witness			
Pediatric	109	65 (60)	
Adult	415	262 (63)	0.66
Total	524	327 (62)	
Signature of physician			
Pediatric	109	69 (63)	
Adult	415	280 (67)	0.73
Total	524	349 (67)	
Purpose of LP			
Pediatric	179	137 (77)	
Adult	758	561 (74)	0.51
Total	937	698 (74)	
Risks of LP			
Pediatric	179	145 (81)	
Adult	758	597 (79)	0.54
Total	937	742 (79)	
Benefits of LP			
Pediatric	179	116 (65)	
Adult	758	489 (65)	1.00
Total	937	605 (65)	
Alternatives to LP			
Pediatric	179	124 (69)	
Adult	758	511 (67)	0.66
Total	937	635 (68)	
Explanation of LP			
Pediatric	179	9 (5)	
Adult	758	48 (6)	0.60
Total	937	57 (6)	
Education material used			
Pediatric	179	0 (0)	
Adult	758	0 (0)	1.00
Total	937	0 (0)	
LP-specific discharge information			
Pediatric	179	3 (2)	
Adult	758	18 (2)	0.78
Total	937	21 (2)	
Questions answered			
Pediatric	179	94 (53)	
Adult	758	377 (50)	0.51
Total	937	471 (50)	
Procedure note			
Pediatric	179	157 (88)	
Adult	758	640 (84)	0.30
Total	937	797 (85)	

ED, emergency department; *LP*, lumbar puncture.
* Fisher's exact (two-tailed).

consent conversation as it actually transpired and remains the only basis on which the quality and completeness of the process can be judged after the fact.

We selected 3 EDs in our local area to identify the documentation practices for LP consent. Though there is significant variability among these EDs and their patient populations, our results may not be generalizable to all EDs across the U.S.

During the study period, 2 of the 3 EDs had emergency medicine residents who worked with assigned attending physicians for the LP procedure. Attending physicians ultimately had the primary responsibility for assuring that LP consent was obtained and documented in the medical record.

The patients' conditions, urgency of the LP, and the mental status of patients/guardians could all impact the type of discussion and subsequent documentation that occurred. Patients who present to the ED and require LPs are deemed to be urgent or emergent, addressing this issue of the patient's condition and urgency of the procedure. Yet the competency/ capability to provide informed consent was documented in only 1% of all patients for this study. Further, this issue was not addressed for the parents/guardians of any pediatric patient in this study, something that could impact the type of discussion/ documentation about procedures done in the ED, raising an opportunity for future research.

Documentation of informed consent may not be a reliable evaluation of what actually took place prior to the LP. However, the current standard of care in this area is to obtain a signed consent form, with documentation about the discussion of the purpose, risks, benefits, and alternatives to the procedure. Our only avenue for obtaining informed consent is what this study reviews, i.e., a signed consent form with documentation of the relevant items.

DISCUSSION

Our data showed that generalized ED consent is obtained in the vast majority of ED patients who had an LP performed but just over one-half of these patients had a specific LP consent form in the EHR. Documentation of purpose, risks, benefits, and alternatives for the LP was noted in approximately 70% of the cases. Our data also showed that the rates of documentation for pediatric patients were not superior to their adult counterparts. Documentation of the educational component of the informed consent process, as measured by documentation of an explanation of the LP, the use of educational material, and LP-specific discharge information, was rarely found in the EHR. Our study of informed consent for lumbar puncture in the ED for all patients (adults and pediatrics) is the first of its kind to our knowledge. Despite the expectation for a signed informed consent in every chart, the data showed that this is not always achieved.

Generalized ED consent was obtained for the vast majority of patients who presented to the ED during the study period. The presence of this generalized consent may have been deemed by EPs to be adequate for procedures like an LP, leading to no further effort to obtain informed consent through the use of an LP-specific consent form. Variables that decrease the perceived need for seeking LP-specific informed consent by physicians in the ED setting could include the following: patients' very presence in the ED often indicates an urgent or emergent medical condition;[28] similar to other emergent procedures like paracentesis and thoracentesis, there are limited alternative options to an LP, which is usually needed emergently and has a high benefit-to-risk profile;[20] ED patients are in a stressful medical situation that may affect their decision-making.[12] In these situations, an additional LP-specific form does not provide liability protection by itself,[6,29] nor does it meet the true spirit of the informed consent process, which may further reduce the likelihood of use by physicians.

Our overall compliance for documenting the various aspects of informed consent (purpose, risk, benefits, and alternatives) was found to be similar to prior studies performed in different settings: purpose (our study 74%; other studies 92% to 94%); risks (our study 79%; other studies 59% to 88%), benefits (our study 65%; other studies 36% to 59%); alternatives (our study 68%; other studies 13% to 62%).[30,31] In a study reviewing 1,057 audiotaped patient encounters, purpose was noted in 84%, risks/benefits (pros and cons) were noted in 26%, and alternatives were noted in 30%.[32] From these data, we conclude that inadequate compliance with informed consent documentation is a prevalent issue. The use of a standardized form to obtain consent could help improve compliance, though a review of 157 hospitals nationwide found that the content of 540 informed consent forms for procedures in those hospitals was inadequate for addressing the standards for informed consent.[33] Even when consent forms are provided, many patients or their parents/guardians do not take the time to carefully read them, believing that the forms are there to protect the physician.[34] Also, comprehension of the informed consent information can be very challenging for the patient or parent/guardian.[35] As a result, a full review of informed consent may not occur, which is then reflected in a lack of documentation of the various aspects of informed consent.

Our data showed that the compliance rate for documenting informed consent for pediatric patients undergoing an LP was not superior to that for adult patients. Informed consent for the pediatric population has some unique challenges. While competent adult patients have a right to refuse treatment for any reason, the parent/guardian of a pediatric patient may not have the same absolute right to refuse treatment for their child.[20] Specific issues related to obtaining adequate parental consent for patients younger than 16 years of age resulted in the suspension of a pediatric study until such issues could be resolved through federal regulations.[36] With respect to the pediatric population, we hypothesized that our physicians might seek more specific documentation compliance for this patient group compared with adult patients. However, our results did not support our hypothesis.

Our pediatric results are generally consistent with reports from other facilities. In a Chicago Children's Memorial Hospital Pediatric ED study, informed consent documentation for an LP was deemed to be inadequate.[30] Comparing their findings with our study data for pediatric patients, they had higher rates of documentation of purpose (94% vs. 74%), risks (88% vs. 81%), and use of a consent form (88% vs. 61%), but a lower rate of documentation of benefits (36% vs. 65%) and alternatives (13% vs. 69%). Further work is needed to improve the documentation rates of informed consent for pediatric, as well as adult, patients.

Documentation of various aspects of patient education with regard to the LP was also found to be inadequate in our study. Our EDs have not used educational tools for an LP, as have been implemented in other settings for improving informed consent. These tools include supplemental written educational forms, video tools, or computer-based education.[23] The lack of educational material usage in our study represents a significant opportunity for future work to improve the informed consent process for an LP. Research suggests that a minority of patients fully read informed consent information, ask questions, or accept a copy of the consent document.[12] However, if an educational model were developed for providing informed consent that is simple and accessible, and geared toward an appropriate grade level of understanding, patients may increase their engagement with the process. Improved patient

participation in the informed consent process would lead to a greater sense of control, improved compliance, and perhaps even improved healthcare outcomes. Patient education may also reduce medical errors,[37] as the process allows the patient to not just be a passive observer, but an active participant in the LP procedure. Sharing information with the patient or parent/guardian improves communication and cooperation and assures better understanding of the procedure by the patient.[3] Such communications may strengthen the doctor-patient relationship by enhancing mutual trust and cooperation.[29]

In conclusion, we found that documentation of informed consent for the general ED visit was excellent. There was room for improvement, however, in obtaining LP-specific informed consent. There was little difference in documentation compliance for informed consent between pediatric and adult patients. Educational material was rarely used and documentation of an explanation of the LP to patients rarely occurred. There are significant opportunities to improve the overall informed consent process for an LP in the ED that begins with education for physicians about informed consent. We would like to undertake a future study to identify how to improve the informed consent process for LP and assess what patients actually understood about the procedure, using a checklist that includes pre-LP educational materials for the patient/guardian, LP-specific discharge instructions for the patient/guardian, and follow-up contact with the patient or guardian to directly assess their knowledge about the LP after this new informed consent process is implemented.

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Depression is Associated with Repeat Emergency Department Visits in Patients with Non-specific Abdominal Pain

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Introduction: Patients with abdominal pain often return multiple times despite no definitive diagnosis. Our objective was to determine if repeat emergency department (ED) use among patients with non-specific abdominal pain might be associated with a diagnosis of moderate to severe depressive disorder.

Methods: We screened 987 ED patients for major depression during weekday daytime hours from June 2011 through November 2011 using a validated depression screening tool, the PHQ-9. Each subject was classified as either no depression, mild depression or moderate/ severe depression based on the screening tool. Within this group, we identified 83 patients with non-specific abdominal pain by either primary or secondary diagnosis. Comparing depressed patients versus non-depressed patients, we analyzed demographic characteristics and number of prior ED visits in the past year.

Results: In patients with non-specific abdominal pain, 61.9% of patients with moderate or severe depression (PHQ9≥10) had at least one visit to our ED for the same complaint within a 365-day period, as compared to 29.2% of patients with no depression (PHQ9<5), (p=0.013).

Conclusion: Repeat ED use among patients with non-specific abdominal pain is associated with moderate to severe depressive disorder. Patients with multiple visits for abdominal pain may benefit from targeted ED screening for depression. [West J Emerg Med. 2014;15(3):325–328.]

INTRODUCTION

Patients with gastrointestinal (GI) complaints are common to emergency departments (EDs) and may be recipients of inefficient and expensive testing.[1] ED patients with non-specific abdominal pain may have an association with psychiatric disorders similar to the association observed with functional GI disorders, a highly prevalent class of diseases that comprise 40% of U.S. gastroenterology practice and are strongly associated with depression and anxiety.[2,3] Despite an increase in testing, many ED patients are discharged with a diagnosis of non-specific abdominal pain.[4] New diagnostic and therapeutic strategies are needed to care for this large group of patients. This study is important to identify a group of patients who may clinically benefit from targeted psychiatric screening to improve their quality of care and ultimately provide more efficient use of diagnostic tests. Our objective was to determine if repeat ED use among patients with non-specific abdominal pain might be associated with a diagnosis of moderate to severe depressive disorder.

METHODS

This research was conducted at an academic urban ED that has approximately 70,000 visits annually. We used a cross-sectional design with an oversample of patients with a history of 4 or more visits in the 365-day period. Patients were selected from the general pool of ED patients. Inclusion criteria were English fluency, aged 18 years or older, and chief complaint of a non-psychiatric complaint. Exclusion criteria

Table 1. Demographics and characteristics of patients in the emergency department per level of depression for depression cohort (n=83).

Characteristic	Abdominal pain patients screened n=83	No depression PHQ-9 (<5) n=41	Mild depression PHQ-9(5-9) n=21	Moderate/Severe depression PHQ-9(≥10) n=21
Mean age (year)	36.2	35.6	30.7	42.5
Female sex (%)	73.4	70.7	80.9	71.4
Race				
Black (%)	66.3	56.1	71.4	81.0
White (%)	16.9	24.4	4.8	14.3
Other (%)	16.9	19.5	23.8	4.8
Insurance				
Medicaid(%)*	38.5	34.1	33.3	52.4
Medicare only (%)**	9.6	9.8	9.5	9.5
Uninsured (%)	2.4	0	4.7	4.8
Private insurance (%)	37.3	43.9	38.1	23.8
Annual income less than 20K (%)	31.2	22.0	42.9	38.1
Existing chronic illness*** (%)	45.8	39.0	47.6	57.1
High school graduate or less (%)	48.2	36.6	57.1	61.9

PHQ9, Patient Health Questionnaire-9
* Includes DC alliance and dual Medicaid/Medicare
** Medicare only without reported coinsurance
*** Existing chronic illness includes asthma, chronic obstructive pulmonary disease/emphysema, chronic bronchitis or other lung disease, diabetes, coronary artery disease, myocardial infarction, congestive heart failure, stroke, kidney disease, human immunodeficiency virus.

included the presence of a primary psychiatric complaint, prisoner status, intoxication, mental status changes and critical illness. Subjects were enrolled by trained research assistants from June 2011 through November 2011 on weekdays between 9AM and 8PM. We measured patient illness with standard physician diagnostic codes (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9]). We analyzed the subset of respondents with non-specific abdominal pain as their primary or secondary diagnosis (ICD-9 code of 789.xx). Eligible patients were asked questions about their demographic, psychiatric, medical and healthcare characteristics. Each patient was screened with the Patient Health Questionnaire-9 (PHQ-9), a 9-item depression scale based on the Diagnostic and Statistical Manual Fourth Edition (DSM-IV.)

To determine repeat use, we captured the index visit date of each patient's ED visit at the time of enrollment, and the number of previous ED visits in the prior year (365 days) was captured by the electronic health record (Picis 5.0.) ED visit frequency was determined by the number of visits during a 365-day period (including the index visit). We chose ED use risk factors according to a literature review, which we grouped into patient demographic, illness and concurrent healthcare use categories. Demographic factors were measured at the index ED visit.

Our principal outcome was the number of repeat ED visits, defined as 1 or more visits for abdominal pain within a 364-day period prior to the index visit. We conducted a chi-squared analysis to compare multiple ED visits among abdominal pain patients with a positive depression screen versus those with a negative depression screen. Results were computed using STATA version 11. The study was approved by our medical center's institutional review board.

RESULTS

We approached a total of 1,116 patients over the course of the study, and 1,012 patients (90.7% response rate) consented to screening. Of those who consented, 987 respondents (97.5%) completed the PHQ-9 and had information available about prior visits. Eighty-three subjects were given a primary or secondary diagnosis of non-specific abdominal pain (74 primary, 9 secondary). The average age of patients with non-specific

Table 2. Emergency department (ED) use for patients with primary or secondary diagnosis of abdominal pain (n=83) analyzed by level of depression.

ED use		All abdominal pain n=83	No depression PHQ-9 (<5) n=41	Mild depression PHQ-9 (5-9) n=21	Moderate depression PHQ-9 (≥10) n=21
≥One ED visit for abdominal pain in Prior 365 days	n	34	12	9	13
	%	41%	29%	43%	62%
	CI	95% CI(31%-52%)	95% CI(18%-44%)	95% CI(24%-63%)	95% CI(41%-79%)

PHQ9, Patient Health Questionnaire-9, *CI,* confidence interval

Table 3. Average number of emergency department (ED) visits for year by category.

	n	Mean number of ED visits for one year period	95% confidence interval
All abdominal pain patients	83	2.53	1.92-3.14
No depression (PHQ9<5) n=41	41	2.07	1.26-2.88
Mild depression (PHQ9: 5-9) n=21	21	2.19	1.08-3.29
Moderate/Severe depression (PHQ9 ≥10) n=21	21	3.76	2.26-5.26

PHQ9, Patient Health Questionnaire-9

abdominal pain was 36.2 and 73% were female. Of patients with non-specific abdominal pain, 41 (49.4%) had a negative depression screen (PHQ-9< 5); 21 (25.3%) had a mild depression screen (PHQ-9, 5-≤9); and, 21 (25.3%) had moderate or severe depression screen (PHQ-9>10) (Table 1). Overall, 34 (41.0%) patients with non-specific abdominal pain had more than one visit to the ED in the year prior to index visit. When analyzing by depression, 61.9% of patients with moderate/ severe depression had at least one prior visit for abdominal pain as compared to only 29.2% of patients with a negative depression screen. (Table 2). On average, patients with non-specific abdominal pain with moderate/severe depression had 3.76 visits (95% confidence interval [CI] 2.26-5.26) as compared to 2.19 visits among patients with abdominal pain and mild depression (95% CI 1.08-3.29) and 2.07 visits (95% CI 1.26-2.88) among patients with abdominal pain and a negative depression screen (Table 3).

DISCUSSION

In our study of 83 subjects with non-specific abdominal pain, we found an association between serial visits and depression. Understanding this association may have significant public health implications. This association may be due to the fact that patients who return to the ED on multiple occasions are more likely to have a chronic medical condition. In general, chronic medical conditions are known to be associated with depression.[6] In addition, functional GI disorders, which include syndromes such as irritable bowel syndrome, functional dyspepsia and cyclic vomiting syndrome, also demonstrate a strong association with psychiatric disorders such as depression and anxiety.[2]

Depressed patients may be less likely than non-depressed patients to have established access to healthcare avenues other than the ED. Depression is associated with cognitive symptoms such as deficits in executive functioning, memory and concentration, and the ED is a relatively easy healthcare access point compared to other mental health services.[7] The cognitive symptoms associated with depression may increase the likelihood for ED recidivism.[8] In general, depressed patients may be more likely to use the ED for all of their healthcare needs.

Abdominal pain may also be a form of somatization, defined as the misattribution of physical symptoms to medical rather than psychiatric causes. Somatization is a common "idiom of distress" used by both healthy and psychiatrically ill individuals to communicate intra-psychic or interpersonal stress to care givers.[9] Patients with depressive illnesses frequently represent their psychological distress in physical terms. When these patients are found not to have any emergent medical illness, they may be discharged without addressing the psychiatric root of their visit. As the source of distress is left unresolved, patients may repeatedly visit the ED when intra-psychic or psychosocial stressors worsen.

For many patients with psychosocial concerns, traditional biomedical language shapes their experience. Lower socioeconomic status, limited education, alcoholism and social dysfunction in family background are known risk factors for somatoform disorders. The major complications are iatrogenic and include unnecessary surgery, repeated medical work-ups, drug dependence and side effects. In addition to depression, associated conditions include functional somatic syndromes, irritable bowel syndrome, non-ulcer dyspepsia, premenstrual syndrome, chronic pelvic pain, fibromyalgia, atypical or non-cardiac chest pain, hyperventilation syndrome, chronic fatigue syndrome, tension headache, temporomandibular joint dysfunction, atypical facial pain, globus syndrome, multiple chemical sensitivity. Particularly relevant to EM physicians, a somatoform syndrome diagnosis is difficult to make or rule out the diagnosis in a single visit.[10]

Patients with psychiatric disorders may fear the stigmatization of a mental health disorder. The stigma associated with depression may influence patients not to discuss the symptoms with their families, friends and healthcare providers.[11] Therefore, depressed patients may be more likely to seek care in the ED rather than from mental health professionals. Since their psychiatric symptoms may not be addressed, patients may revisit frequently without appropriate diagnosis. If diagnosed, brief psychodynamic interpersonal psychotherapy is associated with improved quality of life in patients with somatoform disorder.[12]

The PHQ-9 was administered to all patients at index visit. A 9-item depression scale based on Diagnostic and Statistical Manual Fourth Edition (DSM-IV) diagnostic criteria for major depression, it is composed of 2 components: 1) assessment of symptoms and functional impairment to make a preliminary diagnosis of depression and 2) severity score to evaluate needed treatment. The PHQ-9 is has shown good validity in capturing both the diagnosis of depression, as well as current depression severity, and has been shown to be useful in a number of outpatient primary care settings when time limitations may be a concern. In one study, a PHQ-9 score of 10 and higher had a sensitivity of 88% and a specificity of 88% for moderate depression. Scores of 5, 10, 15, and 20 represented mild, moderate, moderately severe, and severe depression.[5]

LIMITATIONS

The first limitation concerns the small sample size, which has limited our ability to control for potential confounding factors such as insurance status, income levels, co-morbidities and presence of primary care. In addition, we were unable to compare the association of depression in patients with non-specific abdominal pain versus those with documented organic disease. The second limitation of this study is the result of the convenience sample that may create a selection bias. We attempted to address this issue by querying the electronic medical record for the demographics of all ED abdominal pain patients seen during study dates and demonstrated no differences in age, sex and racial characteristics. An additional limitation of the study is related to our determination that ED visits were made by retrospective review from the index visit. Ideally, we would follow patients forward to determine if depression predicted future high use. Study patients could have exhibited signs of depression at enrollment simply because they had to return to the ED again not because of the association with abdominal pain.

CONCLUSION

In conclusion, repeat ED use among patients with non-specific abdominal pain is associated with moderate to severe depressive disorder. ED physicians should consider the diagnosis of depression in patients with non-specific abdominal pain or consider screening patients with multiple visits for non-specific abdominal pain for depression. More study is needed to confirm this association and determine how best to manage it.

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Epidemiology of the Systemic Inflammatory Response Syndrome (SIRS) in the Emergency Department

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Introduction: Consensus guidelines recommend sepsis screening for adults with systemic inflammatory response syndrome (SIRS), but the epidemiology of SIRS among adult emergency department (ED) patients is poorly understood. Recent emphasis on cost-effective, outcomes-based healthcare prompts the evaluation of the performance of large-scale efforts such as sepsis screening. We studied a nationally representative sample to clarify the epidemiology of SIRS in the ED and subsequent category of illness.

Methods: This was a retrospective analysis of ED visits by adults from 2007 to 2010 in the National Hospital Ambulatory Medical Care Survey (NHAMCS). We estimated the incidence of SIRS using initial ED vital signs and a Bayesian construct to estimate white blood cell count based on test ordering. We report estimates with Bayesian modified credible intervals (mCIs).

Results: We used 103,701 raw patient encounters in NHAMCS to estimate 372,844,465 ED visits over the 4-year period. The moderate estimate of SIRS in the ED was 17.8% (95% mCI: 9.7 to 26%). This yields a national moderate estimate of approximately 16.6 million adult ED visits with SIRS per year. Adults with and without SIRS had similar demographic characteristics, but those with SIRS were more likely to be categorized as emergent in triage (17.7% versus 9.9%, $p<0.001$), stay longer in the ED (210 minutes versus 153 minutes, $p<0.0001$), and were more likely to be admitted (31.5% versus 12.5%, $p<0.0001$). Infection accounted for only 26% of SIRS patients. Traumatic causes of SIRS comprised 10% of presentations; other traditional categories of SIRS were rare.

Conclusion: SIRS is very common in the ED. Infectious etiologies make up only a quarter of adult SIRS cases. SIRS may be more useful if modified by clinician judgment when used as a screening test in the rapid identification and assessment of patients with the potential for sepsis. [West J Emerg Med. 2014;15(3):329–336.]

INTRODUCTION

Faced with burgeoning knowledge of the pathogenesis of sepsis and the need for early recognition, the American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference prefaced its landmark 1992 report with the expectation that "the broad definition proposed in this report will improve our ability to make early bedside detection of disease possible, and thus allow early therapeutic intervention."[1] The term "systemic inflammatory response syndrome" (SIRS) was coined to encompass the "common pathogenic link now thought to be present in a number of disorders."[2] In turn, the concept of SIRS was not limited to infectious disorders, but instead was used to describe a physiologic response to a variety of acute insults, such as pancreatitis, ischemia, trauma, hemorrhage, and immune-mediated organ injury.[1]

Consensus guidelines recommend immediate diagnostic testing for adult patients with SIRS and a suspected infection.[3]

Based on these recommendations, large healthcare systems and international task forces have used SIRS as an inclusion criterion for adult sepsis screening protocols, an approach supported by the Joint Commission.[3-5] The process of screening requires venipuncture and diagnostic studies, conceivably leading to higher costs, prolonged ED length of stay, and increased exposure to potentially toxic medications and invasive procedures. Given recent emphasis on cost-effective, outcomes-based healthcare in an increasingly financially stressed climate,[6] there is an exigent need to quantify objectively the national epidemiology of a common presentation: patients presenting with SIRS to the ED.

Previous epidemiological studies have focused on a numerator of sepsis or severe sepsis without studying the denominator of those who present with undifferentiated SIRS.[7-13] Other studies of SIRS have described its presentation in admitted patients only or reported results from a single site.[14-17] As a result, there is no comprehensive understanding of the undifferentiated presentation of patients with SIRS in the ED setting. Without this knowledge, the impact of using SIRS-based sepsis screening on the healthcare system cannot be ascertained. These limitations complicate the practical application of SIRS for the front-line provider and confound the implications of a SIRS-based sepsis screening for our healthcare system.

As clinicians and researchers work to refine the approach to the early identification of sepsis, it is important to understand the performance of the primary entry criterion – SIRS. We conducted a study of a large, nationally represented sample to clarify the epidemiology of SIRS in the ED and subsequent category of illness.

METHODS

Study design and setting

We studied ED visits made by adults, 18 years of age or greater, from 2007 to 2010 in the National Hospital Ambulatory Medical Care Survey (NHAMCS). NHAMCS is a national, representative, probability sample of visits to United States EDs.[18,19] The multi-staged NHAMCS sample design is composed of 3 stages for the ED component: (1) 112 geographic primary sampling units; (2) approximately 480 hospitals within primary sampling units; and (3) patient visits within emergency service areas. Sample hospitals are randomly assigned to 16 panels that rotate across 13 4-week reporting periods throughout the year. Hospital staff or Census Bureau field representatives complete a patient record form for each sampled visit according to information obtained from the medical record. The data collected include information on patient demographics, reasons for visit, vital signs, cause(s) of injury, diagnoses rendered, diagnostic tests ordered, procedures provided, medications prescribed, providers consulted, and disposition, including hospital discharge information if admitted. As part of the quality assurance procedure, a 10% quality control sample of patient record forms is independently keyed and coded. Error rates typically range between 0.3% and 0.9% for various survey items.[20] This study was approved by the institutional review board, as the data are deidentified and publicly available.

The study time frame was chosen because 2007 was the first year to include all vital signs at triage; 2010 is the most recent year for which data were available. NHAMCS records only whether a test was ordered, not its result.

Measurements

To satisfy the white blood cell count (WBC) criterion in SIRS, we developed a novel approach for our estimates. We used a Bayesian logical framework[21,22] of prior probability distributions for WBC result to make minimum, moderate, and maximum estimates for SIRS.[23]

For the minimum estimate, we required that the patient present with at least 2 of the following criteria: abnormal temperature (>38 °C or <36 °C), pulse (>90 beats/min), or respiratory rate (>20 respirations/min). The minimum estimate assumes that a WBC, if drawn, would have resulted as a "negative" test for SIRS. This corresponds to a strict prior probability for the WBC result. For the moderate estimate, even-numbered observations with a WBC ordered were assigned a "positive" test for SIRS (i.e. fulfilling the WBC criterion) and odd-numbered observations with a WBC ordered were assigned a "negative" test for SIRS (i.e. not fulfilling the WBC criterion). This corresponds to a uniform prior distribution. For the maximum estimate, we assumed that all WBCs ordered would fulfill the SIRS criterion. This corresponds to a lenient prior probability for the WBC result. The goal of this gradated approach was to offer Bayesian-style limit estimates akin to credible intervals; that is, the moderate estimate takes equipoise in terms of WBC count and is bound by strict (minimum) and lenient (maximum) "modified credible intervals" (mCI) that encompass the extreme possibilities for WBC results in the study sample.[24-26]

Analysis

We sorted cases that qualified for SIRS into the following categories: infection, pancreatitis, ischemia, trauma, hemorrhage (atraumatic), toxin, anaphylaxis, and other. Previous work used a few key summary diagnoses for definition of SIRS or SIRS-related conditions.[27-30] We reviewed the entirety of the disease lexicon in the *International Statistical Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) and included every qualifying diagnosis in each category of illness (see online Appendices A-G). We did this to capture the SIRS-associated diagnosis with as much granularity as possible. NHAMCS allows up to 3 diagnoses; if a case had any qualifying diagnosis, it was included in that category. In the rare presence of more than one category (<0.5% of SIRS cases based on the moderate estimate), the first listed qualifying category was selected. Adults presenting to triage within 72

Table 1. Minimum, moderate, and maximum estimates of systemic inflammatory response syndrome (SIR) in adults presenting to United States emergency departments, 2007-2010; N=372,844,465 visits.

	Minimum estimate			Moderate estimate			Maximum estimate		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
SIRS present	36,189,780	9.7	9.2 to 10.2	66,388,686	17.8	17.2 to 18.4	96,791,328	26.0	25.1 to 26.8
SIRS absent	336,654,685	90.3	89.8 to 90.8	306,455,779	82.2	81.6 to 82.8	276,053,137	74.0	73.2 to 74.9

CI, confidence interval; N= 72,844,465 estimated visits based on 103,701 patient encounters

hours of a previous visit or those taking β–blocker or calcium-channel blocker medications were excluded from the analysis.

To accommodate the complex survey design of NHAMCS, we invoked the procedures PROC SURVEYMEANS for continuous data and PROC SURVEYFREQ for categorical data using SAS software, version 9.3 (SAS Institute Inc., Cary, NC, USA; 2011). We used the masked sample design variables CSTRATM and CPSUM as well as patient weights to generate population estimates. The sampling weights have been adjusted by the National Center for Health Statistics (NCHS) for survey non-response within time of year, geographic region, and urban/rural and ownership designations, yielding an unbiased national estimate of ED visit occurrences, percentages, and characteristics.[20] We report medians and inter-quartile ranges where appropriate. We tested differences in medians with the non-parametric Wilcoxon rank-sum procedure and differences in proportions with the Rao-Scott chi-square test, which accounts for the hierarchical survey design.[31] Further, we complied with the minimum sample size and relative standard error requirements for reliable estimates, as recommended by the NCHS.[32,33] Reported statistics are for population-based estimates, rather than raw patient encounters, as recommended by the Centers for Disease Control and Prevention.[20]

RESULTS

We surveyed 103,701 raw patient encounters corresponding to a population-based estimate of 372,844,465 visits over the 4r-year period (Table 1). The incidence of SIRS in adults 18 years of age and older presenting to the ED was at least 9.7% (95% CI: 9.2 to 10.2%), moderately 17.8% (95% CI: 17.2 to 18.4%), and at most 26% (95% CI: 25.1 to 26.8). Taking the minimum and maximum estimates as modified credible intervals, we report an overall moderate estimate of the incidence of adult SIRS presenting to the ED to be 17.8% (95% mCI: 9.7 to 26%). This yields a national moderate estimate of approximately 16.6 million (95% mCI: 9.0 to 24.2 million) visits per year made by adults presenting to the ED with SIRS criteria.

Using the moderate estimate, adults with and without SIRS had similar demographic characteristics, but were more likely to arrive by EMS (29.5% versus 17.1%, p<0.0001) and be categorized as emergent in triage (17.7% versus 9.9%, p<0.001) (Table 2). Chronic conditions, such as diabetes, cerebrovascular disease, and congestive heart failure, were more common in SIRS patients (23.7% versus 14.8%, p<0.0001). Length of ED visit was longer in SIRS patients (210 minutes versus 153 minutes, p<0.0001).

Patients with SIRS were more likely to be admitted (31.5% versus 12.5%, p<0.0001) and to be sent to a critical care unit or monitored bed (11.2% versus 3.7%, p<0.0001). Nonetheless, 68.6% of SIRS-positive patients were discharged home.

For those admitted, the median length of hospital stay for SIRS patients was one half-day longer than for non-SIRS patients (3.8 days versus 3.3 days, p<0.0001). Twenty-eight-day in-hospital mortality was higher for patients hospitalized with SIRS (4.6% versus 1.8%, p<0.0001).

Proportions of SIRS categories are reported based on the moderate estimate, as they were stable and consistent in all estimates (minimum, moderate, and maximum distributions). In patients presenting to the ED with SIRS, infection accounted for only 26% of subsequent diagnoses (Figure). Traumatic causes of SIRS accounted for 10% of presentations; other traditional categories of SIRS were rare (≤1%). The majority of diagnoses (56%) did not fall into any of the previously established categories for SIRS.

These SIRS-positive "other" diagnoses were further analyzed and found to populate the following ICD-9-CM domains: "Mental Disorders" (13.8%), "Diseases of the Respiratory System" (11.9%), "Diseases of the Digestive

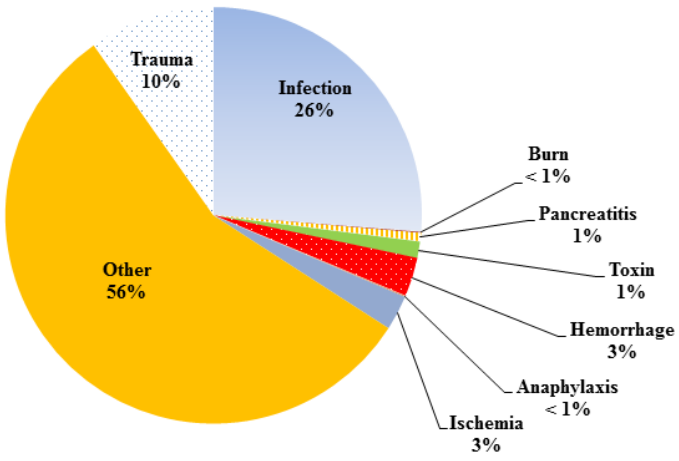

Figure. Adults with SIRS and subsequent category of illness based on moderate estimate presenting to United States emergency departments, 2007-2010; N=66,388,686 visits.

Table 2. Characteristics of adults presenting to United States emergency departments with and without systemic inflammatory response syndrome (SIR) based on moderate estimate, 2007-2010; N=372,844,465 visits.

	SIRS present n=66,388,686		SIRS absent n=306,455,779		p-value
Age - median years (interquartile range [IQR])	46.4	(30.5 to 64.2)	41.7	(27.7 to 57.7)	<0.00
Gender - n (%)					
Female	38,308,858	(57.7)	174,273,528	(56.8)	0.1
Male	28,079,828	(42.2)	132,182,251	(43.1)	
Race - n (%)					
White	45,015,761	(67.8)	198,285,452	(64.7)	<0.01
African-American	12,488,872	(18.8)	63,302,143	(20.7)	
Asian	1,013,058	(1.5)	4,686,692	(1.5)	
American Indian/Alaska Native	319,973	(0.5)	1,784,315	(0.6)	
Native Hawaiian/Pacific Islander	272,890	(0.4)	1,025,472	(0.3)	
More than one race reported	223,135	(0.3)	1,265,961	(0.4)	
Blank	7,054,997	(10.6)	36,105,744	(11.8)	
Arrival by emergency medical services - n (%)*					
Yes	10,184,916	(29.5)	27,399,806	(17.1)	<0.01
No	22,854,574	(66.3)	124,588,334	(77.9)	
Unknown	803,490	(2.3)	4,279,446	(2.7)	
Blank	675,817	(2.0)	3,598,330	(2.3)	
Triage category - n (%)*					
Immediate	934,097	(2.7)	2,264,891	(1.4)	<0.01
Emergent	6,107,468	(17.7)	15,869,354	(9.9)	
Urgent	17,861,332	(51.7)	70,463,651	(44.1)	
Semi-urgent	6,927,911	(20.1)	52,984,362	(33.1)	
Nonurgent	1,292,494	(3.7)	11,338,275	(7.1)	
No triage†	1,395,495	(4.0)	6,945,383	(4.3)	
History of diabetes - n(%)*					
Yes	5,150,488	(14.9)	15,644,202	(9.8)	<0.01
No	29,368,309	(85.1)	144,221,714	(90.2)	
History of cerebrovascular disease or stroke - n (%)*					
Yes	1,530,240	(4.4)	5,068,190	(3.2)	0.01
No	32,988,557	(95.6)	154,797,726	(96.8)	
History of congestive heart failure - n (%)*					
Yes	2,711,259	(7.9)	5,152,810	(3.2)	<0.01
No	31,807,538	(92.1)	154,713,106	(96.8)	
History of human immunodeficiency virus - n (%)*					
Yes	302,451	(0.9)	831,294	(0.5)	0.0006
No	34,216,346	(99.1)	159,034,622	(99.5)	
Chronic conditions listed above - n (%)*					
One or more of the above	8,184,911	(23.7)	23,603,145	(14.8)	<0.01
None of the above	24,027,905	(69.6)	123,304,431	(77.1)	
Blank	2,305,981	(6.7)	12,958,340	(8.1)	
Length of ED Visit - median minutes (IQR)	210	(128 to 317)	153	(84 to 254)	<0.01

* Cell count does not sum to N due to missing values

† Visits in institutions where nursing triage is either not conducted or recorded

Table 2. Continued.

		SIRS present N=66,388,686		SIRS absent N=306,455,779	p-value
Disposition - n (%)					
Home	45,529,799	(68.6)	268,243,290	(87.5)	<0.01
Step down unit	3,780,757	(5.7)	7,401,860	(2.4)	
Critical care unit	3,646,752	(5.5)	3,885,871	(1.3)	
Operating room	735,942	(1.1)	1,509,886	(0.5)	
Cardiac catheterization lab	313,510	(0.5)	1,149,675	(0.4)	
Mental health or detoxification unit	355,310	(0.5)	1,177,501	(0.4)	
Other bed/unit	9,458,890	(14.2)	17,715,447	(5.8)	
Unknown	2,126,523	(3.2)	4,444,949	(1.5)	
Blank	441,203	(0.7)	927,300	(0.3)	
Length of hospital stay, if admitted - days (IQR)	3.8	(2.3 to 6.1)	3.3	(2.0 to 5.5)	<0.00
28-day in-hospital mortality - n (%)	843,677	(4.6)	591,615	(1.8)	<0.01

* Cell count does not sum to N due to missing values
† Visits in institutions where nursing triage is either not conducted or recorded
Differences in medians were tested with the Wilcoxon rank-sum procedure; group difference P reported
Differences in proportions were tested with the Rao-Scott chi-square method; cross-tabulation omnibus P reported

System" (9.4%), "Endocrine, Nutritional and Metabolic Diseases, and Immunity Disorders" (7.2%), "Diseases of the Sense Organs" (5.0%), "Symptoms, Signs, and Ill-defined Conditions" (3.6%), and "Diseases of the Genitourinary System" (3.5%). Neoplasm and disorders of the musculoskeletal, dermatologic, circulatory, and nervous systems together comprised the remaining 1.6% of SIRS cases.

DISCUSSION

We used a national representative survey of United States EDs to estimate the incidence of SIRS and subsequent category of illness, using a Bayesian approach for estimate limits. Previous studies focused on sepsis, relying on a handful of aggregate codes such as "bacteremia" (790.7) or "septicemia" (038).[7,28-30,34] Those studies did not use objective markers of systemic inflammation and relied on limited coding methods, an approach with potential bias. To enhance the accuracy of the estimates of SIRS-associated diagnoses, we used a detailed list of ICD-9-CM codes and vital signs measured at triage to infer an objective estimate of SIRS nationally. With this information, we can determine more fully the epidemiology of SIRS among adult ED patients nationally and the potential implications of a SIRS based severe sepsis screening program.

We found the presence of SIRS to be common in the emergency setting, with 16.6 million presentations per year, or approximately 17.8% of all adult ED visits. SIRS represented a heterogeneous group, with only about a quarter associated with infection. In addition, the majority of SIRS-positive patients were discharged home. This is consistent with previous authors' findings of lack of specificity of SIRS and concerns regarding associated increased utilization of resources.[35,36] Shapiro et al[29] found in a single-center study that although a combination of clinical and laboratory parameters were predictive of short- and long-term mortality, SIRS itself offered no additional prognostic value.

In the current analysis, we found that patients with SIRS are more likely to be admitted, to be admitted to a higher level of care, and to have a slightly longer hospital length of stay. Additionally, patients hospitalized with SIRS had a higher 28-day mortality rate than those without SIRS. The significance of this finding is limited in that we were unable to adjust for illness severity. However, the finding that SIRS patients were more likely to be hospitalized and admitted to an intensive care unit setting demonstrates that SIRS may have some utility in the risk stratification of adult patients at ED triage.

The lack of specificity of SIRS for an infectious process limits its utility for infectious screening in the ED. Given the emphasis on SIRS in consensus guidelines for severe sepsis, clinicians may be compelled to pursue an infectious etiology in "SIRS-positive" patients, in what is clearly a heterogeneous population. Consensus recommendations that require screening millions of undifferentiated patients annually for severe sepsis may add unnecessarily to healthcare costs, length of ED stay, and exposure of additional patients to unnecessary antibiotics or invasive testing. Our findings suggest that a more accurate tool for sepsis screening is needed.

As the U.S. experiences a declining number of EDs and a concomitant rise in ED utilization,[37-40] triage and screening for occult disease become ever more important. For this reason evidence-based tools such as the Emergency Severity Index (ESI)[41] and the Canadian Triage and Acuity Scale (CTAS)[42] have been developed to prioritize patients. With both tools, the

triage provider uses a combination of objective parameters and clinical judgment to classify the patient. SIRS, perhaps fuelled by published clinical guidelines, has been used increasingly as an up-front (i.e. at triage) pre-emptor to clinician judgment, with potential impacts on resource utilization.[43-45] As institutions adapt to the changing healthcare landscape, SIRS criteria may benefit from the success of validated screening tools, such as the ESI and CTAS with a modification that requires clinician input[46] prior to acting on a "SIRS alert," and initializing a cascade of institutional processes.

The finding that 56% of adults with SIRS had miscellaneous other diagnoses emphasizes the lack of specificity for any particular disease condition. SIRS may have value as an early screening test (fairly sensitive) but not as a diagnostic test (poorly specific). In the proper clinical context, SIRS identifies a population with a somewhat higher risk of hospitalization, need for critical care, and short-term mortality. However, the lack of specificity for infection and the limited prognostic utility of SIRS imply that better early warning systems for sepsis are needed.

LIMITATIONS

This report has several important limitations. NHAMCS episodes represent ED visits, not necessarily unique patients. While it is possible that an individual may be represented more than once, the robust sampling procedures used by NHAMCS in addition to our excluding patients recently seen at the presenting hospital make this occurrence unlikely.

There is significant endogeneity inherent in the classification of patients at triage, their diagnosis, and their disposition. That is, the same parameters that qualify patients for SIRS will also affect their triage category, which in turn affects work-up and final diagnosis. In addition, disposition may be driven not only by the results of history, physical examination, and supplemental testing, but also by the patient's initial presentation, including SIRS parameters. Nonetheless, triage or "first recorded" vital signs have been used successfully as entry criteria in previous SIRS and sepsis research.[29,30,47,48]

The vital signs reported in NHAMCS are limited to those measured at triage. Accuracy of vital signs at triage may vary, and this one-time snapshot precludes trend analysis over the course of the ED stay. However, since international guidelines call for sepsis screening as early as possible in adults, many institutions have moved toward screening protocols at triage or as early as possible in the ED stay.[3,4,49,50] As initial vital signs have the most important role in screening programs for critical illness, an analysis of SIRS based on these variables in real-life conditions is relevant.

For this analysis, we assumed that patients who did not have a WBC ordered did not have an elevated WBC. This assumption could potentially slightly underestimate the true incidence of SIRS. However, we also assumed for the moderate estimate that 50% of patients with a WBC ordered had an abnormal result. This assumption likely overestimated the incidence of SIRS; we felt that on balance this approach was appropriate in the context of a screening test. Unfortunately, without WBC results on all ED visits in the NHAMCS database, we cannot determine the actual directly measured incidence of SIRS, but feel that our construct provides a moderate, reasonable estimate of incidence for the adult ED population. The minimum estimate, based only on vital signs, gives an objective baseline estimate against which the others (moderate, maximum) may be considered.

Finally, the use of ICD-9-CM codes may be problematic in reflecting the true clinical diagnosis.[51,52] Previous studies relied on a short list of (mostly sepsis-related) codes.[7,28-30,34] We sought to mitigate this limitation with a detailed categorization of the current ICD-9-CM. We also expanded on the previous epidemiologic studies of sepsis, which relied solely on coding data, by incorporating documented vital signs to improve on the estimation of the epidemiology of SIRS.

CONCLUSION

The presence of at least 2 SIRS criteria is common among adult ED patients. Infectious etiologies make up only a quarter of adult SIRS cases. SIRS may be sensitive for sepsis but it is very non-specific. SIRS may be more useful if modified by clinician judgment when used as a screening test in the rapid identification and assessment of patients with the potential for sepsis.

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Readiness to Change and Reasons for Intended Reduction of Alcohol Consumption in Emergency Department versus Trauma Population

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Introduction: The primary objective was to identify the most common reasons for intending to cut back on alcohol use, in emergency department (ED) and trauma patient populations. The secondary objective was to determine the association between reason to cut back on alcohol and education level.

Methods: We conducted the study at a level one trauma center in California between 2008 and 2012. This was a retrospective analysis of data collected from computerized alcohol screening and intervention (CASI). We excluded patients who drank too little, and those whose scores were consistent with dependency (Alcohol Use Disorders Identification Test [AUDIT]>19). The CASI database includes the patient's age, gender, language, education level, an AUDIT score (1-40 scale), a readiness to change score (1-10), and the option to choose any of 10 "reasons to cut back" on their alcohol consumption.

Results: From 10,537 patients, 1,202 met criteria for the study (848 ED, 354 trauma). Overall, the most common reasons cited for cutting back on alcohol were "To avoid health problems" (68.5%), "To avoid getting a DUI" (43.6%), "It could save me money" (42.0%), and "To avoid situations where I could get hurt" (41.0%). Trauma patients cited the following reasons significantly more than ED patients: "To avoid situations where I could get hurt" (46.3% versus 38.8%, respectively), "So I can be in control of my behavior" (40.7% versus 32.2%), and "My partner or spouse wants me to stop" (20.1% versus 15.0%). Additionally, those patients who cited "To avoid health problems" reported 1.2 points higher than average ($p<0.001$) on the 10-point readiness to change scale. Those who have completed some college or an associate degree cited "To avoid health problems" less often than high school graduates (odds ratio [OR] 0.45), while they cited "To avoid situations where I could get hurt" (OR 2.5) and "To avoid being in a car crash caused by alcohol use" (OR 3.8) more often than high school graduates.

Conclusion: Health, injury, finances, and legal issues remain top concerns for patients, while trauma patients specifically had proportionately more concerns with situations where they could get hurt. [West J Emerg Med. 2014;15(3):337–344.]

Table 1. University hospital trauma activation criteria, modified from Orange County emergency medical services policy.[27]

Inclusion criteria for designated trauma victim	
Physical findings	Mechanism
Diffuse abdominal tenderness	Penetrating injury to extremity above elbow or knee
GCS <14 in the presence of head injury	Ejection (partial or complete) from vehicle
Bleeding disorder, anticoagulant or anti-platelet medication use	Pedestrian or bicyclist hit at >20 mph or thrown any distance
Pregnancy (gestation >20 weeks)	Passenger space intrusion >12 inches
Suspected spinal injury with sensory deficit or weakness	Motorcycle crash >20 mph including laying down bike
Seatbelt bruising/abrasions of neck, chest, abdominal	Person in same passenger compartment in which trauma death occurred
	Adult: Falls >15 feet Child: Fall >10 feet or 2-3 times child's height

INTRODUCTION

Alcohol is a major ongoing public health concern, with evidence of potential for chronic erosion of family structure, employment, and overall health.[1] More significantly, alcohol is a major cause of motor vehicle collisions, along with the subsequent injuries, hospitalizations and deaths.[2] The Centers for Disease Control (CDC) data show that the average annual alcohol-attributable mortality due to excessive use in the United States from 2001-2005 included 36,643 deaths due to chronic causes (cancer, liver cirrhosis, and heart disease) and 43,731 deaths attributed to acute alcohol-induced causes.[1] Motor-vehicle traffic crashes, homicide, and suicide composed 31.6%, 17.8%, and 16.5% of alcohol-attributable deaths respectively. The CDC[2] further indicates that there were 112 million incidents of alcohol-impaired driving in 2010, thus highlighting the magnitude of this problem nationwide.

Numerous public health campaigns regarding the perils of alcohol-impaired driving and alcohol dependence have been conducted over the past several decades. While these need to continue, more innovative solutions are required, as the data are suggestive of a worsening nationwide problem. Recent data showed that the incidence of alcohol-impaired driving appears to be increasing, up 12.9% from 75.7 million in 2004 to 85.5 million just 4 years later.[3] Additionally, certain predictors of hazardous drinking behavior in adult trauma patients are increasingly recognized, such as male gender, younger age, and higher blood alcohol concentrations.[4] In response to this ongoing public health problem, emergency departments (ED) have been actively involved in alcohol screening and providing intervention through programs such as Screening, Brief Intervention, and Referral to Treatment (SBIRT) and Computerized Alcohol Screening and Intervention (CASI). CASI uses an Alcohol Use Disorders Identification Test (AUDIT) score to categorize patient drinking behavior.

Newer research, however, based upon these AUDIT scores and CASI exams, is revealing additional valuable data, regarding the importance of knowing the intended reasons for cutting back on drinking. For example, Barnett et al[5] were able to demonstrate in the college-aged population that the motivation for changing alcoholic behavior is strongly associated with a patient's attribution of alcohol to certain events. Specifically, the authors noted that a "perceived aversiveness of the incident predicted motivation to change drinking and heavy drinking" (p. 760). Walton et al[6] further supported this in showing that patients in the ED are more receptive to brief interventions (BIs) when they attribute their hospital visit to a period of drinking.

Few studies exist that show associations between reason to cut back and educational attainment, although some recent research reveals associations between educational attainment and early alcohol dependency.[7] After adjusting for shared familial contributions to educational attainment, researchers found in co-twin studies that the likelihood of completing less than 16 years of education was significantly higher for those who used alcohol before age 18 or for those with a lifetime alcohol dependence diagnosis.

The primary objective of this study was to identify the most common reasons for intending to cut back on alcohol usage, through an examination of data collected from CASI in an ED setting. We compared reasons to cut back for trauma and ED patients, and also looked for differences in readiness to change among patients citing different reasons to cut back. A secondary objective was to look at associations between reasons to cut back and education level.

METHODS

Study Design and Protocol

This was a retrospective analysis of a convenience

sample, whose responses were collected via CASI at an urban level I trauma center university hospital in California, between November 2008 and January 2012. Figure 1 shows the subject selection process, which began with the exclusion of 8,469 patients because they reported drinking within the NIAAA-recommended drinking limits. We excluded 264 patients with an AUDIT score >19 (consistent with a dependency on alcohol), and 602 incomplete surveys were also removed, leaving 1202 complete responses from non-dependent drinkers exceeding the NIAAA-recommended drinking limits. Patients included in the study were aged 18 and over, and their responses had been collected via CASI, 7 days a week by trained research associates. ED patients in this study are classified as non-trauma patients. We identified trauma patients using the inclusion criteria as shown in Table 1. Patients were excluded from the study if they were medically unstable, under an involuntary psychiatric hold, currently intoxicated, or under police custody. Approximately 160,000 patients were treated in this ED during the 4-year time of this study, but the number of patients who were ineligible or did not consent was not specifically recorded.

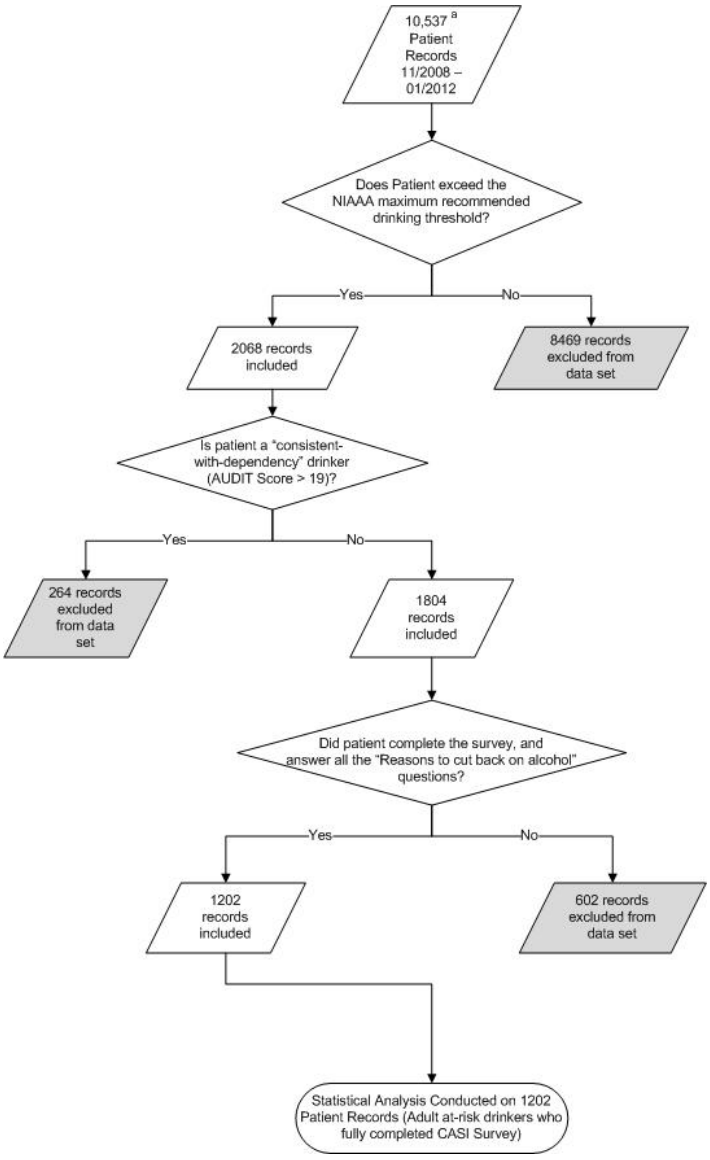


Figure 1. Patient record selection flow chart.
[a]The number of patients who did not consent, or were ineligible for the study, was not recorded.

Once participants gave verbal consent, the CASI system recorded patients' self-reported data, including basic demographic background, number of drinks per day, drinks per week, reasons to cut back, and the subsequently calculated AUDIT score and "Readiness to change" scale. The survey was available in both English and Spanish, both written and audio. The study was reviewed and deemed exempt by the Human Subjects Research Institutional Review Board.

CASI Tablet

CASI is a self-administered computer-administered questionnaire used primarily for screening purposes. Studies showed that CASI was effective at identifying at-risk and consistent-with-dependency drinkers in less than 7 minutes, and demonstrated good acceptability by patients. It can be implemented in bilingual settings (English and Spanish) with minimal time commitment, and has shown to be an effective tool among the Spanish-speaking population in the ED.[8,9] A follow-up study by Vaca et al[10] supported the use of such SBIRT systems as holding "promise as a viable screening and intervention modality for a wide range of emergency department patients," with up to 47% reduction in drinking amongst at-risk patients, 6 months afterwards.

The tablet can be administered at the bedside for ED and trauma patients. The technology employs a user-friendly text, touch-screen interface with an option for text-to-speech. Patient privacy is enhanced with options for Bluetooth technology and headphones. Patients receive a customized alcohol reduction plan and/or counselling referral information. The CASI alcohol screening section was first established based upon the National Institute on Alcohol Abuse and Alcoholism (NIAAA) guideline and AUDIT score.[11] The CASI tablet screening interview time was decreased for non-drinkers and drinkers whose alcohol consumption was within recommended limits established by NIAAA. Lotfipour et al[12] showed trauma patients found the CASI tablet to be both easy to use (92%) and a comfortable form of answering questions (87%).

Measurements

Demographics

CASI assessed basic respondent self-reported demographics such as gender, age, education level and language.

AUDIT score

AUDIT was first introduced in 1989 by the World Health Organization (WHO) and is now in its second edition.[13] Studies continue to demonstrate superior sensitivity, specificity, reliability, and internal consistency for the AUDIT

over other self-reporting methods.[14] AUDIT also has good reliability across both field and web-based administrations, and has recently been used extensively with patients in the ED setting as a validated tool for CASI.[15,8,10] According to the AUDIT scoring, patients were defined as "low-risk" when they are scored 0-7, and "at-risk" patients with an AUDIT score of 8-19. Patients in either group who drank more than NIAAA-recommended limits received a computer-guided brief interview, which included customized feedback, an assessment of readiness to change, reasons to cut back on drinking, goal setting, and a printed personal alcohol reduction plan.[8,10] Patients who had an AUDIT score of 20 or more were "consistent-with-dependency" on alcohol, and received a follow-up consultation with a social worker.

NIAAA recommendation

The limits that have been set are defined as no more than 4 drinks per day, and no more than 14 drinks per week, for men under the age of 65, and no more than 3 drinks per day and no more than 7 drinks per week for women of all ages and men age 65 years and older.[16,17]

Readiness to change scale

As part of the intervention, CASI also subsequently assessed patients with drinking behavior above the NIAAA recommendations, by asking how ready they are to change their drinking behavior on a readiness to change scale from 1 to 10 (1="not at all ready" and 10="extremely ready").[18] Visual analogue scales for readiness to change (RTC) were introduced by Stott et al[19] and applied to substance abuse interventions by Bernstein et al[20]. Such measures of RTC were related to a decrease in alcohol consumption among inpatients receiving a brief intervention and to expressed intentions to decrease drinking among young males.[21,22]

Reasons to cut back on alcohol

For those who drank more than the NIAAA-recommended limits, CASI inquired regarding the "reasons you want to cut back" on alcohol consumption, allowing users to choose any of 10 options as listed in Table 3. Users were allowed to choose more than one option, or no option, in this portion of the survey.

Education level

Patients were also queried regarding their highest degree or level of education completed. Responses adapted from the United States Census,[23] were collected in 9 different categories and were grouped into 4 categories for analysis: less than high school graduate, high school graduate, some college or associate degree, and bachelor's or advanced degree.

Analyses

The data were saved by CASI as comma-separated text files. We imported these files into Stata (version 12.1, StataCorp, College Station, TX). We excluded incomplete records and records with identification numbers that indicated staff tests. Numeric variables were summarized with the median and interquartile range (IQR). We calculated the frequency of positive responses to "Reasons to cut back" and the chi-square test for independence to compare ED and trauma populations. Since a higher percentage of young males were trauma patients compared with ED patients, we used logistic regression to compare frequency of each positive response in ED patients to that in designated trauma patients, adjusting for gender, age in six categories, and the number of other responses checked. The responses of patients with the other 3 categories of education were compared to high school graduates, with adjustment for gender, age in 6 categories, the number of other responses checked, and ED versus designated trauma patient. We used linear regression to estimate the difference in the readiness to change scale (1 to 10), adjusting for age (in the same categories), gender, ED versus trauma patients, and AUDIT score.

RESULTS

As described in the methods, we analysed 1,202 complete responses from non-dependent drinkers exceeding the NIAAA recommended drinking limits. These included 848 (70.6%) who were ED patients and 354 (29.4%) who were trauma patients. Patient demographic characteristics are shown in Table 2. The median age for the group was 30 (IQR 23-43). The largest portion of responses, 38.9%, was from patients in the 21-29 age group. More than twice the number of males compared to females (71.7% males overall) completed the survey, and this proportion was even more pronounced in trauma patients (81.6% male, $p<0.001$). Eleven percent of patients selected the Spanish-language option when taking CASI. The median AUDIT score was 7 (IQR 5-11), and the readiness to change scale (1-10) for these patients had a median of 8 (IQR 5-10).

As shown in Table 3, the most common reason reported for cutting back on alcohol consumption was "To avoid health problems" (68.5%). This was followed by "To avoid getting a 'driving under the influence' (DUI)" (43.6%), "It could save me money" (42.0%), and "To avoid situations where I could get hurt" (41.0%). As shown in Table 3, respondents cited the other 6 reasons less than 38.0% of the time.

We found that trauma patients cited 3 particular reasons significantly more often than ED patients, both when assessed by chi-squared and logistic regression. These were: "To avoid situations where I could get hurt" (46.3% versus 38.8% respectively, odds ratio (OR) 0.48, 95% confidence interval (CI) 0.34-0.68), "So I can be in control of my behavior" (40.7% versus 32.2%, OR 0.49, 95% CI 0.35-0.70), and "My partner or spouse wants me to stop" (20.1% versus 15.0%, OR 0.62, 95% CI 0.43-0.89).

As shown in Figure 2, patients who cited "To avoid health problems" as a reason to cut back, reported 1.2 points

Table 2. Patient characteristics by age, gender, language, and audit score, n=1,202, emergency department (ED) non-trauma versus trauma.

	ED non-trauma patients		Trauma patients		p-value*
	#	%	#	%	
Age					
18-20	66	7.8	58	16.4	<0.001
21-29	332	39.2	135	38.1	
30-39	181	21.3	55	15.5	
40-49	147	17.3	53	15.0	
50-64	103	12.2	42	11.9	
65-99	19	2.2	11	3.1	
Total	848	100	354	100	
Gender					
Male	573	67.6	289	81.6	<0.001
Female	275	32.4	65	18.4	
Language					
English	765	90.2	305	86.2	0.040
Spanish	83	9.8	49	13.8	
Audit score					
0-7	465	54.8	180	50.8	0.206
8-19	383	45.2	174	49.2	

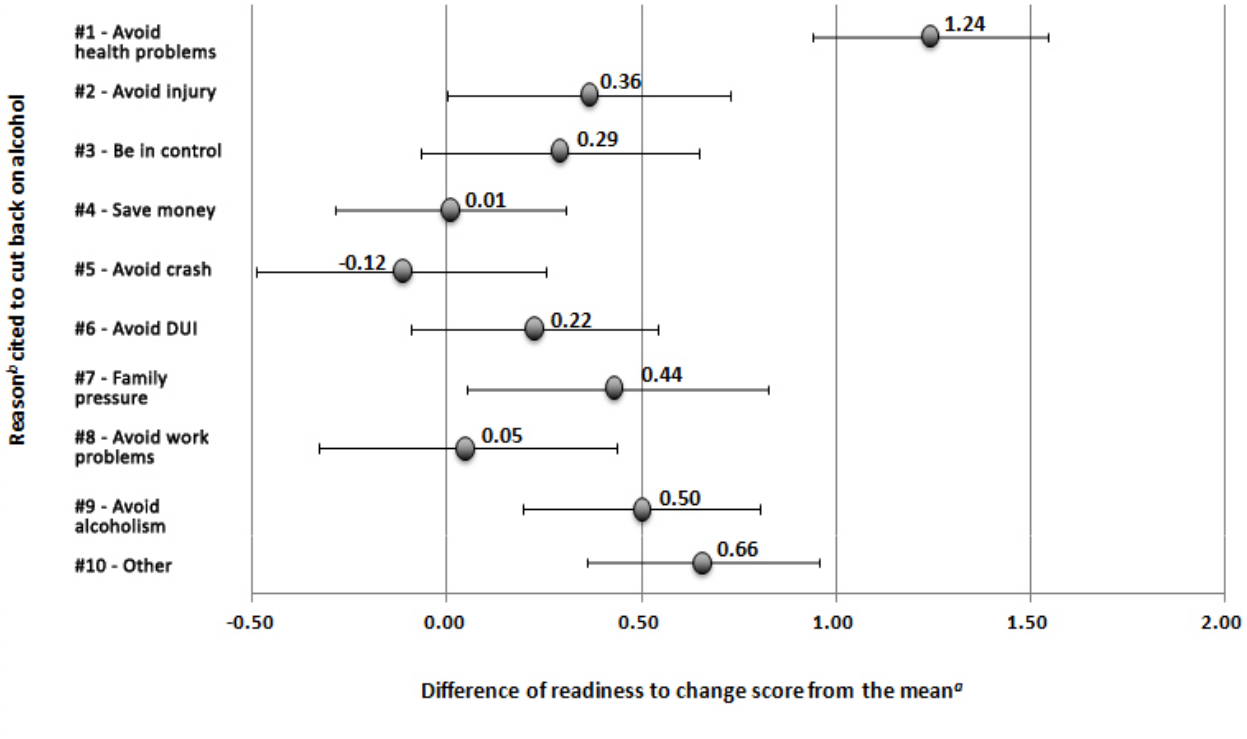
*p-values are from the chi-square test for independence, comparing the difference between ED non-trauma patients. p<0.05 was considered to be significant.

Table 3. Frequency, odds ratio (OR), and confidence interval (CI) regarding patient responses to "Reasons you want to cut back on alcohol consumption," n=1,202, emergency department (ED) non-trauma versus trauma.

Reason cited	All patients		ED non-trauma patients		Trauma patients		OR* (95% CI)
	#	%	#	%	#	%	
1) "To avoid health problems"	823	68.5	618	72.9	205	58.9	2.2 (1.6-2.9)
2) "To avoid situations where I could get hurt"	493	41.0	329	38.8	163	46.3	0.48 (0.34-0.68)
3) "So I can be in control of my behavior"	417	34.7	273	32.2	144	40.7	0.49 (0.35-0.70)
4) "It could save me money"	505	42.0	360	42.5	145	41.0	1.1 (0.80-1.4)
5) "To avoid being in a car crash caused by alcohol use"	456	37.9	323	38.1	133	37.6	0.94 (0.66-1.3)
6) "To avoid getting a DUI"	524	43.6	377	44.5	147	41.5	1.2 (0.85-1.6)
7) "My partner or spouse wants me to stop"	198	16.5	127	15.0	71	20.1	0.62 (0.43-0.89)
8) "To avoid work or school related problems"	255	21.2	177	20.9	78	22.0	0.97 (0.66-1.4)
9) "Not to become an alcoholic like someone in my life"	430	35.8	312	36.8	118	33.3	1.3 (0.96-1.8)
10) "Some other reason"	329	27.4	250	29.5	79	22.3	1.5 (1.1-2.0)

*OR and CI are from logistic regression adjusting for gender, age, language, and the number of other reasons cited by ED non-trauma and trauma patients.

Figure 2. Difference of readiness to change score from the mean versus reason cited to cut back on alcohol, mutually adjusted using linear regression (see text). Error bars show 95% confidence intervals.



[a]Mean readiness to change score =7.24
[b]Full text of reasons cited: #1)"To avoid health problems", #2)"To avoid situations where I could get hurt", #3)"So I can be in control of my behavior", #4)"It could save me money", #5)"To avoid being in a car crash caused by alcohol use", #6)"To avoid getting a DUI", #7)"My partner or spouse wants me to stop", #8)"To avoid work or school related problems", #9)"Not to become an alcoholic like someone in my life", #10)"Some other reason"

higher than average (p<0.001) on the readiness to change scale, adjusted for other reasons cited, age, gender, AUDIT score, and patient type. Those who mentioned 3 other reasons, "My partner or spouse wants me to stop" (p=0.027), "Not to become an alcoholic like someone in my life" (p=0.001), and "Some other reason" (p<0.001), also reported slightly higher than average values on the readiness to change scale. The difference shown in Figure 2 were not substantially influenced by adjustment for age, gender, AUDIT score, and patient type, but were exaggerated if the other reasons were excluded from the regression.

Those who had completed some college or an associate degree cited "To avoid health problems" less often than high school graduates (OR 0.45, 95% CI 0.23-0.90). They also reported cutting back on drinking "To avoid situations where I could get hurt" (OR 2.5, 95% CI 1.1-5.8) and "To avoid being in a car crash caused by alcohol use" (OR 3.8, 95% CI 1.5-9.7) more often than high school graduates. No other statistically significant correlations between reason to cut back and education level were found.

DISCUSSION

Several novel and first-reported findings were identified through this study, regarding reasons for intending to cut back on alcohol usage, readiness to change, and educational attainment. The most common reasons cited for cutting back on alcohol consumption were avoidance of health problems, avoidance of getting a DUI, cost savings, and avoidance of injury. In our investigation of the literature, there was no comparable study looking at these reasons. Trauma patients cited the following reasons significantly more frequently than ED patients: avoidance of injury, better control of behavior, and influence from spouse. Additionally, those patients who cited "To avoid health problems" as a reason to cut back also reported "a higher readiness to change." This is an association that has not previously been reported. Analysis of education levels showed those who have completed some college or an associate degree had cited "To avoid health problems" less often than high school graduates, while they cited "To avoid situations where I could get hurt" and "To avoid being in a car crash caused by alcohol use" more often than high school graduates. This provides some further insight into the associations between educational levels and alcohol dependency as studied by Grant et al[7].

Our study found that patients are more concerned with the

impact of alcohol on their health, finances, and legal problems, than any other reasons provided to them. Based on these findings, the implications may be significant, as interventions that are customized to a patient's CASI results can be more effective. As Leontieva et al[25] illustrated, the setting of patient goals and referrals made to addiction facilities during the SBIRT phase were the most critical components in discriminating which patients generally improved. We suggest using the patient's own intention to change as part of their brief intervention program, especially for those 823 (68.5%) patients in this study who specifically cited a desire to avoid health problems. In addition, the trauma patients in particular were proportionately more concerned with avoidance of situations where they could get hurt than their ED counterparts, which was another new finding not seen in the literature in the setting of alcohol drinkers.

It is noteworthy that health, injury, finances, and legal issues remain top concerns listed as reasons to cut back, for the patients surveyed in this study. Especially for those who had listed "To avoid health problems," it is particularly important to take advantage of their reported higher readiness to change. Furthermore, trauma patients had proportionately more concerns with situations where they could get hurt, as an example, and this is critical information that could be leveraged into a teachable moment.[12] Taking into account the education level of the respondent may also further direct treatment plans to those most interested.[7] Such tailored treatments might include customized information and signed behavioral contracts that incorporate the same "Reasons to cut back" cited by the patients themselves. This would ideally lead to an even more sophisticated set of customized interventions that can be offered to patients prior to discharge, thus taking advantage of this unique brief opportunity for intervention with these patients.

LIMITATIONS

This study has some limitations to consider. Although the CASI and AUDIT score are validated tools, these results are nonetheless based upon self-reported data, which does lend itself to some degree of inaccuracy.[8,14] Within the reasons to cut back on alcohol, there may be some bias introduced, given the order of reasons listed, as users may choose the first few reasons more often than the last few reasons. Additionally, the tenth reason provided to respondents, "Some other reason," may contain some additional valuable data, which could be further dissected in future studies. External validity of this study may be somewhat limited with non-drinkers, or the heaviest drinkers, given the exclusion of those patients from this data set due to their higher rates of relapse.[24] Thus, these results don't generalize to those with AUDIT score <1, or those drinkers with an AUDIT score >19 (consistent with dependency). It is also worth noting that this was a convenience sampling of subjects enrolled in the study. The subjects were derived from patients in the ED and included non-trauma or trauma patients. As a result of this the data contain unequal sample sizes and may be less generalizable.

FUTURE RESEARCH

There remains room for further research in this area. Tailoring these brief interventions to specific populations may allow for customized healthcare reference material, highlighting the health risks of continued drinking. Studies have recently shown that patients whose brief intervention included a "behavioral contract," attendance prompt, and subsequent reinforcers (CPR), were more likely to complete treatment programs, and remain abstinent for at least one year.[26] Given sufficient time and resources, patients may be able to present their behavioral contract to a counselor from a 12-step or other substance abuse program. Such studies would produce even more valuable data on the utility of such an intervention, and allow for an examination of how intentions actually influence the reduction of at-risk drinking behavior over time.

CONCLUSION

Health, injury, finances, and legal issues remain top concerns for patients in this study, particularly the 68.5% who cited "To avoid health problems" as the most common reason for cutting back on alcohol consumption. Furthermore, trauma patients had proportionately more concerns with situations where they "could get hurt" compared to ED patients, and this is critical information that could be leveraged into a teachable moment. Future brief intervention could be more effective if tailored to address unique concerns of these 2 patient populations.

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2015 *Academic Emergency Medicine* Consensus Conference

Diagnostic Imaging in the Emergency Department:
A Research Agenda to Optimize Utilization

The 2015 *Academic Emergency Medicine* (*AEM*) consensus conference, **Diagnostic imaging in the emergency department: A research agenda to optimize utilization** will be held on May 12, 2015, immediately preceding the SAEM Annual Meeting in San Diego, CA. Original papers on this topic, if accepted, will be published together with the conference proceedings in the December 2015 issue of *AEM*.

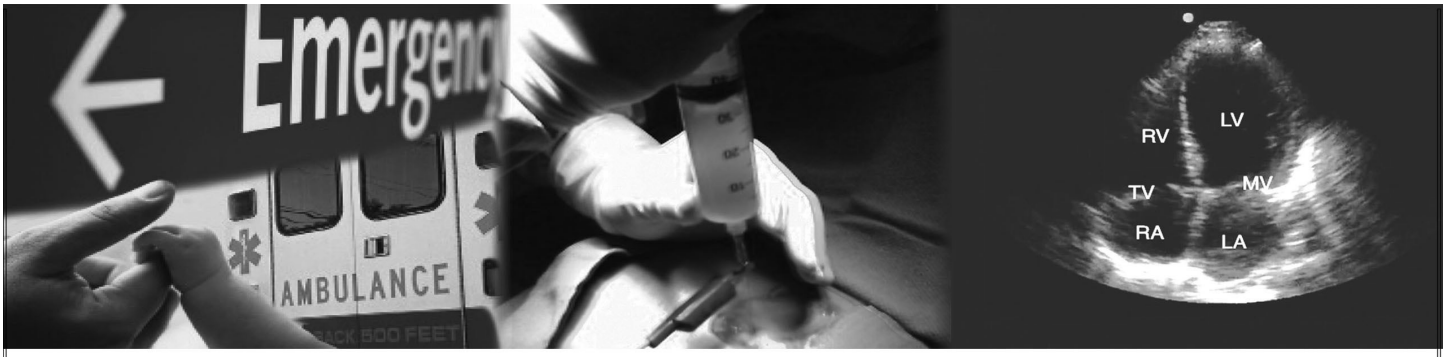
Diagnostic imaging is integral and beneficial to the practice of emergency medicine. Over the last several decades, emergency department (ED) diagnostic imaging has increased without a commensurate rise in identified pathology or improvement in patient-centered outcomes. Unnecessary imaging results in increased resource use and significant exposure risks. ED diagnostic imaging has become the focus of many stakeholders, including patients and various regulatory agencies. This multidisciplinary consensus conference represents the first coordinated effort to further our evidence-based knowledge of ED diagnostic imaging. This consensus conference will formulate the research priorities for emergency diagnostic imaging, initiate a collaborative dialogue between stakeholders, and align this research agenda with that of federal funding agencies.

Consensus Goal:
The overall mission of the 2015 *AEM* consensus conference will be to create a prioritized research agenda in emergency diagnostic imaging for the next decade and beyond. The consensus conference will feature expert keynote speakers, panel discussions including nationally recognized experts, and facilitated breakout group sessions to develop consensus on research agendas by topic. Optimizing diagnostic imaging in the ED is a timely topic that is relevant to all who practice emergency medicine. Furthermore, the conference content spans many other specialties (e.g. radiology, pediatrics, cardiology, surgery, internal medicine), all of which will be invited to participate in the conference to optimize the agenda and for future collaboration in order to improve emergency diagnostic imaging use.

Consensus Objectives:
1. Understand the current state of evidence regarding diagnostic imaging utilization in the ED and identify opportunities, limitations, and gaps in knowledge of previous study designs and methodology
2. Develop a consensus statement that emphasizes the priorities and opportunities for research in emergency diagnostic imaging that will result in practice changes, and the most effective methodologic approaches to emergency diagnostic imaging research
3. Explore and improve knowledge of specific funding mechanisms available to perform research in emergency diagnostic imaging

Accepted manuscripts will present original, high-quality research in emergency diagnostic imaging in areas such as clinical decision rules, shared decision making, knowledge translation, comparative effectiveness research, and multidisciplinary collaboration. They may include work in clinical/translational, health systems, policy, or basic sciences research. Papers will be considered for publication in the December 2015 issue of *AEM* if received by April 17, 2015. All submissions will undergo peer review and publication cannot be guaranteed.

For queries, please contact Jennifer R. Marin, MD, MSc (jennifer.marin@chp.edu) or Angela M. Mills, MD (millsa@uphs.upenn.edu) the 2015 consensus conference co-chairs. Information and updates will be regularly posted in *AEM*, the SAEM Newsletter, and the journal and SAEM websites.



JOB ANNOUNCEMENT

INSTRUCTOR, ASSISTANT OR ASSOCIATE PROFESSOR POSITIONS DEPARTMENT OF EMERGENCY MEDICINE AMERICAN UNIVERSITY OF BEIRUT, FACULTY OF MEDICINE AND MEDICAL CENTER BEIRUT, LEBANON

The Department of Emergency Medicine is recruiting for full-time academic positions at the Instructor, Assistant or Associate Professor levels. Candidates must be experienced Emergency Medicine Physicians, graduates of nationally recognized Emergency Medicine residency training programs or board-certified or -eligible in Emergency Medicine by the American Board of Emergency Medicine or the American Board of Osteopathic Emergency Medicine, and must be fluent in English and, preferably, Arabic though the latter is not a requirement. Excellent opportunities exist for faculty development, research and teaching. The compensation is competitive and the positions offer excellent benefits.

Applicants should submit electronically: curriculum vitae, the names and addresses of four references, a summary of their accomplishments in the areas of clinical scholarly activities, teaching and research; and future plans. All requested documents should be forwarded to Dr. Eveline Hitti, Interim Chairperson of Department of Emergency Medicine, at the following e-mail address eh16@aub.edu.lb

Eveline Hitti, MD.
Assistant Professor of Clinical Emergency Medicine
Department of Emergency Medicine
American University of Beirut
P.O. Box 11-0236 - Riad El Solh 1107 2020
Beirut - Lebanon

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Health Sciences Clinical Professor Series, Open Ranks
Department of Emergency Medicine

The University of California, Irvine School of Medicine, Department of Emergency Medicine anticipates openings in the HS Clinical Professor Series.

Requirements: The HS Clinical Series includes substantial patient care, medical student and resident teaching, and optional clinical research. Board preparation or certification in EM required. Fellowship or advanced degree, or both, strongly desired. The University of California, Irvine Medical Center is a 472-bed tertiary care hospital with all residencies. The ED is a progressive 35-bed Level I Trauma Center with 40,000 patients, in urban Orange County. Collegial relationships with all services. Excellent salary and benefits with incentive plan.

Salary and rank will be commensurate with qualifications and experience.

Application Procedure: Interested candidates should apply through UCI Irvine's RECRUIT system located at: https://recruit.ap.uci.edu/apply/.

Applicants should complete an online application profile and upload the following application materials electronically to be considered for the position:

1. Curriculum Vitae
2. Names and addresses of four references

The University of California, Irvine is an equal opportunity employer committed to excellence through diversity.

SCHOOL OF MEDICINE
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Post-Doctoral Scholar Fellow

The University of California, Irvine School of Medicine's Center for Trauma and Injury Prevention Research (CTIPR) is committed to the reduction of associated personal and societal burden of traumatic injury through conducting multidisciplinary research, translating research into policy and practice, serving as a regional and national resource, and working in close partnership with communities. The Center is based in the Department of Emergency Medicine and has strong working relationship with Trauma Surgery and the Trauma Registry. Recent projects include injury prevention, alcohol screening and brief intervention, and management mental health issues in the emergency department.

The Post-Doctoral Fellow will carry out injury research in close collaboration with mentors and colleagues in the Department of Emergency Medicine, Program in Public Health, and School of Social Ecology. The fellow will analyze data from current research projects and existing traffic injury data sets, develop skills as an independent researcher, and develop new projects.

Minimum qualifications:
Required doctoral degree in epidemiology, public health, or safety research, with a focus on injury, alcohol, or mental health research.

Other considerations:
1. Strong analytic skills and outstanding individual initiative.
2. Strong skills in data management and analysis, including experience using standard statistical packages.
3. Excellent scientific writing and spoken English skills.
4. Preference is given to applicants whose training and research interests align with the CTIPR.

Anticipated salary range:
http://www.som.uci.edu/academic-affairs/docs/postdoc.pdf

Applications are accepted until the position is filled.

Submit letter of interest, resume, research interests, and three references to:
Shahram Lotfipour, MD MPH (SHL@uci.edu, 714-456-2326) and Bharath Chakravarthy MD MPH (bchakrav@uci.edu, 714-456-6986).

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The University of Utah
Division of Emergency Medicine

ACADEMIC-AFFILIATED COMMUNITY PHYSICIANS

The Division of Emergency Medicine at the University of Utah Health Sciences Center is recruiting for a number of physicians to staff University-affiliated community hospital emergency departments in Rock Springs, WY and Rexburg, ID. These hospitals are located in rural communities that will also be used for training medical students, residents, and fellows. Direct access to the main University hospital will be available by EMR, telemedicine, and air medical transport. Opportunities for part-time work, off-site CME, and blended academic practices are also available.

The University of Utah is the primary medical teaching and research institution in the state. Candidates must be board certified/prepared and have an interest in education of residents and medical students. A competitive salary with an excellent benefits package is offered.

Applicants must apply at: http://utah.peopleadmin.com/postings/28004 for Wyoming.
http://utah.peopleadmin.com/postings/29719 for Idaho

Please submit the following:
1. Current Curriculum Vitae
2. Cover letter
3. Please address all required questions.
4. If you respond "Yes" to any of the posting questions, please include a written detailed explanation with your cover letter.

Erik D. Barton, MD, MS, MBA Division Chief
Division of Emergency Medicine
University of Utah School of Medicine
30 North 1900 East, RM 1C26
Salt Lake City, Utah 84132 (801) 587-8595
Fax: (801) 585-0603 becky.bryce@hsc.utah.edu

The University of Utah is an Equal Opportunity/Affirmative Action employer and educator. Minorities, women, and persons with disabilities are strongly encouraged to apply, Veterans' preference. Reasonable accommodations provided. For additional information: http://www.regulations.utah.edu/humanResources/5106.html.

UC Irvine Health
School of Medicine

The University of California, Irvine, School of Medicine, invites applicants for **Chair** of the **Department of Emergency Medicine.**

The University of California, Irvine, has a vibrant scientific community with outstanding collaborative opportunities. The Emergency Department is a 35-bed clinical unit with 7 resuscitation bays, caring for more than 47,000 patients per year. The ACS-verified Level I trauma center has 3600 activations per year, and the ACS-verified Burn Center cares for more than 300 patients. UC Irvine was recently verified officially as a Level II Pediatric Trauma Center. In addition, the department is designated as a Base Hospital, Joint Commission and Orange County Cardiac and Stroke Receiving Center. The department is the most capable in the area for disaster preparedness and response, and is one of only nine comprehensive emergency departments in California.

The department houses 19 full-time faculty (2 Ph.D.), four Clinical Instructor fellows, and a fully accredited PGY 1, 2, 3 EM residency (since 1988). The research effort is focused in the Center for Trauma and Injury Prevention Research and the Center for Disaster Medical Sciences. The Division of Emergency Ultrasound is internationally known, as UC Irvine was the first medical school to adopt a four-year integrated ultrasound curriculum. Other faculty in the department lead significant efforts in educational technology and simulation, and EMR implementation. The department publishes the Western Journal of Emergency Medicine: Integrating Emergency Care with Population Health, an open-access peer reviewed international journal.

Applicants for this position must have an M.D., or M.D./Ph.D. degrees, with Master's degree and/or subspecialty fellowship training desirable. Board certification in Emergency Medicine is required, as is an academic record sufficient for appointment in the Clinical X (Scholar) Line or In-Residence series at the full professor level. Candidates must have a strong record of scholarly activity and peer reviewed publications, including a research program with extramural funding. The candidates should also hold, or be eligible for, a medical license in the State of California. The successful candidate will be responsible for the effective management of all administrative and operational processes of the department, providing not only comprehensive, interactive clinical services, but also supporting the teaching, educational and research missions of the department, school and university. The candidate must have strong interpersonal skills, and be able to work cooperatively and congenially within a diverse academic and clinical environment. Candidates with leadership skills and vision for enhancing the clinical and academic components of a multi-disciplinary department are especially encouraged to submit applications to:

Applicants should complete an online application profile and upload their Curriculum vitae electronically to be considered for the position: https://recruit.ap.uci.edu/apply/JPF02153.

UCI is an equal opportunity employer committed to excellence through diversity and strongly encourages applications from all qualified applicants, including women and minorities. UCI is responsive to the needs of dual career couples, is dedicated to work-life balance through an array of family-friendly policies, and is the recipient of an NSF ADVANCE Award for gender equity.

SINAI
Sinai Health System

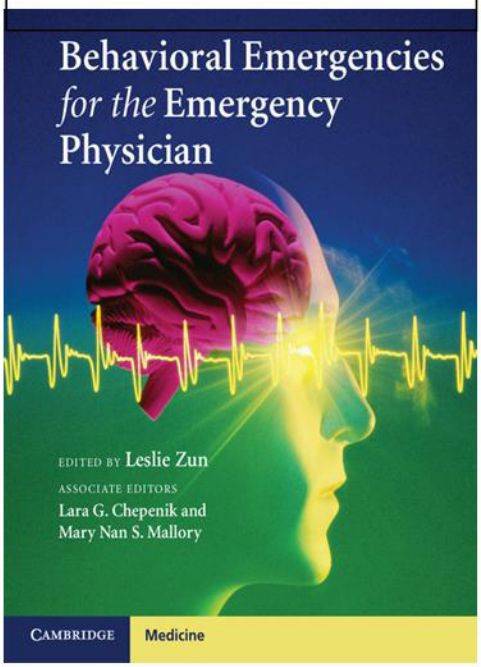
December 10-12
Scottsdale Conference Center
Scottsdale, AZ

5th Annual National Update on Behavioral Emergencies

Topics (Tentative) Thursday December 11 (Day 1)
Working with Law Enforcement
What is New in Medical Clearance
Suicide and Substance Use
Deadly Disorders in Psychiatric
New Drugs of Abuse
Difficult Behavioral Disorders
Excited Delirium
Pediatric Psychiatric Illness
Case Management in the Emergency
Intellectually and DD
Geropsychiatric Issues
Medication Update
Appropriate Treatments in the ED/PES
Agitation Tx Delirium and Dementia
New Treatments for Agitation
Successful Restraint Reduction
Who Can Go Home with Suicide
Dealing with Psychiatric Boarders

Topics (Tentative) Friday December 12 (Day 2)
Reduction of Frequent Users
Working with EMS
Role of Community Mental Health
Nursing Issues of Caring for Behavioral Emergencies
Mobile Care and Crisis Management
Training in Behavioral Emergencies
Medical Records in HIE
Legislative issues
Wall Time Collaborative
Models of Care
ED Tool Kit
Billing and Reimbursement
EMTALA
Scientific Session

Every Registrant receives a copy



Invited Speakers

Doug Rund
David Hinton
Peter Gutierrez
Kim Nordstrom
Frank Lovecchio
Lara Chepenik
Gary Vilke
Joanna Kowalik
Sheri Richardt
Jennifer Walthall
Jack Rozel
Jon Berlin
Rachel Glick
Lara Chepenik
Scott Goldstein
Ken Thompson
Anne Maton
Pablo Sadler
Kurt Isenberger
Laura Zaremba
B Bartleson
Scott Zeller
Junji Takeshita
Richard Wild
Michael Wilson
Eric Katz
Seth Powsner

Pre-Conference Course on Dec 10th Sponsored by IBHI

Course Director
Leslie Zun, MD, MBA
Endorsements
Sinai Health System
The Chicago Medical School
American Association for Emergency Psychiatry

For Further Details
www.behavioralemergencies.com

All Full Registrations Include a Copy of Behavioral Emergencies for the Emergency Physician

CME Approved for ACEP Category 1
CEUs available for RNs, PAs & SWs

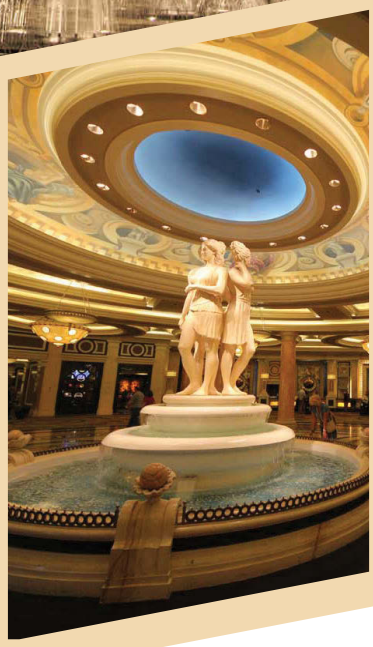
Registration Fees $545 in advance
$645 at the conference.
Reduced fee for residents and students

Trena Burke, Research Coordinator,
Phone: 773-257-6589
E-mail: burtr@sinai.org

ACOEP Presents

THE EDGE '14

SCIENTIFIC ASSEMBLY



SAVE THE DATE

Scientific Assembly 2014
Caesars Palace
Las Vegas, Nevada

October 12 - 15, 2014

"CEP America gave me the chance to explore many leadership opportunities."

"I'm very fortunate that I chose a group that makes me happy and whose leadership I respect and want to be part of."

—Tiffany Hackett, MD
ED Medical Director
San Leandro Hospital

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Hear Tiffany's story by visiting
go.cep.com/tiffanystory

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