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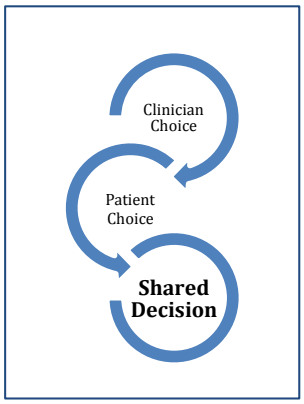

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Shared Decision Making in the Emergency Department: Development of a Policy-Relevant Patient-Centered Research Agenda

The 2016 *Academic Emergency Medicine* (*AEM*) consensus conference, "**Shared Decision Making in the Emergency Department: Development of a Policy-Relevant Patient-Centered Research Agenda,**" will be held on May 10, 2016, immediately preceding the SAEM Annual Meeting in New Orleans, LA. Original research papers on this topic, if accepted, will be published together with the conference proceedings in the December 2016 issue of *AEM*.

The consensus conference will convene major thought leaders and necessary stakeholders on shared decision making in acute care. Specifically, the conference will include patients, patient representatives from national advocacy organizations, emergency physicians, mid-level providers, emergency nurses, and researchers with expertise in shared decision making and patient-centered outcomes research, comparative effectiveness research, and health information technology. There will be clinicians across various disciplines such as emergency medicine, health services research, psychology, and quality improvement. Finally, the conference will include national policy makers, payer representatives, and other stakeholders with the expressed goal of developing a multidisciplinary, consensus-based, high-priority research agenda to improve and optimize shared decision making in the emergency department.

Consensus Objectives:

1. Critically examine the state of science on shared decision making in emergency medicine, and identify opportunities, limitations, and gaps in knowledge and methodology;
2. Develop a consensus statement that prioritizes opportunities for research in shared decision making that will result in practice changes, and identifies effective methodological approaches;
3. Identify and build collaborative research networks to study the use of shared decision making and patient-centered outcomes research in emergency medicine that will be competitive for federal funding.

Accepted manuscripts will present original, high-quality research in shared decision making in the ED, 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 science research. Papers will be considered for publication in the December 2016 issue of *AEM* if received by April 17, 2016. All submissions will undergo peer review and publication cannot be guaranteed.

For queries, please contact the conference chair, Corita R. Grudzen, MD, MSHS (corita.grudzen@nyumc.org), or the co-chairs Christopher R. Carpenter, MD, MSc (carpenterc@wusm.wustl.edu) and Erik Hess, MD (Hess.Erik@mayo.edu). Information and updates will be regularly posted in *AEM* and the SAEM Newsletter, and on the journal and SAEM websites.

Approach to Management of Intravascular Missile Emboli: Review of the Literature and Case Report

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INTRODUCTION

Missile embolization is regarded as a rare phenomenon in the world of penetrating trauma. While figures in the world of civilian trauma do not exist, there is reason to believe that missile emboli are frequent enough to warrant the attention of any medical decision maker who cares for trauma patients. The current literature offers a variety of cases, but consolidated commentaries on management are infrequent. While a diagnostic and management plan may be pieced together with literature review, the situation in the setting of an unfolding trauma scenario often demands a more efficient approach. In this article, the authors offer a case report, as well as a review of diagnostic evaluation and management of missile emboli with support from the literature. While definitive recommendations cannot be made based on current medical and surgical understanding of missile emboli, we summarize this article by offering a likely model of managing missile emboli by anatomical location.

CASE REPORT

A 24-year-old male with no significant prior medical history was brought to the emergency department (ED) after sustaining nine gunshot wounds (GSWs), inflicted by two assailants wielding handguns from 4-6 meters away.

Upon arrival to the ED, the patient was alert and oriented. Breath sounds were symmetric and clear, and pulse oximetry was 100%. Central and peripheral pulses were strong and symmetric. One GSW was sustained to the left buttock posteriorly. Another penetrated the right lower quadrant of the abdomen, but the rest of the abdomen was otherwise soft, non-tender, and non-distended. No deformity or bullet wound was noted in the neck, thoracic, axillary, or upper abdominal areas. Exposure of the extremities revealed GSWs to the right thigh and left arm.

During the log roll examination of the back, SpO2 dropped to 80-90% while the patient breathed spontaneously on nasal cannula with oxygen at 2 liters per minute. The patient was positioned supine and the nasal cannula was replaced with 15 liters per minute of oxygen delivered via non-rebreather mask. After 2 minutes, his SpO2 corrected to 100% with resolution of his shortness of breath. The patient remained hemodynamically stable and the quality of the pulse oximetry waveform signal was confirmed throughout the episode. Bedside eFAST (Extended Focused Assessment with Sonography for Trauma) was negative for pneumothorax, pericardial and intra-abdominal fluid. Chest radiograph demonstrated a radiopaque foreign body measuring approximately 9x19mm, overlying the cardiac silhouette (Figure 1). The patient denied ever being shot in the past, and a preliminary concern for a bullet embolus was raised.

Computed tomograph (CT) of the chest confirmed a bullet in the right ventricle (Figure 2). CT of the abdomen and pelvis along with cystogram revealed a moderate amount of acute pelvic hemorrhage with evidence of right common iliac vein injury.

Cardiothoracic surgery and cardiology were then consulted for removal of the bullet. Intraoperative transesophageal echocardiogram (TEE) was performed to confirm the location of the bullet within the right ventricle, adjacent to the ventricular septum (Figure 3 and attached .mp4 video at 0.5x speed [Supplemental Digital Content][SDC-1]). The right ventricular transverse view on TEE showed a comet tail artifact, commonly seen with metal foreign bodies (Figure

3b). TEE further revealed normal right ventricular function, normal left ventricular function, no pericardial effusion, and no valvular abnormalities. It was uncertain after TEE whether the bullet was free floating within the ventricle at the time. Given the lack of direct damage to cardiac structures, an attempt at endovascular retrieval was made. Right internal jugular venous access was obtained by surgical cutdown, and an 11 French sheath was placed under direct visualization through the right internal jugular vein. With guided fluoroscopy, multiple attempts were made to retrieve the bullet with both Amplatz GooseNeck® (Coviden, Plymouth, MN) and ensnare devices (Figure 4). The cardiothoracic surgeons then performed a median sternotomy, and approached the right ventricle via right atriotomy with cardiopulmonary bypass and cardioplegic arrest. Exploration of the right ventricle through the tricuspid valve revealed the bullet was embedded within the right ventricular trabeculations. Extraction of the bullet required minor dissection of some trabeculations with Metzenbaum scissors. The intact bullet was discovered to be a minimally deformed .38 caliber pistol round, specifically 9x19mm Parabellum full metal jacket. The atriotomy and sternotomy were closed with no complication. The patient was transferred to intensive care in stable condition, and extubated later that day.

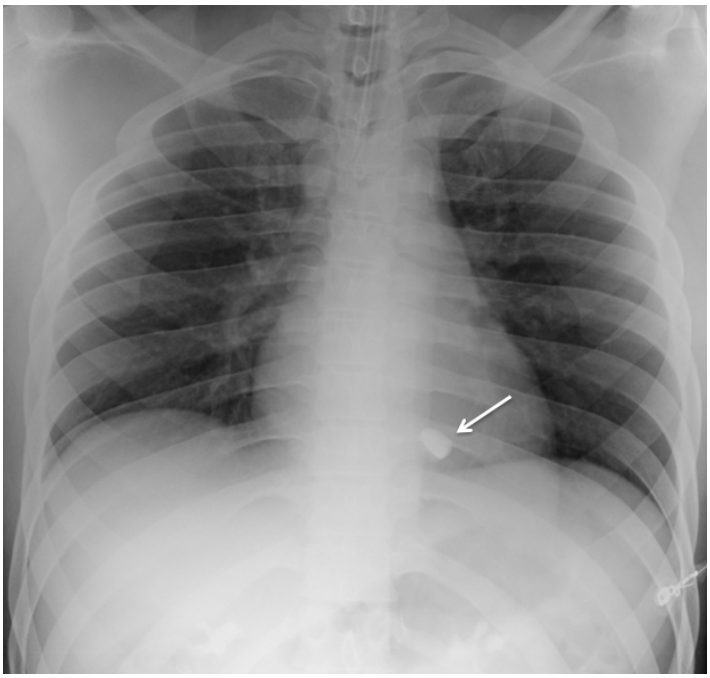

Figure 1. Chest radiograph showing blurred foreign body within the cardiac silhouette (arrow).

On POD #6, the patient developed a fever. A CT chest/abdomen/pelvis showed a large pericardial effusion, and moderate right pleural effusion with right lower lobe collapse. Echocardiogram demonstrated low-normal left ventricular ejection fraction at 50%, and furthermore confirmed the large pericardial effusion without any tamponade criteria. Clinically, the patient experienced intermittent drops in pulse oximetry and concurrent shortness of breath, but remained hemodynamically stable. Pericardiocentesis removed 650mL of hemorrhagic effusion immediately, and a drain left in place evacuated 320mL over the next three days. Follow-up echocardiogram showed a very small pericardial effusion. The 340mL of serosanginous fluid was then drained from the right pleural effusion, with no residual fluid on repeat ultrasound. There were no further acute events, and the patient was determined to be stable for transfer to the comprehensive rehabilitation center on POD #15.

CASE DISCUSSION

This patient experienced multiple GSW to the lower extremities and pelvis. After an initially unexplained oxygen desaturation, a chest radiograph revealed a likely bullet overlying the cardiac silhouette. After the complete evaluation in the trauma bay yielded no evidence of direct thoracic penetration and negative history of prior GSWs, a suspicion was raised for bullet embolus. After CT confirmed this diagnosis, the patient underwent successful operative removal. After a complicated post-op course, the patient was transferred for intensive rehabilitation.

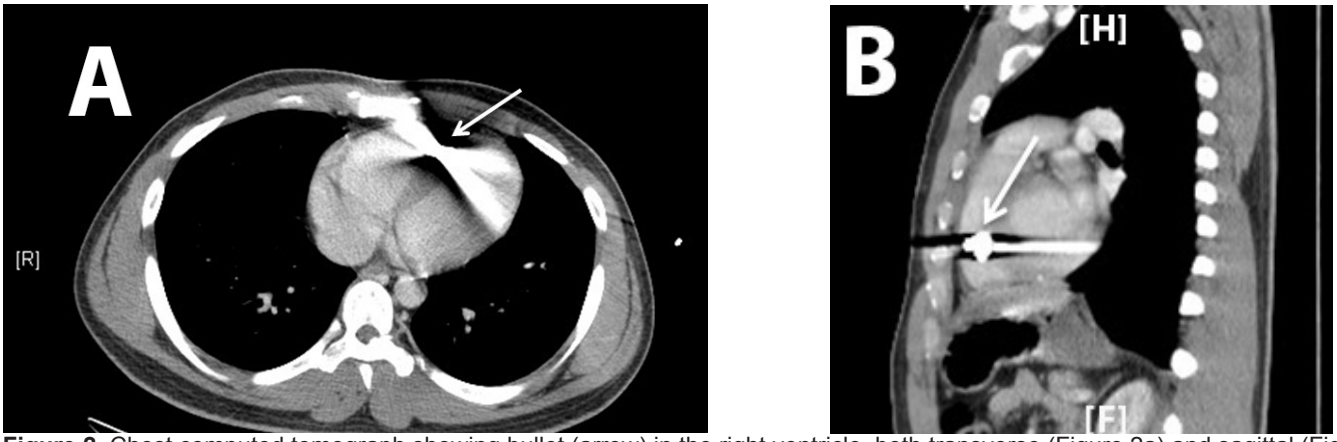

Figure 2. Chest computed tomograph showing bullet (arrow) in the right ventricle, both transverse (Figure 2a) and sagittal (Figure 2b) views showing significant glare.

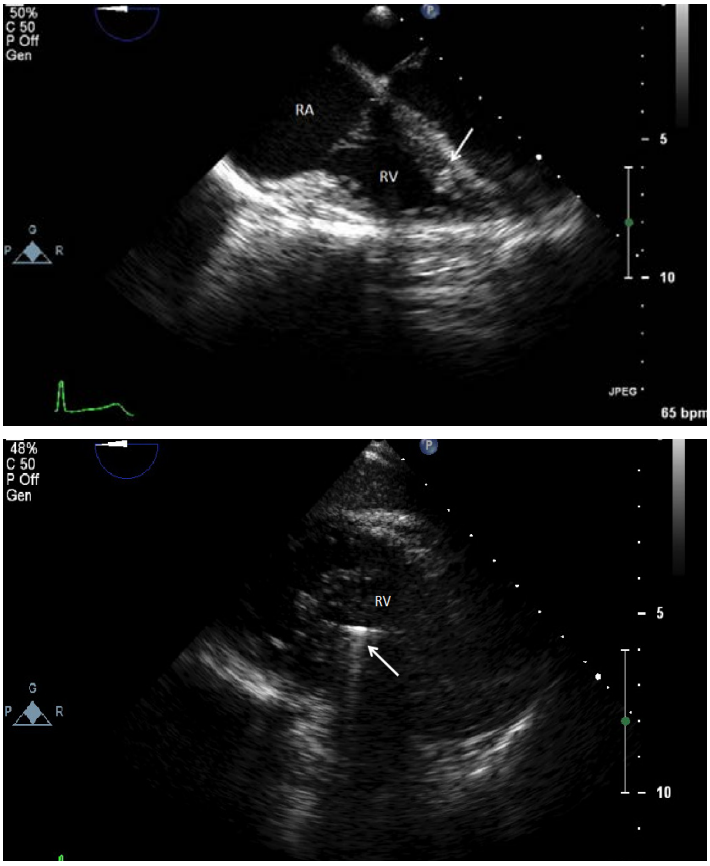

Figure 3. Transesophageal echocardiogram views of right ventricular (RV) apical view (Figure 3a [top]; arrow as bullet tip in RV trabeculae) and RV transverse view (Figure 3b [bottom]; arrow as bullet demonstrating significant comet tail artifact).

Our patient was shot with a .38 caliber low-velocity full metal jacket round that minimally deformed. The bullet size was the second largest recorded, with only a handful of reported .38 caliber pistol rounds of similar grain weights becoming intravascular emboli. There was only one reported instance of a .40 caliber pistol embolus, the largest bullet embolus in current literature.[1] Evidence of injury to the right common iliac vein in our patient with no other accompanying vessel injury on imaging suggested the bullet embolized from there. Given the episode of hypoxia during the log roll, it is possible that the bullet embolized to the right ventricle at that time. Any tissue clot or air that concurrently embolized to the pulmonary vasculature likely resolved by the time CT of the chest was performed.

DISCUSSION

Intravascular and intracardiac missile emboli, including bullets, pellets, or shrapnel secondary to mortars, grenades, and mines, are considered rare.[2] A review of 7,500 Vietnam War missile injuries yielded 22 cases (0.3%) of missile emboli, most of which came from explosive devices.[3] A more recent report from combined operations in Afghanistan and Iraq of 346 soldiers with vessel injury found missile emboli in 1.1%.[4] There are no figures that accurately depict incidence in the civilian population, and the disproportionate high velocity firearm and blast injuries in the military make it difficult to extrapolate to non-military settings.

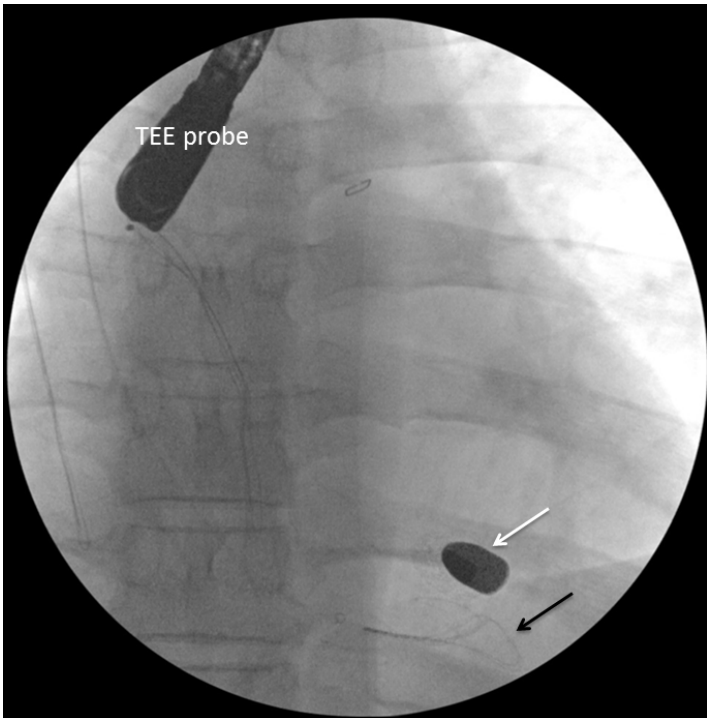

Figure 4. Fluoroscopy intraoperatively showing snare (black arrow) next to bullet (white arrow) and transesophageal echocardiogram probe.

The primary factors that determine the probability of missile embolization are vessel proximity, kinetic energy, and projectile size. The kinetic energy of the projectile must be such that it enters but does not traverse the vulnerable vessel. The diameter of the object must be smaller than the intraluminal diameter of the vessel. Small, low-velocity projectiles common in civilian trauma, such as shotgun pellets, .22 caliber bullets, and air gun pellets, represent the majority of intravascular emboli.[1,5] Despite a lack of reliable data confirming actual incidence, the risk of projectile embolization in the civilian realm may be more likely than in the military arena for the following reasons: 1) Low-velocity handgun and shotgun injuries are more common than wartime high velocity rifle injuries, 2) Even at several hundred meters, military assault rifle rounds are nearly twice as fast as pistol rounds at muzzle velocity,[6] 3) Civilian rounds are typically of smaller overall size, 4) High velocity explosion injuries, uncommon in the Westernized civilian realm, comprise a large proportion of historical and modern military injuries, 5) Civilian ammunition is not restricted by the Hague Convention of 1899, meaning that bullets that fragment into smaller pieces are more common than full metal jacket military rounds.[7] Ultimately, definitive conclusions about civilian prevalence cannot be made, but there exists the important notion that missile emboli are likely frequent enough that any practitioner in a high-volume civilian trauma center should be aware of it.

DIAGNOSTIC EVALUATION

Suspicion of intravascular missile embolus usually begins with current presentation or history of penetrating missile trauma, alongside evidence with imaging. Other clinical factors include incongruent number of entry and exit wounds, unexpected missile trajectory, and absence of direct injury to tissue adjacent to the lingering location of the missile (Figure 5).[8] While these factors led to the suspicion for bullet embolus in our patient upon first presentation, there have been many reports of delayed discoveries. One case described a largely uncomplicated bullet allowed to remain adjacent to the patient's pelvic vasculature, that later was found to embolize to the right middle lobe pulmonary artery two weeks later.[9] Another reported a 68-year-old World War II veteran who had an incidental finding of a bullet lodged in his right ventricle found upon chest radiograph imaging originally intended to visualize pacemaker placement.[10]

To determine appropriate treatment strategies, the diagnostic workup must include an accurate evaluation of size and location of the missile embolus. For intracardiac missile emboli, the first level of evidence may be a chest radiograph, which frequently shows a blurred foreign body superimposed on the cardiac silhouette.[11] CT chest/abdomen/pelvis may help determine missile trajectory and damage to surrounding cardiac structures, but metal commonly causes scatter, making it difficult to ascertain the exact location of the foreign body.[12] Expedient management of intracardiac emboli depends on determining whether the missile is freely mobile within a chamber, within the myocardium, within the pericardium, or nearby important cardiac structures. One fatal case was described in which specific localization was not performed prior to cardiopulmonary bypass. The authors stated that the use of 2D echocardiogram intraoperatively may have led to finding the bullet in the left atrium before it migrated in a retrograde fashion to the right pulmonary vein.[13,14] TEE intraoperatively is the modality of choice for confirming intracardiac missile emboli, with TEE preferred to transthoracic echocardiogram since TEE helps better visualize the level of myocardial damage.[15] In addition, echocardiogram sometimes demonstrates how deeply embedded the foreign body is, further affecting medical decision making. Determination of whether the intracardiac missile is left sided or right sided dictates the technical surgical approach. Clinicians must also exclude that the missile may be resting within the pericardium, since all intrapericardial missiles should be managed with surgical retrieval and antibiotics to reduce risk for pericarditis and pericardial effusions.[16-18] Surgical intervention for intrapericardial missiles differs as

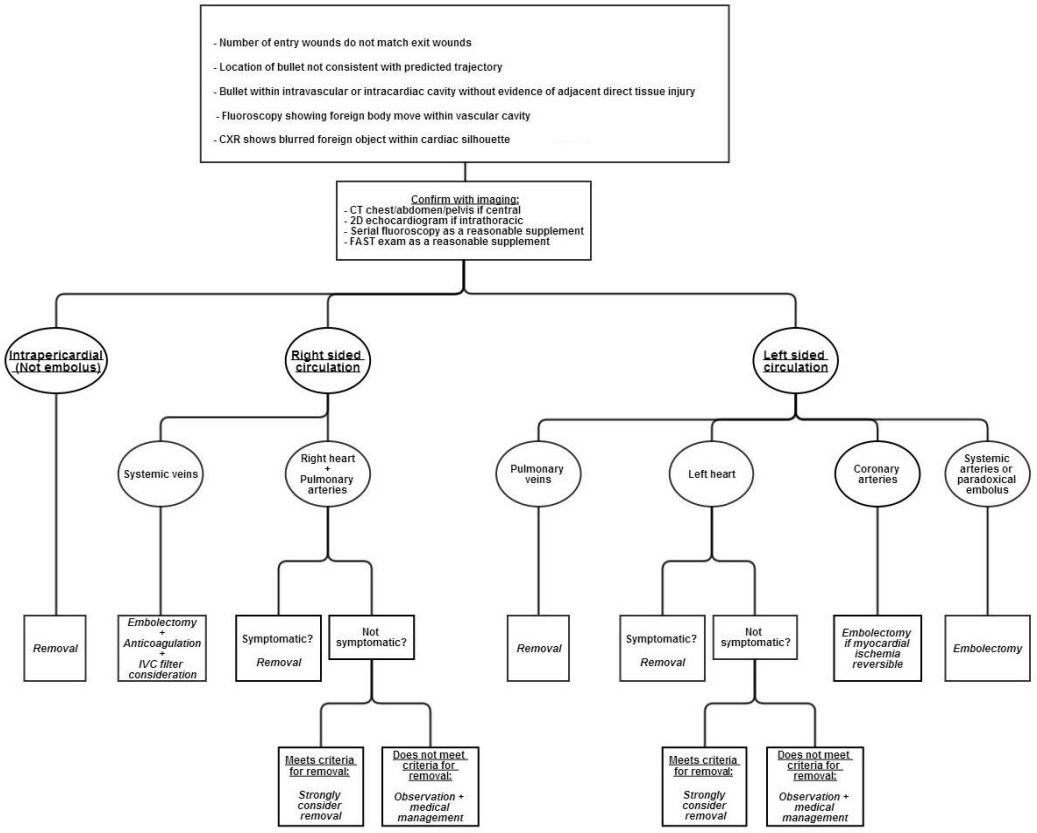

Figure 5. A model of missile embolus management by anatomical location based on review of the literature and authors' own experiences.
CT, computed tomography; *CXY*, chest x-ray; *IVC,* inferior vena cava*; FAST*, focused assessment with sonography for trauma

well, since subxiphoid pericardial window is preferred to median sternotomy.[12] Missiles within the pericardial sac are best differentiated from intracavitary missiles with serial fluoroscopy.[15] Other than the pericardial sac, it should also be noted that missile embolization may occur within any luminal tract or potential space in the body, and that a migrating abdominal foreign body on repeat imaging may indicate an embolus within the gastrointestinal tract.[19] Lastly, as in the case with our patient, an eFAST upon initial evaluation is a reasonable supplement to look for thoracic injuries.

Intravascular missile emboli are generally classified as arterial or venous. Currently, reports conflict regarding which type of embolus represents the majority of cases. Arterial bullet emboli are traditionally cited as more common, with figures up to 75% as arterial.[1,20] Another report with over 200 compiled cases found missile emboli to be 46% arterial, 52% venous, and the rest paradoxical, which occurs when there is direct communication between the right and left heart such as a patent foramen ovale.[21,22]

MANAGEMENT

Recommendations have varied widely on management of bullet emboli. Case reports numbering only in the hundreds have yielded inherently weak recommendations based primarily on anecdotal evidence. Though the authors of this article hope to present information that helps future clinicians make an informed decision, we recognize that we present only a model of an approach and not a series of guidelines.

Historically, the policy of United States armed forces in World War II was to remove intracavitary missiles from the heart, but no attempt at retrieval was to be made in patients who already stabilized after intracardiac implantation of the missile.[23] This practice was derived from an understanding that mortality from foreign bodies in the heart was approximately 20%, but death from surgical intervention was also 20% during that time period.[24] Dramatic surgical advancements have been made since then, with median sternotomy largely replacing thoracotomy whenever possible. There have also been many successful reports of minimally invasive endovascular retrievals of emboli since 1980, even with a case series of four from one institution that were all managed successfully with endovascular approaches.[8,25]

Controversy remains regarding management of intracardiac missile emboli. The rationale for leaving retained cardiac missiles comes from Fritz et al., who implanted small metal objects in dog hearts which all encapsulated the metal in fibrous tissue with minimal complication by eight weeks.[26] Categorization of intracardiac missile emboli to left-sided versus right-sided site is traditionally deemed important for surgical management (Figure 5). All right-sided emboli have the potential to embolize to the pulmonary arteries, and all left-sided emboli may further occlude distal arterial sites. Most dangerous are the partially embedded or freely mobile intracavitary missiles. Emboli fully embedded within the myocardium are presumed to be at substantially lower risk for further embolization.[2] To determine the combined immediate and long-term symptomatic rates of left-sided versus right-sided intracardiac emboli, we examined a combination of two articles with databases between 1940-1988 and 1990-2009. Symbas et al. reviewed 127 cases of intracardiac missiles during 1940-1988, that could be differentiated into left versus right sided and whether they were symptomatic or not.[2] Symptomatic patients included those who either had symptoms at initial presentation or significantly after penetrating trauma injury. Our review of Symbas' database excluded cases that either did not localize missiles, did not report whether there were symptoms or not, or reported missiles in the coronary arteries or pericardium. The addition of Lundy et al.'s data during 1990-2009 provided a total of 151 cases that reported location and symptomatic rates.[27] Using these two databases, we determined that 18 out of 90 (20.0%) right-heart missile emboli were symptomatic or eventually symptomatic, and 17 out of 61 (27.9%) left-heart missile emboli were symptomatic or eventually symptomatic. This difference was shown to not be statistically significant even at a two-tailed confidence interval of 80% (Z-score=1.1, two-tailed probability=0.271). Interestingly, Symbas et al. and Lundy et al. at times implied that right-sided cardiac missile emboli were safe to manage conservatively, with exception of missiles freely mobile within the cardiac chamber or those that passed through contaminated viscera. However, combination of both databases revealed that right-sided and left-sided cardiac missile emboli had similar complication rates. Thus, the erroneous dismissal of a right-heart embolus as largely benign and pursuance of medical management alone may cause the clinician to inadvertently incur the same amount of risk as left-sided cardiac missile emboli. Depending on the clinician and patient, 20-30% symptomatic rates with conservative management alone may be unacceptable especially given the unpredictable nature of symptoms arising in intracardiac emboli well after immediate presentation.

There is little controversy, however, over whether arterial missiles within the vasculature require removal (Figure 5). Arterial bullets are symptomatic in 80% of cases, but venous missile emboli are symptomatic in only one third of cases.[28] Most authors agree systemic arterial missile emboli should be removed to prevent distal ischemia, but debate persists in the literature over how venous emboli should be handled. Medical management alone of systemic venous emboli has been successful in many reports, and several authors conclude that venous emboli may be left alone if asymptomatic.[4,29] Other authors have maintained that mandatory removal of venous emboli is necessary because morbidity of retained missiles is significant at 25%.[30] Many clinicians may also find symptomatic rates at one third of cases to be unacceptable, as most patients are not immediately symptomatic, and it may be difficult to predict which venous emboli will be complicated in the future. Finally, endovascular snaring or venotomy in

the periphery is preferable and much simpler in comparison to working centrally within the lungs or heart after the missile embolize further. Review of 120 cases of venous missile emboli between 1900 and 1990 showed that 83% eventually travelled to the right heart or pulmonary artery, and 4% remained in the peripheral venous system.[31] Given the significant possibility of complications with conservative management, removal of missiles within the systemic venous circulation whether currently symptomatic or not must be placed in the context of each case (Figure 5). Proper medical management with anticoagulation for 12 months duration barring presence of significant hemorrhage, and inferior vena cava filter should also be discussed by the management team.[4,31]

There is a significant amount of literature about pulmonary arterial embolizations. Thirty-two cases of pulmonary artery bullet emboli were observed without complication in one article.[32] Pulmonary artery embolization that already occurred upon discovery is frequently asymptomatic.[9] Asymptomatic missile embolizations already resting in the pulmonary arteries may be conservatively managed since the risk following thoracotomy is greater than observing an asymptomatic patient.[8] However, missile emboli upstream of the pulmonary arterial system must be scrutinized closely. With approximately 26% of systemic venous emboli ultimately settling in a pulmonary artery, removal of a missile embolus regardless of final resting location upstream of the pulmonary arteries must be strongly considered (Figure 5).[22] Possible complications of retained pulmonary arterial missiles include abscess formation, infarction, erosion, or fatal exsanguination.[4,22]

Examples of pulmonary venous missile embolization remain sparse in the literature. As mentioned earlier, Schulman et al. reported one case in which a right pulmonary vein embolus caused fatal outflow obstruction between the right lung and left heart.[13] While most emboli to the left heart presumably originate from the pulmonary veins, and some left-heart missiles may be managed conservatively, missile emboli retained in the pulmonary veins are dangerous. Though future case reports may give us better understanding of this phenomenon, as it stands now, all missile emboli in the pulmonary veins likely require removal (Figure 5).

The remaining types of missile embolization are rare, but whether or not to surgically intervene is less controversial. Coronary artery embolectomy should be performed if myocardial ischemia is reversible (Figure 5).[33] Attempt should always be made to remove cerebral intravascular foreign body emboli, as mortality may be as high as 25-33% (Figure 5).[2,34] Depending on the size of the missile fragment, a microsnare may be used to remove intracerebral emboli.[35]

SPECIAL CONSIDERATIONS

Most authors recommend removal of missile emboli if the patient is symptomatic. Consequences of retained emboli include physiologic disturbances as well as psychiatric complications. Distal ischemia, thrombosis, and further embolism are the main complications of arterial missile embolus. Complications of venous missile emboli include pulmonary artery embolism, cardiac valve dysfunction, endocarditis, abscess formation, sepsis, thrombosis, dysrhythmias, intraventricular communications, conduction defects, tissue erosion, hemorrhage, cardiac ischemia from erosion into coronary vessels, and thrombophlebitis.[8,36] Psychiatric consequences range from severe anxiety to cardiac neurosis, a debilitating psychological disturbance in which patients fear movement that may result in a dislodgment of the bullet from its current location.[1,2,34,37]

Regardless of presenting symptoms, there are certain characteristics of the mechanism of injury and the foreign body itself that should warrant serious consideration for removal for fear of future complication. Logically, minimally invasive embolectomies should also be performed if successful retrieval is highly probable based on localization. For pediatric populations, most missile emboli in the West are less traumatic, small-caliber pellet injuries requiring observation alone, but one international report on pediatric wartime injuries demonstrated a 9.5% mortality rate among 21 patients with missile emboli.[5,34] In terms of defining large missile emboli, 5mm is a commonly accepted cutoff that has been adopted but it is arbitrary.[3,9,27,36,38] Thus, we propose a more specific definition of large missiles with combined dimensions of greater than 5mm in diameter and 10mm in length. For reference, this includes all commonplace .22 caliber bullets and up, but do not include typical air gun pellets and shotgun fragments. Other characteristics prompting surgical intervention include likely embolization to distal sites, damage to adjacent tissue, and passage of missile through contaminated sites such as unclean objects external to the victim as well as abdominal viscera.[39]

Adjunctive medical management is patient specific, and few specific recommendations for missile emboli exist. Though no strong evidence suggests it as a necessity, prophylactic antibiotics should be considered. Intracardiac emboli may require post-injury bacterial endocarditis prophylaxis as no bullet or missile embolus is ever deemed sterile.[5] If antibiotics are used, 48 hours of a first generation cephalosporin may be used in any high-velocity gunshot or shotgun injury, with addition of an aminoglycoside in the case of soft tissue cavitation which may house contaminated debris swept in upon bullet impact.[40-42] Anticoagulation for pulmonary arterial and systemic venous emboli may be necessary in adult patients for 12 months if patients remain asymptomatic. Of note, lead toxicity does not need to be monitored with retained cardiac or vascular bullets, except when the bullet is exposed to joint synovial fluid or bone marrow.[43] Serial imaging during hospital admission and outpatient follow up is required especially for patients who are chosen to be treated conservatively without surgical intervention. Finally, regardless of conservative or surgical management, counseling about complications the patient may

experience should include seeking medical attention for fever, chest pain, palpitations, shortness of breath, or anxiety about retained cardiac missiles.[27]

CONCLUSION

Management of intravascular and intracardiac missile emboli is not common knowledge. This review offers a synthesis of existing literature. It is our hope that this article provides a central source of reference, maximizing expedient decision making. It must be noted, however, that we only offer a model of an approach to missile emboli, and high level recommendations cannot yet exist given current understandings of missile emboli management. Intravascular and cardiac missile emboli have significant morbidity and mortality associated with them, and they are encountered frequently enough to merit significant attention by those who work with trauma patients. As represented in our case, there is also undeniable risk of complications associated with missile embolus removal, and it is suggested by our review that our patient may have done well without removal of the bullet. In the case of our patient, it was decided that a retained .38 caliber bullet in the right ventricle had substantial risk for further complication since it could not be reliably shown before open surgical intervention whether the bullet was freely moving within the right ventricle, so removal was deemed necessary. This was not without consequence as the patient required drainage of significant pleural and pericardial fluid collections before stabilizing postoperatively. Our patient's surgical complications provide yet another example of why the decision to remove or retain missile emboli is such a point of controversy, and further emphasize the need for a thorough discussion of risks and benefits of interventions with the patient and available family. As more reports become available, recommendations on management will hopefully become more robust. Until then, the level of intervention must be made on a case-by-case basis by the clinicians and their informed patients.

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Poisonings with Suicidal Intent Aged 0-21 Years Reported to Poison Centers 2003-12

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Introduction: Few studies explore the clinical features of youth suicide by poisoning. The use of both social and clinical features of self-poisoning with suicidal intent could be helpful in enhancing existing and creating new prevention strategies. We sought to characterize self-poisonings with suicide intent in ages 0 to 21 years reported to three regional poison control centers from 2003-2012.

Methods: This study was a blinded retrospective review of intentional self-poisonings by those age 21 or younger captured by the Poison Information Control Network. Age, sex, substance(s) used, medical outcome, management site, clinical effects, and therapies were described using counts and percentages and analyzed using chi-square tests. We analyzed the medical outcome ranging from no effect to death using the Wilcoxon rank-sum test. Serious medical outcome was defined as death or major outcome.

Results: We analyzed a total of 29,737 cases. The majority were females (20,945;70.5%), of whom 274 (1.3%) were pregnant. Most cases were 15-18 year olds (15,520;52.2%). Many experienced no effects (9,068;30.5%) or minor medical outcomes (8,612;29%). Males had more serious medical outcomes ($p<0.0001$), but females were more likely to be admitted to a critical care unit ($p<0.0001$). There were 17 deaths (0.06%), most in males (10;$p=0.008$). Of the 52 substances reported in the death cases, 12 (23.1%) were analgesics. In eight (47.1%) of the deaths, over two substances were used. Overall, drowsiness/lethargy (7,097;19.3%) and single-dose charcoal (8,815;16.3%) were frequently reported. Nearly 20% were admitted to critical care units (5,727;19.3%) and 28.7% went to psychiatric facilities (8,523). Of those admitted to hospitals (8,203), nearly 70% (5,727) required critical care units. Almost half <10 years old were evaluated and released (43;47.2%). Of the 114 reported substances for this population, 22.8% involved psychotropic medications, 15.8% analgesics, and 14% Attention Deficit-Hyperactive Disorder (ADHD) medications. Analgesics (13,539;33.6%) were the most common medication category used by all age groups. Typically only one substance (20,549;69.1%) was used.

Conclusion: Undiagnosed ADHD may be a potential underlying cause for self-harming behaviors in the very young. Gender-specific suicide prevention strategies may be more effective at identifying those at risk than traditional measures alone. Further study into admitting practices by emergency physicians is needed to understand the difference in critical care admission rates based on gender. Once identified to be at-risk for suicidal behavior, access to analgesics and psychotropics should be monitored by care-givers especially in those between the ages of 15-18. [West J Emerg Med. 2015;16(4):497–502.]

INTRODUCTION

Self-poisoning is a top cause of pediatric injury.[1,2] The 1997-2002 National Hospital Ambulatory Medical Care Survey found the annual emergency department (ED) rate for self-harm in those aged 7-24 was 225.3 per 100,000.[3] It has been reported across all age groups that for nearly every suicide there are 12-15 self-harm related ED visits.[4] The mean charge for each ED visit related to self-harm was found to be $1,874 ($12,801 for visits resulting in hospital admission) with total U.S. hospitalization charges estimated to be $227.85 million.[2] Early identification and effective prevention strategies may ease the health and financial burden for this preventable situation.

Studies have attempted to identify predictors for pediatric suicide. These include demographic and social factors, such as female gender, history of adoption, gay and lesbian youth, depression, history of previous suicide attempt, drug abuse, and poor social support.[1,5,6] However, few studies have characterized the clinical features of youth suicide. The National Electronic Injury Surveillance System All Injury Program found that among the 1,197 nonfatal self-harm injury cases between ages 10-14 years treated in an ED from 2001-2003, nearly half of the cases involved either an over-the-counter (OTC) (28.3%) or prescription drug (21%).[7] This study did not detail the OTC and prescription medication(s) used. A non-United States study identified analgesics as a frequent cause of pediatric poisoning from both accidental and intentional exposures, including misuse, abuse, and suicide.[8]

Most of the pediatric suicide literature focuses on demographic and social characteristics. Few studies explore the clinical features of youth suicide by poisoning. The use of both social and clinical features of self-poisoning with suicidal intent could be helpful in enhancing existing and creating new prevention strategies.

METHODS

Calls made to the poison control centers (PCC) are received by certified poison specialists who are trained and prompted by the electronic charting system to ask for standardized data points. Data from the initial call and subsequent follow-up calls are recorded in a standardized electronic chart. Whether an exposure is a suspected suicide attempt is reported by the caller and is not a determination made by the specialist taking the call. The Florida Poison Information Control Network (FPICN) database houses all the electronic charts generated from every call made by the public and medical caregivers to each of the three Florida PCCs. This database can be queried to select charts of interest based on standard data points, such as age, gender, route of exposure to toxin, medical severity/outcome, clinical effects, treatments, type of toxin, management site, etc. These data points are collected for every call made to the poison center when possible and are consistent with the standardized coding system set forth by the American Association of PCCs.

We obtained institutional review board approval prior to initiation of the study. A blinded retrospective review of data collected by all three PCCs was performed. We collected data via a blinded query of the FPICN database. All human exposure cases coded as "intentional-suspected suicide" in those up to 21 years of age reported to a PCC from 2003 to 2012 were exported to Microsoft (MS) Excel® 2010. Exclusion criteria included the following: (1) information calls (i.e. pill identification); (2) calls with an active clinical course; (3) reported exposures determined to not be clinically related or was a confirmed non-exposure by the PCC; (4) unintentional, intentional misuse, or intentional abuse exposures; and (5) suicide other than self-poisoning.

We collected and analyzed data on age, gender, medical outcome, management site, clinical effects, and therapies using MS Excel® 2010 and SAS® 9.3. Age, sex, substance(s) used, medical outcome, management site, clinical effects, and therapies were described using counts and percentages and analyzed using chi-square tests. We analyzed medical outcome using the Wilcoxon rank-sum test. The Wilcoxon rank-sum test effect size was 0.07. Gender data was missing for 26 cases (0.087% of all cases).

Serious medical outcome was defined as death or major outcome (Table 1). Because we collected clinical effects, treatment, and substance data as aggregate data for ages 10-21 years, we were thus unable to further analyze the data by gender.

RESULTS

We analyzed a total of 29,737 cases. Gender data was missing for 26 cases. Table 1 describes demographic and health data. Table 2 lists the health data by gender. Of the 40,297 substances reported, analgesics (13,539;33.6%), psychotropic medications (10,710;26.6%), and antihistamines/ cough and cold preparations (4,339;10.8%) were the top medication categories used. Youths typically used one substance (20,549;69.1%). Over three substances were used by 4.3% of the youths.

Deaths

There were 17 deaths (0.06%), all over age 13, with more males (10;59%) resulting in death than females (p=0.008). Analgesics (12;23.1%) were most commonly reported. More than two substances were used in 8 (47.1%) deaths.

Less than 10 years of age (91,<1%)

There was no significant difference in gender for this age group. Patients typically had minor clinical effects (31.9%). Drowsiness/lethargy was the top reported clinical effect (24.2%). Of the 114 reported substances for this population, 22.8% involved psychotropic medications, 15.8% analgesics, and 14% attention deficit-hyperactive disorder (ADHD) medications. Of the 118 different treatments given, single dose activate charcoal was most common (17.5%). Observation only was performed in 17.5% of the cases. Almost half were evaluated/ released

Table 1. Demographic and health data of self-poisonings with suicidal intent in young patients (N=29,737).

Demographics	N (%)
Females	20,945 (70.5%)
Pregnant	274 (1.3%)
Age (years)	
<10	91 (0.31%)
10-14	4,454 (15%)
15-18	15,520 (52.2%)
19-21	9,672 (32.5%)
Health data	
Medical outcome[1,2]	
No effect-The patient did not develop any sign or symptoms as a result of the exposure	9,068 (30.5%)
Minor-The patient developed minimally bothersome symptoms (e.g., self-limited gastrointestinal symptoms, drowsiness, skin irritation, sinus tachycardia without hypotension) that resolved with no residual effects.	8,612 (29%)
Moderate-The patient exhibited more pronounced, more prolonged, or more systemic symptoms than minor but not life-threatening and no residual symptoms (e.g., corneal abrasion, acid-base disturbance, high fever, disorientation, responsive hypotension, brief seizure). Usually treatment was required.	7,136 (24%)
Major-The patient exhibited symptoms that were life-threatening or resulted in residual disability (e.g., repeated seizure, respiratory compromise requiring intubation, ventricular tachycardia with hypotension, cardiac/ respiratory arrest, esophageal stricture).	719 (2.4%)
Death-The patient died as a result of the exposure or as a direct complication of the exposure.	17 (0.06%)
Unable to follow-potentially toxic exposure	4,185 (14.1%)
Management site	
Treated/evaluated and released	8,507 (28.6%)
Managed on site (non-healthcare facility)	31 (0.1%)
Admission to hospital	8,203 (27.6%)
Non-critical care unit	2,476 (30.2%)
Critical care unit	5,727 (69.8%)
Admission to psychiatric facility	8,523 (28.7%)
Patient lost to follow up/left against medical advice	1,767 (5.9%)
Other/unknown	2,706 (9.1%)
Clinical effects**	36,776
Drowsiness/lethargy	7,097 (19.3%)
Tachycardia	5,789 (15.7%)
Vomiting	3,790 (10.3%)
Treatment**	
Single-dose activated charcoal	8,815 (16.3%)
Intravenous fluids	7,786 (14.4%)

[1]Medical outcome categories are consistent with those of the American Association of Poison Control Centers.
[2]Serious outcome defined as death or major effect.
*Gender data missing for 26 cases.
**Collected as aggregate data for ages over 10 years.

(43;47.2%), with 12% (11) requiring critical care unit admission, and 11% (10) to a psychiatric facility.

DISCUSSION

Consistent with existing literature, we found that patients between the ages of 15-18 years to be particularly vulnerable to committing self-harm compared to other age groups.[3] We also found a surprisingly high number of very young patients (less than age 10) attempting suicide. Unlike previous reported data, we did not find a difference in gender for this age group.[9] Social stressors, psychiatric/behavioral disorders, and modeling adult behavior have been reported as potential

Table 2. Health data analysis by gender.

	Male N(%)	Female N(%)	Overall N(%)	p-value
Death				
No	8,756 (99.9)	20,938 (99.9)	29,694 (99.9)	0.008
Yes	10 (0.1)	7 (0.03)	17 (0.1)	
Management site				
Admitted to critical care unit	1,922 (21.9)	3,804 (18.2)	5,726 (19.3)	<0.0001
Admitted to noncritical care unit	730 (8.3)	1,745 (8.3)	2,475 (8.3)	
Admitted to psychiatric facility	2,304 (26.3)	6,218 (29.7)	8,522 (28.7)	
Managed on site (non-healthcare facility)	13 (0.15)	18 (0.1)	31 (0.1)	
Other/unknown/refused	838 (9.6)	1,858 (8.9)	2,696 (9.1)	
Patient lost to follow up/left against medical advice	541 (6.2)	1,216 (5.8)	1,757 (5.9)	
Treated/evaluated and released	2,418 (27.6)	6,086 (29.1)	8,504 (28.6)	
Medical outcome[1]				
Death	10 (0.1)	7 (<0.0)	17 (0.1)	<0.0001
Major effect	280 (3.2)	439 (2.1)	719 (2.4)	
Minor effect	2,417 (27.6)	6,192 (29.6)	8,609 (29)	
Moderate effect	2,452 (28)	4,683 (22.4)	7,135 (24)	
No effect-nontoxic exposure	2,312 (26.4)	6,753 (32.2)	9,065 (30.5)	
Unable to follow-potentially toxic exposure	1,295 (14.8)	2,871 (13.7)	4,166 (14)	
Serious outcome[2]				
No	8,476 (96.7)	20,499 (97.9)	28,975 (97.5)	<0.0001
Yes	290 (3.3)	446 (2.1)	736 (2.5)	

All tests performed using chi-squared analysis.
[1]Medical outcome categories are consistent with those of the American Association of Poison Control Centers.
[2]Serious outcome defined as death or major effect.

causes for self-harm in the very young.[9] Patients in this age group typically are not considered to have the means nor ability to carry out pre-planned self-harming behaviors as they usually receive more adult supervision than older children and are cognitively less able to devise and implement a plan with the intent of self- injury. It is speculated that these acts are the result of impulsivity. Impulsivity is a defining feature of ADHD. We found ADHD medications to be frequently used by our younger population (less than 10 years old) for committing self-harm. Impulsivity may be the primary contributing factor in these cases as depression is rare in this age group. Interestingly, children with ADHD (especially females) between the ages of 4-6 years have been shown to be at increased risk for developing depression and suicidality through age 18.[10] Thus, with increasing age impulsivity may take a less influencing role compared to depression for committing self-harming behavior. ADHD, along with other mental health conditions, may predispose patients to self-harm now and in the future. Therefore, we suggest that screening for ADHD, in addition to the other screening measures, should be considered in the very young when presenting with self-harming behavior. Further study into this potential cause of self-harm in this population is needed.

Our study is consistent with others that have suggested gender differences in suicide-related behaviors. Some reported differences are that males tend to be unmarried, unemployed, consume alcohol, marijuana, or tobacco.[11] We found males developed more serious medical outcomes including death, but committed self-poisonings less often. This conflicts with previous findings showing a greater proportion of male ED visits for self-inflicted injury were discharged compared to females. This implies less morbidity in males. However, this study also reported that more males died in the ED than females.[2] Given the presence of gender differences when it comes to suicide-related behaviors and outcomes, it has been proposed that the use of traditional suicide ideation/depression screening measures alone may not be adequate. Females tend to score higher on traditional suicidal ideation/depression measures, whereas alcoholism/substance abuse (risk-taking behaviors) are more commonly diagnosed in males.[11-12] Instead a combination of traditional and risk-taking/life-diminishing screening should be performed to increase identification of those at-risk for both genders.[12]

Most of our patients did not develop significant symptoms and required simple therapies. Despite this, most of the 8,203 (27.6% of total patients) admissions were

sent to a critical care setting (5727,69.8%). Conversely, a study looking at mostly adult patients (1,573;76.4%) found that only 31% of the one-third admitted as a result of self-harm went to a critical care unit.[3] Interestingly, we found that females were more likely to be admitted to a critical care unit even though males tended to have more serious medical outcomes. Reasons for this discrepancy in admitting practices for pediatric compared to adult self-harm patients and for pediatric female compared to pediatric males are unclear from our data. This difference may be due to physicians opting for more conservative management for pediatric suicide cases compared to similar adult cases. However this does not explain differences in admitting practices for pediatric patients based on gender. Often the decision for admission to a critical care setting is made by the treating emergency physician. Further study into the management and disposition decisions made by treating emergency physicians may help shed light on these practices.

Most patients used only one medication when attempting self-harm. However, in cases resulting in death, nearly half used more than one substance. For death and non-death resulting cases, analgesics were most commonly used for committing self-harm. Self-poisoning by non-prescription analgesics may be a popular choice by the pediatric population because of accessibility. Consistent with existing literature, we found that psychotropic medications were also popular choices.[2] The presence of a mental health disorder has been shown to confer a significant risk for committing self-harm. It is possible that certain suicidal patients, such as those on antidepressants, may be more likely to use their own prescribed medications to commit self-harm. However, further study would need to be done to explore this possibility. Parents of these at-risk populations should be educated regarding limiting access to OTC and prescription medications.

CONCLUSION

Undiagnosed ADHD may be a potential underlying cause for self-harming behaviors in the very young. Gender-specific suicide prevention strategies may be more effective at identifying those at risk than traditional measures alone. Further study into admitting practices by emergency physicians is needed to understand the difference in critical care admission rates based on gender. Once identified to be at-risk for suicidal behavior, access to analgesics and psychotropics should be monitored by care-givers especially in those between ages 15-18.

LIMITATIONS

The limitations of this study are inherent to PCC data such as second-hand passive reporting, convenience sampling, and incomplete data as all information for a case may not have been reported and not call cases are reported to PCCs. Additionally, as this was a retrospective study bias and potential confounders may not have been fully accounted for. Also, the study population may not accurately reflect the entire US and thus our conclusions may not be generalizable outside the study region. Since calls made to PCCs are voluntary all potential cases may not have been captured. It is also possible that treating medical staff may be more likely to call in cases of serious overdose. However, despite this we still found that nearly 60% of reported cases had either minor medical outcome or no symptoms.

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Prehospital Evaluation of Effusion, Pneumothorax, and Standstill (PEEPS): Point-of-care Ultrasound in Emergency Medical Services

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Introduction: In the United States, there are limited studies regarding use of prehospital ultrasound (US) by emergency medical service (EMS) providers. Field diagnosis of life-threatening conditions using US could be of great utility. This study assesses the ability of EMS providers and students to accurately interpret heart and lung US images.

Methods: We tested certified emergency medical technicians (EMT-B) and paramedics (EMT-P) as well as EMT-B and EMT-P students enrolled in prehospital training programs within two California counties. Participants completed a pre-test of sonographic imaging of normal findings and three pathologic findings: pericardial effusion, pneumothorax, and cardiac standstill. A focused one-hour lecture on emergency US imaging followed. Post-tests were given to all EMS providers immediately following the lecture and to a subgroup one week later.

Results: We enrolled 57 prehospital providers (19 EMT-B students, 16 EMT-P students, 18 certified EMT-B, and 4 certified EMT-P). The mean pre-test score was 65.2%±12.7% with mean immediate post-test score of 91.1%±7.9% (95% CI [22%-30%], p<0.001). Scores significantly improved for all three pathologic findings. Nineteen subjects took the one-week post-test. Their mean score remained significantly higher: pre-test 65.8%±10.7%; immediate post-test 90.5%±7.0% (95% CI [19%-31%], p<0.001), one-week post-test 93.1%±8.3% (95% CI [21%-34%], p<0.001).

Conclusion: Using a small sample of EMS providers and students, this study shows the potential feasibility for educating prehospital providers to accurately identify images of pericardial effusion, pneumothorax, and cardiac standstill after a focused lecture. [West J Emerg Med. 2015;16(4):503-509.]

INTRODUCTION

The use of bedside point-of-care ultrasound (US) in the emergency department (ED) has been increasing over the past two decades, and is now routinely used by emergency physicians as part of the diagnostic workup of sick patients and screening of trauma victims. It has decreased the time to life-saving interventions for many conditions. For example, use of the extended-focused assessment with sonography for

trauma (E-FAST) exam by emergency physicians accurately identifies fluid in the abdomen requiring urgent blood transfusion or exploratory laparotomy, pericardial effusion requiring immediate evacuation, or pneumothorax requiring immediate decompression.[1-5] It is now considered standard-of-care in advanced trauma life support.[6]

Emergency medical service (EMS) providers have the opportunity to diagnose, initiate treatment, and stabilize life-threatening conditions within the first critical minutes of a patient's decompensation. US has been used by physicians, flight nurses, and EMTs, on both ground and air ambulance teams in several countries in Europe[7] as well as by emergency physicians in military combat.[8] Several international studies have shown prehospital bedside US can be conducted with accurate interpretation by physician and non-physician providers, allowing specific interventions to be performed or hospital preparations to be made.[9-12] These studies were of emergency or prehospital physicians, or trained sonographers.[8,11-12] To date, there is limited literature on the use of prehospital US in the United States.

Prior studies have demonstrated that flight medics and ground EMS providers can obtain and interpret images for abdominal aortic aneurysm assessment, FAST exam screening, and cardiothoracic US images.[13-16] A recent case report demonstrated that prehospital emergency US allowed paramedics to accurately identify a clinically significant pericardial effusion in a stabbing victim, allowing them to report this to the trauma surgeon prior to arrival.[17] A recent 2013 study (the PAUSE pilot) examined professional paramedics' ability to acquire and interpret images using a protocol to diagnose pneumothorax, pericardial effusion, or cardiac standstill, finding that after a 2-hour didactic program the providers had an accurate recognition score of 9.1 out of 10. However, this single-center study was limited to 20 trained paramedics.[18] A separate study found that aeromedical prehospital personnel at a Level I trauma center had significant improvement in scores on both a written exam and observed clinical examination after undergoing a structured, 2 month training curriculum. However, these providers were critical care paramedics and nurses who already had significant clinical knowledge, and the study focused primarily on the E-FAST modality.[19] In addition, many of the studies, including the PAUSE pilot, also demonstrate adequate image acquisition ability of prehospital providers,[9,14,18] and that these images are not subject to inaccuracy even when obtained in moving transport vehicles.[12,16]

There remain significant gaps and limitations in existing studies regarding the ability of prehospital providers to acquire and interpret point-of-care US images. Here, we aimed to determine if EMS providers would be able to 1) accurately identify the presence or absence of pericardial effusion, pneumothorax, and cardiac standstill after a one-hour didactic course, and 2) retain the ability to interpret the images over time.

METHODS

We conducted a prospective, observational study of certified emergency medical technicians (EMT-B) and EMT-paramedics (EMT-P) as well as students enrolled in prehospital training programs within two counties in California. The institutional review board approved the study. Participants were recruited from four EMS training programs, and study sessions were held at each of these training programs with written consent obtained from participants.

Inclusion criteria for the study were age greater than or equal to 18 years, enrollment in an EMS training course and/or current certification as an EMS provider, and ability to attend all sessions (pre-testing, lecture, and post-testing) during the study. Subjects were excluded if they were below the age of 18, were not involved within the county EMS system as either an actively enrolled student or certified EMS provider, did not consent to participation in the study, and/or were unable to attend the required sessions.

Study sessions were held prior to or after scheduled classes for the local prehospital training programs; certified EMS providers were also invited to attend these study sessions. Study participants were first asked to complete an anonymous demographics questionnaire including gender, age, educational status, EMS affiliation, and prior US experience. This was followed by a multiple-choice question (MCQ) pre-test that included 16 full-motion and still US clips of normal and abnormal pathology. They then received a one-hour didactic lecture covering basic scanning technique, normal US anatomy, and image interpretation of both normal and pathologic heart and lung imaging videos. This included presence or absence of pericardial effusion, pneumothorax, and cardiac standstill. Immediately following the lecture, study participants were given a post-test consisting of the same video clips in different order with different questions from the pre-test. For one of the local prehospital training classes, the same post-test was administered one-week later. The test contained 16 image-questions, with six of the images having been shown in the lecture and 10 novel images. The images were originally obtained in the ED setting by emergency physicians with prior US training and knowledge. While the repeat post-test did contain the same questions from the immediate post-test, subjects were not given answers or feedback on their initial tests. Participants were asked to self-rate their confidence level with US interpretation and given one minute to answer each MCQ on both the pre- and post-tests. Scores were determined as percentage of questions answered correctly on the test. Subjects did not acquire any of the US images.

Both the pre- and post-tests were validated using a population of emergency medicine physicians (both attendings and residents) knowledgeable on bedside point-of-care US, but who had no prior knowledge of the test images. The validation tests were administered to the physician group without receipt

of the lecture intervention and prior to utilization of the tests for the study participants. All data were analyzed using two-tailed, paired t-tests in SPSS 11.0 (Chicago, IL).

RESULTS

We enrolled 57 prehospital providers (49 male, mean age and SD 26.2 years±7.0) consisting of 19 EMT-B students, 16 EMT-P students, 18 certified EMT-B providers, and 4 certified EMT-paramedics (Table 1). There was no prior US experience in 84% of subjects. Of those who reported prior US experience, this consisted primarily of observing emergency providers conducting US scans during the EMS providers' shadowing shifts in the ED. Test images were validated by 11 emergency physicians with a pre-test score of 98.9% and post-test score of 99.4% (95% CI [-18%-70%], p=0.34).

There was a significant improvement for all subjects between the pre- and post-tests with a mean pre-test score of 65.2%±12.7% and a mean immediate post-test score of 91.1%±7.9% (95% CI [22%-30%], p<0.001). Scores significantly improved for all three individual pathologies as shown in Figure 1. The mean pre-test overall score for cardiac standstill was 92.1%±15.1% with a mean immediate post-test score increase to 98.6%±5.6% (95% CI [11%-23%], p=0.003). The mean score for pericardial effusion improved from 57.9%±26.3% pre-test to 84.6%±21.5% immediate post-test (95% CI [35%-19%], p<0.001) and the mean score for pneumothorax increased from 55.5%±20.9% pre-test to 90.6%±9.82% (95% CI [29%-41%], p<0.001) immediate post-test.

Table 1. Participant characteristics (n=57).

Demographics	Number of participants
Male gender	49 (86.0%)
Mean age ± SD (years)[§]	26.24±7.03
Emergency medical service affiliation	
EMT student	19 (33.3%)
Paramedic student	16 (28.1%)
Certified EMT	18 (31.6%)
Certified paramedic	4 (7.0%)
Highest level of education completed[ψ]	
High school	38 (66.7%)
Undergraduate	14 (24.6%)
Master's	4 (7.0%)
Prior ultrasound experience[†]	
Formal education	2 (3.6%)
Informal training	7 (12.7%)
None	46 (83.6%)

EMT, emergency medical technician
[§]N=54
[ψ]N=56
[†]N=55

Among the certified EMS providers (N=22), scores showed significant increases in mean score pre-test (63.9%±16.6%) to immediate post-test (93.4%±6.5%, 95% CI [22%-37%], p<0.001). Among these providers, scores for identification of pneumothorax and pericardial effusion showed significant increases after subjects received the focused lecture. There was no significant change for identification of cardiac standstill: pre-test score 90.9%±18.1% and post-test score 98.9%±5.3% (CI [-17%-6.9%], p=0.069) (Table 2).

The repeat post-test was administered one week later to 19 EMT-B students. Post-test scores remained significantly higher than pre-test scores (Table 3). There was no significant difference between the immediate and repeat post-test mean scores.

Among all subjects, self-reported confidence with point-of-care US increased after the study intervention. During the pre-test, 53 participants (96%) reported no or low confidence with US interpretation. During the immediate-post test, only 8 participants (15%) reported no or low confidence whereas 46 subjects (85%) reported some or high confidence with US interpretation (Figure 2).

DISCUSSION

Although use of bedside ultrasonography within United States EDs is now common, the use of this technology in the field by EMS providers is limited. Use of bedside ultrasonography in the prehospital setting has the potential to provide EMS providers with important diagnostic data and assist with difficult treatment and transport decisions in the field. Furthermore, as EMS systems within the United States evolve to focus on transport to specialty centers, such as trauma or cardiac care centers, prehospital US could play a role in guiding these decisions, just as they have in Europe.[15,20] To date, data regarding the ability of EMT-B and EMT-P providers to accurately interpret US imaging is limited, with only a few pilot studies having examined this question. Our results demonstrate that prehospital providers are able to gain the ability to interpret US images for specific life-threatening pathologies after a brief and focused lecture. This study adds to the growing body of literature demonstrating that EMS providers within the United States can accurately interpret point-of-care bedside US images.

Our study findings concur with previous reports supporting the feasibility of formal US instruction and subsequent accurate US interpretation by EMS providers. Previous studies, however, were primarily conducted among international EMS subjects,[9-10,15,21] military providers,[13] or with subjects having prior clinical experience and training in US.[11,14,19,22] Our study supports the findings of the previously discussed PAUSE protocol[18] but builds on it by including a larger cohort of prehospital providers, and incorporating both certified prehospital paramedics and EMTs, as well as EMT students. Further, we showed that after the focused lecture, providers could not only interpret US images accurately, but also reported increases in their confidence with US interpretation and retained the knowledge over time.

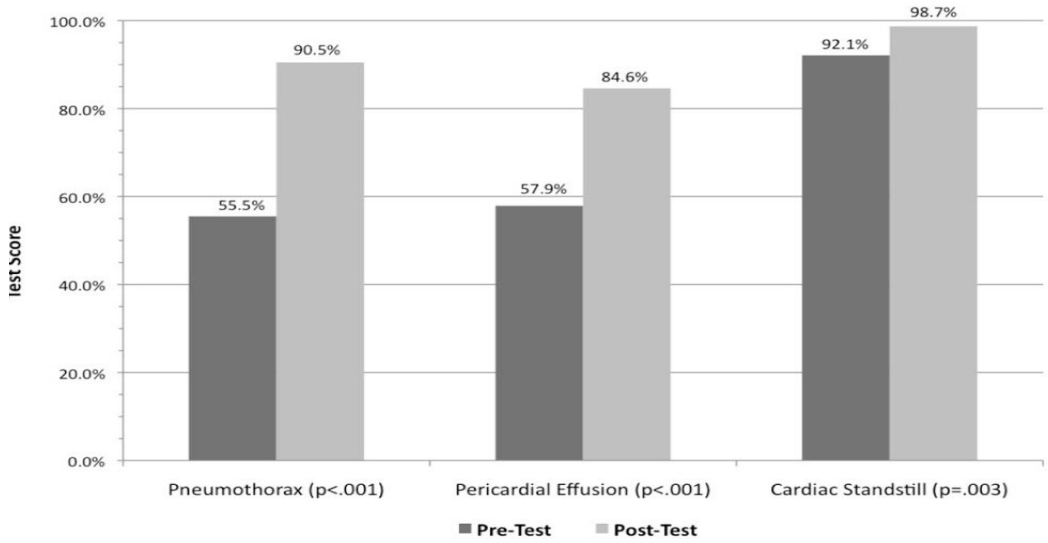

Figure 1. Pre- and post-test scores among all certified pre-hospital providers and students significantly improved (p<0.05) among each modality after a focused one-hour didactic lecture.

Table 2. Scores for certified pre-hospital providers (n=22).

	Pre-test	Immediate post-test	p-value (95% CI)
Total score	63.9±16.7	93.5±6.5	p<0.001 (22%-37%)
Pneumothorax	52.8±24	92.6±10	p<0.001 (28%-52%)
Pericardial effusion	59.1±34.1	89.7±14.8	p<0.001 (17%-45%)
Cardiac standstill	90.9±18.2	98.9±5.3	p=0.069 (-17%-6.9%)

Scores reported as mean(%) ± SD(%), p-values are calculated using two-tailed, paired t-test.

Table 3. Scores for repeat post-testing among emergency medical technicians students (n=19).

	Pre-test	Immediate post-test	1-week post-test	Pre- vs. 1-week p-value (95% CI)	Immediate vs. 1-week p-value (95% CI)
Total score	65.8±10.7	90.5±7.0	93.1±8.3	p<0.001 (21%-34%)	p=0.134 (-6.1%-8.9%)
Pneumothorax	55.3±21	91.4±9.4	95.4±10.4	p<0.001 (30%-51%)	p=0.083 (-8.4%-5.6%)
Pericardial effusion	61.8±21	80.3±22.9	82.9±20.5	p=0.004 (7.6%-35%)	p=0.706 (-17%-12%)
Cardiac standstill	90.8±12.4	98.7±5.7	98.7±5.7	p=0.03 (8.8%-15%)	p=1.0 (-4.0%-4.0%)

Scores reported as mean(%) ± SD(%), p-values are calculated using two-tailed, paired t-test.

Knowledge retention among the cohort of EMT-B students was high one week after the teaching session, and this effect was seen across all three pathologies tested. This complements prior work that showed retention of pneumothorax identification by prehospital providers in a cadaveric model up to nine months after initial teaching by prehospital providers.[22] A recent study showed that aeromedical providers were able to successfully demonstrate image acquisition and accurate interpretation of E-FAST imaging after 6 weeks; however, their study was based on a time-intensive training curriculum among providers who already had significant clinical experience.[19]

Our results suggest that incorporation of a succinct and relevant one-hour didactic on prehospital point-of-care US into the EMS training curriculum could have a large and lasting impact on the providers' skill set, even at a junior level, without much burden on already stretched curricula. In addition, the didactic material can be focused in scope, emphasizing those emergencies for which early identification might change treatment or triage decisions. Given a growing body of literature regarding potential impacts of prehospital identification of pneumothorax, pericardial effusion or cardiac standstill, we chose to focus our one-hour curriculum on these three modalities.

Our findings validate European studies on pneumothorax evaluation, which demonstrated prehospital providers' ability to correctly identify lung sliding.[9,11,15-16] Several studies have outlined needle thoracostomy failure in the prehospital setting.[23-25] Evaluation of the presence or absence of pneumothorax could obviate unnecessary thoracostomy or indicate need for a repeat attempt after failed thoracostomy in the field. Similarly, presence or absence of lung sliding

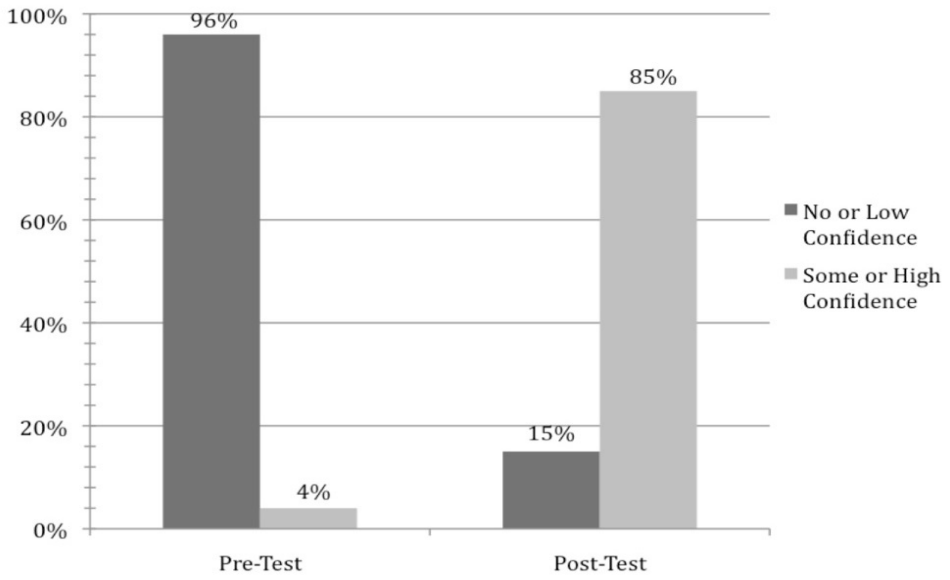

Figure 2. Study participants reported markedly higher confidence in their ultrasound interpretation skills after a focused, one-hour didactic lecture. N-value for pre-test is 55 subjects, and N-value post-test of 54 subjects.

post-intubation by EMS providers could be used to confirm appropriate endotracheal tube placement.[22,26-27]

Presence of cardiac standstill during non-traumatic arrest in the field could affect the need for transport to the ED given the growing body of evidence that patients with cardiac standstill have a nearly zero percent chance of survival to hospital discharge.[28-29] Interestingly, this modality may be the most feasible and intuitive to teach EMS providers based on our results. Mean scores for this modality were greater than 90% pre-test and for all-comers, significantly improved to approach 99% on immediate post-testing. This suggests that EMS providers may be able to identify cardiac standstill with enough precision that it could assist their ability to declare patients deceased in the field or assess need for transport to an acute care facility. In fact, in a study of Dutch physicians working in a prehospital helicopter system, in nine of 60 patients (15%) the physician made a decision to stop all prehospital treatment and resuscitation, based on cardiac US in the field.[15]

Our results also provide validation that EMS providers can identify the presence of pericardial effusion after receiving brief instruction. The significance of this modality in the prehospital setting is especially relevant among penetrating thoracic trauma patients, in whom early identification of an effusion or tamponade may expedite thoracotomy or pericardiocentesis upon ED arrival.[17,30] However, this modality may prove challenging when signs are subtle. In our cohort, although scores significantly increased among all participants, the mean post-test score remained just under 85% accurate, compared with greater than 90% accuracy on the other two modalities. Thus, the clinical impact of this potentially more challenging study and potential false negative findings in the field may need to be explored further.

LIMITATIONS

Our study represents the evaluation of prehospital providers' ability to interpret US images. The results do show that these providers can acquire and retain US interpretation skills and confidence. Limitations include the fact that this was an observational trial using a convenience sample of EMS volunteers, with limited sample sizes. It is possible that these volunteers may not represent the rank-and-file EMS student. Demographics and confidence data were acquired by self-report, which could be skewed by bias. However, this would not affect the objective statistical improvement in scores after our study intervention. Because participation was voluntary and did require attendance at both the didactic and post-testing sessions for inclusion in the retention cohort, it is possible that the retention cohort contained selection-bias from individuals more enthusiastic about US thus affecting results with a bias toward improvement. Additionally, this cohort had a smaller sample size due to our ability to have a follow-up session one week later with only one EMS class, thus potentially impacting statistical significant and generalizability of results. Similarly, our specific analysis of certified providers should be taken in the context that the majority of these providers were EMT-B trained with very few EMT-P trained individuals. While the analysis combined all certified providers into one cohort, the statistical significance of our findings could be skewed by the small sample of EMT-P individuals, and further, it would be difficult to analyze the results as to whether US may be more easily taught to either EMT-B or EMT-P certified individuals.

Our study utilized test images that were obtained within the ED setting and although they were validated prior to use,

the images may represent idealized versions of findings when compared with those that are obtained by EMS providers themselves or subject to other environmental factors while obtaining US in the prehospital setting. Though this may limit the strength of our findings, several prior studies have shown that EMS providers can obtain adequate images,[9,14,18] and that these images are not affected by moving transport vehicles.[12,16] There may be some bias introduced through utilizing the same images on post-testing and repeat-testing one week later; however, providers were not given directed feedback nor access to the testing materials within the interim period, thus we feel this is only a small limitation on the validity of our results.

Our study demonstrates the potential ability of EMS students and certified providers to acquire and retain knowledge of US interpretation with regard to specific pathologies. However, the impact on patient care and transport remains to be determined. Given studies noting the changes in management and transport to appropriate levels of care by European providers, the same may hold true for EMS US use and decision-making in the United States.[15,20]

There remains a tangible cost to implementation of US in the EMS field, with the need to obtain and maintain equipment. Although our chosen modalities – pneumothorax, pericardial effusion, and cardiac standstill – could likely have potential benefits for triage, transport, and treatment of prehospital patients, the true impact and cost-effectiveness of such decisions has yet to be determined. Ongoing studies will need to assess prehospital providers' acquisition of US, and potential delays in treatment or transport within EMS systems in the United States. There may also be differences in utility and clinical impact within urban versus rural communities. Future study could also focus on longitudinal tracking of individual EMS providers to evaluate the number of USs being completed, image acquisition ability, and also longitudinal knowledge retention and skills.

CONCLUSION

This study showed potential promise for training prehospital EMS providers in accurate US interpretation through a one-hour didactic lecture focused on US technique and anatomy for the assessment of pericardial effusion, pneumothorax, and cardiac standstill. Using a small group of EMS students and providers, subjects' performance on US image interpretation increased from 60% to 90% after training and was maintained at one week. Additionally, subjects reported increased confidence in their comfort level with US interpretation. Although limited, our findings lend potential support to existing data that demonstrate prehospital providers may be able to sufficiently gain and retain knowledge of point-of-care US interpretation for pericardial effusion, pneumothorax, and cardiac standstill.

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Recommendations from the Council of Residency Directors (CORD) Social Media Committee on the Role of Social Media in Residency Education and Strategies on Implementation

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Social media (SM) is a form of electronic communication through which users create online communities and interactive platforms to exchange information, ideas, messages, podcasts, videos, and other user-generated content. Emergency medicine (EM) has embraced the healthcare applications of SM at a rapid pace and continues to explore the potential benefit for education. Free Open Access Meducation has emerged from the ever-expanding collection of SM interactions and now represents a virtual platform for sharing educational media. This guidance document constitutes an expert consensus opinion for best practices in the use of SM in EM residency education. The goals are the following: 1) Recommend adoption of SM as a valuable graduate medical education (GME) tool, 2) Provide advocacy and support for SM as a GME tool, and 3) Recommend best practices of educational deliverables using SM. These guidelines are intended for EM educators and residency programs for the development and use of a program-specific SM presence for residency education, taking into account appropriate SM stewardship that adheres to institution-specific guidelines, content management, Accreditation Council for GME milestone requirements, and integration of SM in EM residency curriculum to enhance the learner's experience. Additionally, potential obstacles to the uptake of SM as an educational modality are discussed with proposed solutions. [West J Emerg Med. 2015;16(4):510-515.]

INTRODUCTION

Social media (SM) is a form of digital communication through which users create online communities using interactive platforms to exchange information, ideas, messages, podcasts, videos, and many other types of user-generated content. Emergency medicine (EM) has embraced the healthcare applications of SM at a rapid pace and continues to explore the potential benefit for knowledge translation, content management and education.[1-5] The Free Open Access Meducation (FOAM) movement has emerged as a worldwide digital community of learning and practice, harnessing the ever-expanding collection of SM-based content and functioning as a virtual platform for the dissemination of knowledge and education.[6]

SM use by EM residencies continues to grow rapidly with a near ubiquity in its use.[7-8] Opportunities now exist to enhance the current EM curriculum both with traditional learning sessions such as didactics or simulation, or with asynchronous learning.[9] Learners are engaging with social-networking sites for educational purposes, and learner satisfaction is typically high with this modality.[10-12] SM allows learners to interact and collaborate with content generators outside the confines of physical space and time. Learners report that SM provides the opportunity for peer collaboration, enhanced communication, and complementary learning.[13-17] Users of SM for education report a strong desire to use it but also a strong desire to maintain privacy,

specifically between their personal and professional lives. At present, there remains a chasm between educators and residents on how to most effectively integrate and implement SM in their EM curriculum.

SM is not an essential modality for residency education; however, it has distinctive advantages for augmentation of residency curricula. SM helps generate discussion across institutions, allows for rapid, near-real-time peer review and exchange of ideas, increases the audience of a lecture or teaching curriculum, and can provide detailed analytics of viewership including information on the viewers' location and time spent on the activity. Further, SM has helped numerous individuals advance their academic careers with additional academic opportunities (e.g. lecture opportunities, research projects, publications). SM also aligns with adult learning models of providing educational resources when and where the student is ready to learn. Finally, SM can decrease the time to knowledge translation as articles are often debated and discussed even before they reach the official print journal. Potential disadvantages to implementation of SM is over-reliance by learners over conventional educational modalities (e.g. textbooks, manuscripts), technological barriers decreasing widespread use, potential inaccuracies of posted content, and potential legal or professional risks associated with posting private health information or inappropriate content. With SM in education ever expanding, continuing to assess these advantages and disadvantages plays an important role in effective use of SM in medical education.

According to the Accreditation Council for Graduate Medical Education (ACGME), "milestones are knowledge, skills, and other attributes for each of the ACGME competencies organized in a developmental framework from less to more advanced."[18-19] SM is another modality to achieve milestones-based competency, ranging from professionalism to medical knowledge and proper use of SM may be viewed as another "entrustable professional activity."[20]

The goals of this guideline statement are to focus on SM as a tool for residency education. These guidelines are designed to provide support for EM residency programs in the development and use of program-specific SM presence for residency education. They are designed to complement and do not supersede any institutional guidelines or local, state or federal laws. The SM guidelines outlined in this paper constitute an expert consensus opinion, from a group of current program directors, educators and SM contributors, for best practices of the use of SM in EM residency education. The scope of this document is to function as a foundation document for further development of more detailed content and location-specific guidelines and best practices.

METHODS

In 2013, a SM Committee that reports to the Council of Residency Directors (CORD) Board of Directors was formed. The committee met regularly to review available literature and discuss best practices of integrating SM into their educational curricula. At the CORD Academic Assembly in 2014, a pre-day session entitled "#dontgetleftbehind: FOAMed and SM for EM Educators" further explored the use of SM in education. Due to the considerable variation among institutions regarding the use of SM in residency education, the committee developed a GME-specific set of recommendations. These recommendations formed the preliminary work of this manuscript.

After the preliminary stage, members of the forum and other identified experts in SM who have been recognized in the field for their use of SM for education purposes used a modified Delphi technique, specifically, a discursive method based on an online discussion platform (Google Groups) curated and moderated by the chairperson of the committee. Four rounds of comments and revisions were obtained before the authors reconciled the recommendations and edited the final document.

These recommendations were approved by the CORD Board of Directors.

Recommendations

CORD supports the use of SM as a valuable GME tool. Each residency program is encouraged to create a presence on SM and build SM content to enhance the sharing of knowledge. The CORD SM Committee developed the following recommendations for best practices in use of SM in residency education.

1. Institutional support: It is our recommendation that each institution allow and encourage residencies to use SM in their educational efforts. Institutional officials should be involved in the development of policies for its use, including allowing access to SM within the hospital network firewall. Specifically, access to medical education content on SM sites during clinical shifts can enhance clinical education as it facilitates real-time learning and feedback.[11] SM can also help augment educational discussions by providing additional resources, and allow the viewpoints of those who are not physically present in the conference.

2. Residency leadership: Residency leadership should discuss the institutional SM policy and guidelines with residents, and ensure SM is used for educational purposes in an appropriate manner. The residency leadership or a designee should be responsible for monitoring the content generated by learners or other users of the designated sponsored platform.

3. Residency education: SM is a digital tool for enhancing EM education, and leadership should integrate it into the curriculum. SM modalities such as blogs, podcasts, vodcasts, Twitter, and Google Hangouts have been successfully implemented into curriculum.[8,14] Program directors and residency leadership should explore the various aspects of their curriculum to determine the best fit for their residency. For examples, see Figure. Additional goals of integration are to identify and curate SM as a means for

Curriculum/activity	Objectives of integration	SM modalities	Examples
Conference (Including flipped classroom, small group sessions, workshops, orientation, etc.)	Improve retention, increase faculty and learner engagement, and enhance topic discussions	Twitter, Wiki, blogs, podcasts, vodcasts (podcast with video content), video blogs	• Twitter conversation regarding clinical aspects of case discussion, i.e. #EMCONF • Posting clinical summaries of conferences to blogs to benefit both attendees of the conference as well as those that could not attend the conference • Embedding SM resources for lecture materials (i.e., embedding links within Microsoft Powerpoint slides) • Team-based learning: assign blogs or podcasts to each learner group and discuss via either faculty-selected or moderated sessions • Web-site with flipped classroom & FOAM information: i.e., preparation before conference with interactive discussion during conference
Individualized interactive instruction (III)	Provide broad platform for educational asynchronous learning activities	Blogs, podcasts, vodcasts, video blogs, FOAM	• Approved Instructional Resources (AIR) series for emergency medicine (EM) resident and III instruction. • Fee-based services (HIPPO EM, MedChallenger, Rosh Review) • Blogs/vodcasts/video blogs: resident selects focused content area of needed improvement, prepares by watching above evidence-based on-line educational module, takes the Continuing Medical Education questions on the specific self-selected content area, then reviews their performance with their faculty advisor • Developing individualized learning plan for each resident • Becoming content experts on one topic: two residents can be paired and ultimately responsible for new information/ studies on given topic
Journal club	Enhance discussion of evidence-based practices	Twitter, blogs, podcasts, vodcasts, video blogs, FOAM	• Teaching how to critically analyze both journal articles and podcasts • Include broader participation base for discussion to those unable to attend journal club (i.e. residents working clinically, alumni, those outside residency to include national or international reach) • On-line/media-based journal club podcast, i.e., Washington University School of Medicine in St. Louis podcast (http://emjclub.com) • Joint Academic Life in Emergency Medicine (ALiEM) – Annals of EM on-line journal club (http://www.aliem.com/aliem-annals-global-em-journal-club/) • Joint Academy of Emergency Ultrasound – Sonoround Table journal club (http://sonoroundtable.com)
Off-service rotations	Ensure appropriate EM-focus	Twitter, blogs	• Off-service residents: education and departmental orientation • Peer-to-peer learning, i.e. off-service resident on orthopedics posts orthopedic related content on the EM-based platform
Patient follow-ups	Increase dissemination of lessons learned from final diagnosis and outcomes	Blogs	• Follow-up blogs: post pearls of wisdom regarding specifics follow-up cases with opportunity to have peers post responses
Academic/quality improvement project	Increase dissemination of lessons learned, and increase compliance with quality improvement projects	Google Groups	• Integrating a google forum (Google Groups) for direct observation of procedures (attendings pull up form and submit on-line; spreadsheet tracking of performance)

Figure. Examples of integration of social media into the emergency medicine curriculum.
SM, social media; *EMCONF*, emergency medicine conferences; *FOAM*, free open access meducation; *HIPPO*, hippocrates

Curriculum/activity	Objectives of integration	SM modalities	Examples
Alumni organization	Increase dissemination of information to those that are no longer at the academic institution, increase networking	Twitter, Facebook, blogs	• Develop and interact with alumni network
Board review	Increase medical knowledge	Twitter, blogs	• Board review questions via Twitter feed • Automated "tweets" (Twitter blog posts) on specific topics, i.e., ultrasound tweets
Peer-to-peer education	Increase medical knowledge, networking, and support	Twitter, Google Groups, Google Hangouts	• Residents to share selected SM content amongst each other • Residents to teach based on SM to fellow residents

Figure. Continued. Examples of integration of social media into the emergency medicine curriculum.
SM, social media; *EMCONF*, emergency medicine conferences; *FOAM*, free open access meducation; *HIPPO*, hippocrates

facilitating lifelong continuing education, practice-based learning, professionalism, responsible communication, and the giving of medical advice. CORD's SM Committee is currently developing an educational series on the use of these various modalities.

4. Posting for purposes of education: Descriptions of specific patient encounters and clinical images should not be posted to personal or public SM sites unless intended for the purpose of education and all patient identifiers have been removed. Protected health information, including photographs, may not be placed on personal or public SM sites without specific informed written consent given by the patient for this specific purpose. For private, secure, or protected internal SM sites, local institutional guidelines should be used.

5. Affiliation with institution/program:

a. The name and logo of the program or institution should only be used on the designated sponsored platform, unless specific written consent is obtained from the program or institution. They should not be attached to personal accounts, home pages or identifiers on SM, unless approved by the program or institution. If permitted, institutional public relations/marketing guidelines must be followed and are expected to be consistent with the professional standards of conduct of these institutions.

b. When a connection to the program or institution is apparent, it should be clearly stated that the content posted is that of the individual and not an official opinion or endorsement of the institution. The medical information contained in the SM platforms must have a clear disclaimer that the information is general, may not be applicable for specific patients, is provided for didactic purposes only and does not establish a clinical or legal standard of care.

6. Content management: For residency-sponsored SM sites, the program should designate a non-resident content manager who is responsible for oversight and compliance. It is also essential to provide appropriate attribution and citation to content posted online. Despite the relative ease by which information can be obtained digitally, content generated by other individuals in SM should be appropriately cited and referenced to the original online postings.[21]

7. Professional SM engagement: Patient privacy also must be maintained. This includes complying with institutional policies regarding patient privacy, non-discrimination, and anti-harassment. Breaches of privacy, confidentiality, professionalism, or abuse of coworkers through disparaging comments are not acceptable in any circumstance. Potential conflicts of interest should be disclosed. The use of sound judgment and accuracy in communication is paramount. Inaccuracies should be promptly corrected. Whenever possible, a citation or reference with posted educational information is encouraged and promotes academic integrity.

8. ACGME milestone assessment: SM can be used as a tool to address several milestones. Specifically, EM milestones 15, 18, 19, 20, and 21 that address medical knowledge, technology, practice-based performance improvement, professional values, and accountability, respectively.

CHALLENGES

Implementation of SM as an educational tool has some potential obstacles.[15,17] Some of these obstacles are:

1. Hospital system/administrative barriers: Despite the growth of SM in medical education, some institutions still do not allow access to SM sites on their institutional networks or limit the participation of its employees on them. Reasons of limiting access include the possibility of decreased productivity, and the risk of exposing the institution if there are unprofessional posts. The hospital's information technology (IT) teams should be involved early. Multiple departments within an institution (i.e.: IT, legal, public relations) will need to be involved for SM access approval via hospital computers, as well as to establish a residency SM presence. It is recommended to provide a proposal that outlines your purpose for education and plan for oversight and monitoring.

2. Technology barriers: Providing educational sessions to faculty and residents is strongly recommended to familiarize them with the technology. This can be provided in conjunction with intern orientation, faculty meetings, and educational conference.

3. Engagement and time constraints: The use of SM in a curriculum requires a committed faculty and dedicated educators to create the educational experience via SM to optimize the learner's experience. Several recurring themes are evident that may create faculty reluctance to incorporating SM and FOAM.

a. Additional funding and resources required to integrate into curriculum: As SM integration can require extra work over existing educational modalities, educators can use pre-existing FOAM materials to supplement traditional approaches. Some institutions report that residents can help with early implementation to foster faculty engagement. Expenditures related to the use and creation of SM content can be thought of in terms of capital expenses and time expenses. Capital expenses can range from zero for free platforms (Facebook®, Twitter®) to several thousands dollars for independently hosted blog and podcast platforms. Time expenses are difficult to quantify. Faculty often create this content separate of their teaching responsibilities, however, utilizing these tools may also fit within protected time used to develop curricula and other learning resources.

b. Peer review on SM platforms: SM posts to the most popular SM education sites have post-publication peer-review with comments from a broad base of international medical practitioners. Some SM experts (www.aliem.com/pilot-aliem-journal/) are working to establish pre-publication peer-review processes on various SM platforms.[22-23]

c. Generational gap: FOAM continues to grow and many younger learners are using this to supplement their education. Integrating this into the curriculum is an effective means to ensure residents are receiving high-quality education and ensuring life-long learning strategies in the context of SM.

d. Information Overload: The explosive growth in the medical literature and number of available learning modalities has been present well before SM. FOAM allows for prioritization of topics of interest. However, it is important to be aware of the potential of overemphasis on certain "hot" topics.

4. Promotion and Tenure: Promotions and Tenure committees may currently not provide credit or incentives for educational content created on SM. However, SM has been used effectively to increase an individual's national and international reputation, which can lead to a variety of academic opportunities (i.e. lecturing, manuscript authorship, committee participation).

5. Engaging learners: It is imperative to have diverse modalities to address adult learning. It is important to ensure SM enhances the broader learning modalities rather than be the sole tool. SM can augment the discussion of a journal article, blog post or educational podcast. Some residents are engaged in content curation on behalf of their program, which is another form of peer-to-peer learning.

6. Faculty endorsement of SM: In order to fully and effectively incorporate SM into a residency-wide curriculum one needs to have faculty and residency leadership that support SM as a legitimate form of education.

7. Barriers to privacy: The learner may have concerns over personal privacy. Strategies such as restricting viewership of personal posts can be used. Separating professional and private lives online can and should be done.

8. Quality assurance/Validation metrics: The quality assurance of blogs and tweets occurs with near-instantaneous post-publication review by other peer experts and are digitally responded to within minutes. Errors can be corrected and retracted in a short time period. Web-based technology can also provide high-quality validation metrics on the reach of SM. An author can obtain detailed metrics on viewership which includes location data (i.e.: country, state, city) and frequency of sharing.

LIMITATIONS

Unfortunately, there are no scientific studies on the role of SM in residency education. Therefore, this manuscript is limited in that it represents the opinions and consensus of an expert panel and has all the typical limitations of expert panels.

CONCLUSIONS

SM utilization in EM residency education continues to grow. Faculty and residents should receive education detailing appropriate SM stewardship that adheres to institution-specific guidelines. For residency program-sanctioned SM sites, the program should designate a content manager who is responsible for oversight and compliance. Institutions should endorse the use of SM as a part of medical education since access to high-quality educational materials can enhance the learner's experience.

DEFINITIONS

Program Leadership: Composed of the Program Director, Associate Program Director(s), Assistant Program Director(s) of an EM Residency Program, and the departmental Chair.
Content Manager: Individual(s) in the organization entrusted with monitoring, contributing to, filtering, and otherwise guiding the SM presence of the program.

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Demographic, Operational, and Healthcare Utilization Factors Associated with Emergency Department Patient Satisfaction

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Introduction: The primary aim of this study was to determine which objectively-measured patient demographics, emergency department (ED) operational characteristics, and healthcare utilization frequencies (care factors) were associated with patient satisfaction ratings obtained from phone surveys conducted by a third-party vendor for patients discharged from our ED.

Methods: This is a retrospective, observational analysis of data obtained between September 2011 and August 2012 from all English- and Spanish-speaking patients discharged from our ED who were contacted by a third-party patient satisfaction vendor to complete a standardized nine-item telephone survey by a trained phone surveyor. We linked data from completed surveys to the patient's electronic medical record to abstract additional demographic, ED operational, and healthcare utilization data. We used univariate ordinal logistic regression, followed by two multivariate models, to identify significant predictors of patient satisfaction.

Results: We included 20,940 patients for analysis. The overall patient satisfaction ratings were as follows: 1=471 (2%); 2=558 (3%); 3=2,014 (10%), 4=5,347 (26%); 5=12,550 (60%). Factors associated with higher satisfaction included race/ethnicity (Non-Hispanic Black; Hispanic patients), age (patients ≥65), insurance (Medicare), mode of arrival (arrived by bus or on foot), and having a medication ordered in the ED. Patients who felt their medical condition did not improve, those treated in our ED behavioral health area, and those experiencing longer wait times had reduced satisfaction.

Conclusion: These findings provide a basis for development and evaluation of targeted interventions that could be used to improve patient satisfaction in our ED. [West J Emerg Med. 2015;16(4)516-526.]

INTRODUCTION

Background

Recent healthcare reform efforts have increasingly focused on the concept of patient-centered care, which expects patients to actively participate in healthcare decision making and for care to be as individualized as possible.[1] Patient satisfaction is a metric that has been used to measure healthcare providers' effectiveness around achieving true patient-centered care. Since 2008, the Hospital Consumer Assessment of Healthcare Providers Survey (HCAHPS) has been administered to patients as a standardized tool to assess patient satisfaction nationwide.[2] Aggregated results are publicly available online through the Department of Health and Human Services, giving consumers the ability to compare patient satisfaction scores among healthcare providers. Patient satisfaction metrics are also becoming increasingly important financially. The Patient Protection and Affordable Care Act of 2010 (P.L. 111-148) includes HCAHPS among the measures to be used to calculate value-based incentive payments in the hospital Value-Based Purchasing program, beginning with discharges in October 2012.[3]

Importance

Although the association between patient satisfaction and clinical quality and outcomes has been studied in other care settings, little is known about factors associated with higher patient satisfaction, effective methods for improving satisfaction and what effect satisfaction has on health care outcomes for emergency department (ED) patients.[4-6] Previous studies have identified timeliness of care, provision of information, staff empathy/attitude, and pain management as service factors influencing ED patient satisfaction.[7-8] Demographic factors have been variably associated with satisfaction.[8-9] Non-emergency ambulatory setting patient satisfaction has been correlated with improved patient outcomes, including higher medical compliance, decreased utilization of medical services, less malpractice litigation, and greater willingness to return.[7,10] Following the ED patient satisfaction research agenda proposed by Boudreaux and O'Hea, we focused our attention in this analysis on factors that influenced patient satisfaction using a robust methodology that included multiple demographic, operational, and healthcare utilization variables within a large set of patients.[11]

Objectives of This Investigation

The primary aim of our study was to determine which objectively measured factors related to patient demographics, ED operational characteristics, and healthcare utilization frequencies (care factors) were associated with patient satisfaction ratings obtained from phone surveys conducted by a third-party vendor for patients discharged from our ED.

METHODS

Study Design and Setting

This was a retrospective, observational convenience sample study with the primary aim of assessing objectively measured patient demographic, ED operational, and healthcare utilization factors as predictors of patient satisfaction. Our institution is an urban, upper Midwest Level I Adult and Pediatric Trauma Center with an ED residency training program with approximately 78,000 patient encounters per year. This study was reviewed and approved by the HealthPartners Institutional Review Board, with the consent requirement waived.

Selection of Participants

Since March 2011, all English- and Spanish-speaking patients discharged from our ED are contacted by a third-party vendor (Emergency Excellence, Brentwood, TN) to complete a standardized nine-item telephone survey by a trained phone surveyor. Patients are contacted up to four times, in the 48-hour period following discharge, before they are determined to be unreachable. In September 2011, the survey methodology changed to a 1-5 scoring system for the satisfaction rating questions (5=best; 1=worst). We included all patients discharged from our ED between September 1, 2011, and August 31st, 2012 who provided a response to the "overall satisfaction" question on the satisfaction survey and associated link to the electronic medical record of the patient's encounter. Exclusion criteria included patients who were admitted following their ED encounter, patient seen outside of the one-year study period, patients who were unable to be reached to complete the telephone survey, and patients excluded due to proactively placing their name on our institutional research opt-out list.

Intervention

Using the 1-5 scoring scale, all patients were asked to assess their medical condition compared to the day of their visit, their understanding of the discharge instructions they received, their confidence and trust level in the physicians who treated them, and satisfaction ratings for their overall experience, their physician, their nurse, and their advanced practice provider. The phone survey took approximately 15 minutes to complete. If the patient expressed concern about their care, the phone surveyor relayed the information to the ED quality committee for further follow up.

Methods and Measurements

Programming staff from our institution electronically abstracted patient demographic information (age, sex, primary language, and zip code of residence) for all patients discharged from the ED between September 1, 2011, and August 31, 2012. Patients with satisfaction scores obtained by the survey vendor had additional demographic, ED operational and healthcare utilization variables abstracted from the electronic medical record and the satisfaction survey database. Additional demographic factors included self-reported race/ethnicity, use of an interpreter in the ED, language spoken during the survey, zip code-based median income, zip code-based percent in poverty, mode of arrival, and payer type. ED operational variables included the day of the week, weekend vs. weekday, calendar month and quarter, time of day (11pm-7am vs. all other times), wait time from arrival to physician and from physician to disposition, and treatment location within the ED. Healthcare utilization variables included whether any medications were ordered in the ED, whether any imaging was performed, whether laboratory tests were performed. We also abstracted for analysis the patient's self-assessed change in medical condition. The final data set was reviewed for accuracy with the study investigators, and a de-identified analysis database was provided for analysis.

Outcome

The outcome measure for this analysis was a predicted one-unit increase in patient satisfaction score.

Data Analysis

We compared age, sex, primary language, and poverty rate based on zip code between the satisfaction survey

responders and non-responders to assess potential sampling bias. All potential analysis variables were then tabulated by satisfaction score and reviewed manually (SAS 9.2 and 9.3; Cary, NC). We condensed categorical variables with many possible values into a smaller number of categorical levels before further analysis.

We analyzed the impact of multiple visits within the study period on satisfaction score. A more in-depth analysis of language was also conducted to determine the effect of the listed primary language, use of an interpreter in the ED, and language spoken during the telephone interview on satisfaction score.

Variables were considered for further analysis and inclusion in the regression model if the variable level had a material interaction with the distribution of satisfaction scores. We used ordinal logistic regression models with one predictor in each model to provide preliminary assessments of many possible predictive variables, with the outcome measure equal to a one-unit increase in satisfaction score. Variables with non-significant findings ($p>0.10$) in univariate analyses or variables with no material difference determined by the investigators were removed from further analyses. We examined relationships between closely related categorical predictors and consolidated strongly overlapping categories to improve the stability of possible multivariate models. A multivariate model was constructed using all remaining predictors, and backwards elimination based on p-values was used to identify the remaining significant predictors. To verify software-generated backward elimination methodology, we also manually completed backwards elimination to monitor developing patterns. Categories of multi-level variables were combined if they were not associated with materially different odds ratios. We then re-checked the model by examining changes to Akaike Information Criterion when excluded variables were added back in. Finally, given that some compensation schemes use a dichotomous satisfaction score we performed a secondary analysis, using satisfaction score=5 vs not 5.

RESULTS

Figure 1 shows our patient selection flowchart, with 20,940 (59%) patients included in the final analysis. There were no material differences between responders and non-responders with respect to age, poverty rate based on zip code of residence, language, or chief complaint. There were 10,503 responders to the telephone survey with more than one encounter within the study period. Due to no association with a change-in-satisfaction score based on the number of encounters (OR=0.99; 95% CI [0.97-1.01]), a single visit per patient was randomly selected and included in the analysis.

The overall patient satisfaction ratings were as follows: 1=471 (2%); 2=558 (3%); 3=2,014 (10%), 4=5,347 (26%); 5=12,550 (60%) (Table 1). Use of an interpreter in the ED, zip code-based median income, day of the week, calendar month and quarter, imaging done (yes or no), and lab work done (yes or no) were removed from further analysis after descriptive summaries showed no material differences in satisfaction rates. Variables with statistically significant predictive power from the univariate analyses are seen in Table 2. The only variable excluded from the multivariate analysis was day of the week (OR=1.03; 95% CI [0.97-1.09]). To reduce collinearity in multivariate models, we collapsed age and Medicare status into a single multi-level categorical variable : ≥65 years old; <65 years old and on Medicare; <65 years old and not on Medicare., Similarly, race and language were also consolidated into a single four-level variable: non-Hispanic Black, English-speaking Hispanic, Spanish-speaking Hispanic, all other. We reduced categories for mode of transportation to bus/walk vs. all other because the other modes of transportation (private, ambulance and other) were not significantly different from each other.

Accounting for all potentially significant factors included in this analysis, minorities (Black and Hispanic patients), seniors (≥65 years old), patients who arrived by bus or on foot, and those who had a medication ordered in the ED were more likely to have significantly higher overall satisfaction scores (Table 3). Patients who felt their medical condition did not improve or who were treated in our behavioral health unit were less satisfied. Longer wait times, particularly from door

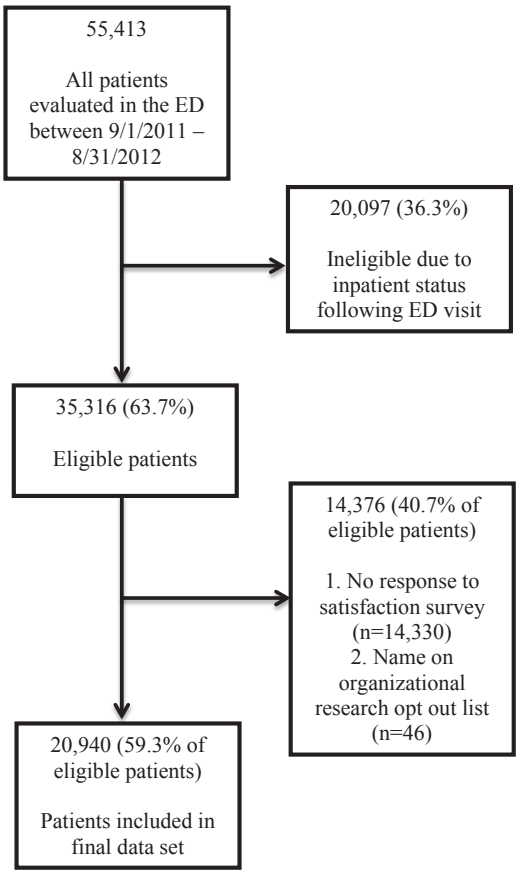

Figure 1. Patient selection flowchart.
ED, emergency department

Table 1. Demographic, operational, and healthcare utilization characteristics across satisfaction scores.

	No rating	Score=1	Score=2	Score=3	Score=4	Score=5	Scored
All visits	14,330 (41%)	471 (2%)	558 (3%)	2,014 (10%)	5,347 (26%)	12,550 (60%)	20,940
Age group							
0-17 yrs	2,003 (42%)	52 (2%)	62 (2%)	252 (9%)	701 (25%)	1,739 (62%)	2,806
18-64 yrs	11,432 (41%)	377 (2%)	459 (3%)	1,620 (10%)	4,219 (26%)	9,528 (59%)	16,203
65 and older	895 (32%)	42 (2%)	37 (2%)	142 (7%)	427 (22%)	1,283 (66%)	1,931
Sex							
Female	7,092 (38%)	289 (3%)	328 (3%)	1,212 (11%)	2,873 (25%)	6,731 (59%)	11,433
Male	7,238 (43%)	182 (2%)	230 (2%)	802 (8%)	2,474 (26%)	5,819 (61%)	9,507
Race/ethnicity (5-level)							
White	7,030 (41%)	246 (2%)	294 (3%)	1,031 (10%)	2,824 (27%)	5,903 (57%)	10,298
Black	4,201 (39%)	144 (2%)	159 (2%)	625 (9%)	1,538 (23%)	4,160 (63%)	6,626
Hispanic	1,194 (39%)	25 (1%)	34 (2%)	118 (6%)	378 (20%)	1,294 (70%)	1,849
Other	1,135 (46%)	40 (3%)	42 (3%)	147 (11%)	388 (29%)	728 (54%)	1,345
Unknown	770 (48%)	16 (2%)	29 (4%)	93 (11%)	219 (27%)	465 (57%)	822
Emergency department language							
English	13,784 (41%)	467 (2%)	548 (3%)	1,968 (10%)	5,221 (26%)	11,918 (59%)	20,122
Spanish	493 (39%)	4 (1%)	8 (1%)	40 (5%)	110 (14%)	603 (79%)	765
Other	53 (50%)	0 (0%)	2 (4%)	6 (11%)	16 (30%)	29 (55%)	53
Zipcode median household income (2007-2011)							
$ 0-35,000	1,474 (41%)	45 (2%)	50 (2%)	208 (10%)	540 (25%)	1,313 (61%)	2,156
$35-50,000	5,861 (41%)	193 (2%)	231 (3%)	830 (10%)	2,129 (25%)	5,135 (60%)	8,518
$50-75,000	4,646 (40%)	154 (2%)	192 (3%)	672 (10%)	1,816 (26%)	4,175 (60%)	7,009
$75,000+	1,721 (41%)	69 (3%)	62 (2%)	230 (9%)	676 (27%)	1,480 (59%)	2,517
Unknown	628 (46%)	10 (1%)	23 (3%)	74 (10%)	186 (25%)	447 (60%)	740
ZIP code percent of households in poverty (2007-2011)							
0-10%	6,624 (40%)	235 (2%)	255 (3%)	925 (9%)	2,574 (26%)	5,857 (59%)	9,846
10-20%	3,799 (41%)	136 (2%)	150 (3%)	555 (10%)	1,424 (26%)	3,291 (59%)	5,556
20-30%	1,863 (41%)	47 (2%)	81 (3%)	255 (9%)	654 (24%)	1,682 (62%)	2,719
30%+	1,416 (41%)	43 (2%)	49 (2%)	205 (10%)	509 (24%)	1,273 (61%)	2,079
Unknown	628 (46%)	10 (1%)	23 (3%)	74 (10%)	186 (25%)	447 (60%)	740
Behavioral health treatment area							
Yes	711 (54%)	22 (4%)	14 (2%)	86 (14%)	183 (30%)	297 (49%)	602
No	13,619 (40%)	449 (2%)	544 (3%)	1,928 (9%)	5,164 (25%)	12,253 (60%)	20,338
Arrival means							
Private	9,738 (39%)	337 (2%)	420 (3%)	1,514 (10%)	3,968 (26%)	9,042 (59%)	15,281
Ambulance	2,808 (47%)	78 (2%)	79 (2%)	302 (9%)	780 (24%)	1,952 (61%)	3,191
Bus/walk	1,161 (43%)	37 (2%)	31 (2%)	117 (8%)	367 (24%)	997 (64%)	1,549
Other	623 (40%)	19 (2%)	28 (3%)	81 (9%)	232 (25%)	559 (61%)	919

Table 1. continued.

	No rating	Score=1	Score=2	Score=3	Score=4	Score=5	Scored
Payer							
Medicaid	5,256 (40%)	210 (3%)	227 (3%)	793 (10%)	1,908 (24%)	4,877 (61%)	8,015
Commercial	4,466 (40%)	125 (2%)	184 (3%)	662 (10%)	2,005 (29%)	3,862 (56%)	6,838
Medicare	1,588 (34%)	87 (3%)	80 (3%)	272 (9%)	689 (22%)	1,985 (64%)	3,113
Self-pay	2,529 (51%)	41 (2%)	59 (2%)	231 (10%)	613 (25%)	1,484 (61%)	2,428
Other	491 (47%)	8 (1%)	8 (1%)	56 (10%)	132 (24%)	342 (63%)	546
Day of week							
Sunday	2,179 (40%)	70 (2%)	79 (2%)	274 (8%)	822 (25%)	1,998 (62%)	3,243
Monday	2,191 (42%)	72 (2%)	90 (3%)	308 (10%)	769 (26%)	1,760 (59%)	2,999
Tuesday	2,136 (41%)	78 (3%)	90 (3%)	305 (10%)	790 (26%)	1,794 (59%)	3,057
Wednesday	1,849 (39%)	59 (2%)	64 (2%)	276 (10%)	757 (26%)	1,710 (60%)	2,866
Thursday	1,974 (41%)	63 (2%)	76 (3%)	298 (10%)	712 (25%)	1,750 (60%)	2,899
Friday	1,883 (40%)	61 (2%)	83 (3%)	263 (9%)	724 (25%)	1,731 (60%)	2,862
Saturday	2,118 (41%)	68 (2%)	76 (3%)	290 (10%)	773 (26%)	1,807 (60%)	3,014
Weekend							
Yes	4,875 (40%)	151 (2%)	189 (3%)	664 (9%)	1,865 (26%)	4,336 (60%)	7,205
No	9,455 (41%)	320 (2%)	369 (3%)	1,350 (10%)	3,482 (25%)	8,214 (60%)	13,735
Night time (11pm-7am)							
Yes	3,528 (42%)	129 (3%)	151 (3%)	576 (12%)	1,233 (25%)	2,792 (57%)	4,881
No	10,802 (40%)	342 (2%)	407 (3%)	1,438 (9%)	4,114 (26%)	9,758 (61%)	16,059
Calendar month							
1	1,213 (41%)	30 (2%)	39 (2%)	155 (9%)	446 (26%)	1,044 (61%)	1,714
2	1,190 (48%)	29 (2%)	27 (2%)	112 (9%)	340 (26%)	799 (61%)	1,307
3	1,183 (41%)	30 (2%)	53 (3%)	143 (8%)	438 (26%)	1,047 (61%)	1,711
4	1,169 (41%)	57 (3%)	47 (3%)	154 (9%)	432 (25%)	1,017 (60%)	1,707
5	1,142 (39%)	49 (3%)	57 (3%)	219 (12%)	471 (27%)	958 (55%)	1,754
6	1,213 (40%)	48 (3%)	58 (3%)	198 (11%)	489 (27%)	1,043 (57%)	1,836
7	1,316 (40%)	35 (2%)	65 (3%)	197 (10%)	535 (28%)	1,103 (57%)	1,935
8	1,188 (38%)	47 (2%)	44 (2%)	171 (9%)	436 (22%)	1,260 (64%)	1,958
9	1,389 (47%)	30 (2%)	39 (2%)	148 (9%)	423 (27%)	943 (60%)	1,583
10	1,288 (41%)	37 (2%)	40 (2%)	169 (9%)	496 (27%)	1,074 (59%)	1,816
11	972 (34%)	37 (2%)	45 (2%)	166 (9%)	420 (23%)	1,182 (64%)	1,850
12	1,067 (38%)	42 (2%)	44 (2%)	182 (10%)	421 (24%)	1,080 (61%)	1,769
Calendar quarter							
1	3,586 (43%)	89 (2%)	119 (3%)	410 (9%)	1,224 (26%)	2,890 (61%)	5,824
2	3,524 (40%)	154 (3%)	162 (3%)	571 (11%)	1,392 (26%)	3,018 (57%)	6,487
3	3,893 (42%)	112 (2%)	148 (3%)	516 (9%)	1,394 (25%)	3,306 (60%)	6,627
4	3,327 (38%)	116 (2%)	129 (2%)	517 (10%)	1,337 (25%)	3,336 (61%)	6,681
Imaging done							
Yes	5,547 (38%)	176 (2%)	231 (3%)	811 (9%)	2,272 (26%)	5,393 (61%)	8,883
No	8,783 (42%)	295 (2%)	327 (3%)	1,203 (10%)	3,075 (26%)	7,157 (59%)	12,057

Table 1. continued.

	No rating	Score=1	Score=2	Score=3	Score=4	Score=5	Scored
Labwork done							
Yes	5,221 (37%)	205 (2%)	226 (3%)	827 (9%)	2,215 (25%)	5,274 (60%)	8,747
No	9,109 (43%)	266 (2%)	332 (3%)	1,187 (10%)	3,132 (26%)	7,276 (60%)	12,193
Medications ordered in the emergency department							
Yes	8,558 (39%)	258 (2%)	339 (3%)	1,249 (10%)	3,325 (25%)	7,962 (61%)	13,133
No	5,772 (43%)	213 (3%)	219 (3%)	765 (10%)	2,022 (26%)	4,588 (59%)	7,807
Wait time: door to provider							
0-1 hour	8,751 (41%)	221 (2%)	234 (2%)	899 (7%)	2,989 (24%)	8,118 (65%)	12,461
1-2 hour	3,190 (39%)	105 (2%)	141 (3%)	546 (11%)	1,367 (27%)	2,818 (57%)	4,977
2-3 hour	1,395 (41%)	75 (4%)	83 (4%)	297 (15%)	595 (29%)	975 (48%)	2,025
3-4 hour	566 (40%)	30 (4%)	55 (7%)	153 (18%)	237 (28%)	371 (44%)	846
Unknown*	428 (40%)	40 (6%)	45 (7%)	119 (19%)	159 (25%)	268 (42%)	631
Wait time: provider to discharge							
0-1 hour	3,898 (43%)	99 (2%)	140 (3%)	462 (9%)	1,263 (24%)	3,214 (62%)	5,178
1-2 hour	3,916 (40%)	114 (2%)	140 (2%)	522 (9%)	1,477 (26%)	3,506 (61%)	5,759
2-3 hour	2,460 (38%)	87 (2%)	87 (2%)	387 (10%)	1,043 (26%)	2,436 (60%)	4,040
3-4 hour	1,511 (39%)	50 (2%)	54 (2%)	222 (9%)	621 (26%)	1,439 (60%)	2,386
4-5 hour	801 (39%)	26 (2%)	34 (3%)	124 (10%)	318 (25%)	749 (60%)	1,251
5-6 hour	489 (41%)	26 (4%)	17 (2%)	75 (11%)	201 (28%)	387 (55%)	706
6-7 hour	248 (39%)	11 (3%)	12 (3%)	49 (13%)	94 (24%)	218 (57%)	384
7+ hour	155 (43%)	5 (2%)	8 (4%)	24 (12%)	57 (28%)	109 (54%)	203
Unknown*	852 (45%)	53 (5%)	66 (6%)	149 (14%)	273 (26%)	492 (48%)	1,033
Self-reported medical condition change							
Improved	399 (3%)	197 (1%)	292 (2%)	1,243 (8%)	3,837 (25%)	9,514 (63%)	15,083
Same	171 (3%)	177 (4%)	198 (4%)	625 (13%)	1,282 (27%)	2,533 (53%)	4,815
Worsened	79 (7%)	96 (9%)	68 (7%)	145 (14%)	226 (22%)	497 (48%)	1,032
(Unknown)	13,681 (100%)	1 (10%)	0 (0%)	1 (10%)	2 (20%)	6 (60%)	10

Percent for no rating is based on all patients: percent for a given satisfaction score is based on all patients with a score.
*Unknown due to missing timestamp data or timestamp data resulting in a negative wait time.

to doctor, also reduced patient satisfaction. Figure 2 shows the nearly linear relationship of patient satisfaction across a broad range of wait times. A two-hour increase in the door-to-doctor wait time decreased the five-point patient satisfaction score by an average of 0.34 points. In contrast, a two-hour increase in doctor-to-disposition wait times decreased the patient satisfaction score by only 0.04 points.

We validated the model by examining changes in the model fit (AIC) when excluded variables were added back in one by one. Adding the percent of households below the poverty level improved the model fit; however ,the variable itself did not have a material odds ratio and did not materially affect other estimates [OR estimated as 0.99 (95% CI [0.99-1.02], p=0.44) for a 10% change in zip code-based poverty rate]. The number of visits per patient, weekend, nighttime, and more detailed analyses of mode of arrival, age and payer did not improve the model fit and could clearly be discarded.

When patient satisfaction was dichotomized (5 vs. not 5), the only notable difference from the results presented in Table 3 was the magnitude of association between patients <65 and on Medicaid with patient satisfaction (OR=1.08; 95% CI [1.01-1.15]). No other findings were materially different from the ordinal multiple regression model results.

DISCUSSION

The decision to tie patient satisfaction to provider and hospital reimbursement is a source of passionate debate among

ED physicians, hospital administrators, and payors. Given the likelihood that this methodology will continue into the future, identifying factors associated with lower patient satisfaction and design interventions targeted to those variables will be an important process for all care providers to undertake.

Demographic Factors

The influence of demographic factors on patient satisfaction has not been consistently demonstrated in previous studies. Patient demographics are not modifiable factors for ED providers. However, identifying whether and why differences exist locally are key questions. In our study, patients with Hispanic ethnicity and Spanish as their first language reported higher satisfaction than other patients. This is consistent with previously reported literature.[7,8] In past studies, African Americans have reported similar or lower rates of satisfaction than Caucasians, which was not the case in this investigation.[7,12] For non-English speaking patients, Garret et al. speculated about the presence of a "happy migrant effect," theorizing that those of another culture and speaking a different language may discount or minimize negative attributes of their care for various reasons, including language difficulties.[13] The use of interpreters is essentially universal in our ED for those whose primary language is not English, and the patient satisfaction survey was administered in Spanish for non-English speaking Hispanic patients. Identification of the root cause for higher satisfaction in these populations will need to be undertaken through further study, most likely through qualitative research methods.

We also found older patients (≥65 years old) were more likely to be satisfied. Past studies examining age as a factor in patient satisfaction have shown mixed results. Sun found younger patients to be less satisfied, while Boudreaux found older patients more likely to recommend but not more satisfied.[7,12] Others have found no association between age and satisfaction.[14,15] In our patient population, those with Medicare who were less than age 65 and those without insurance were also more likely to report a high level of satisfaction. Other studies have found little relationship between insurance status and satisfaction.[12,14,15]

Healthcare Utilization Factors

A previous study examining patient expectations about diagnostic studies found no correlation with overall satisfaction.[16] In our study, performance of laboratory testing and imaging similarly showed no effect. These results counter conventional wisdom and other published literature that suggests testing makes patients happier.[17,18] The current study did find a positive association between the presence of one or more medication orders and satisfaction score. Previous studies have looked specifically at pain management as a subjective measure and found a positive association with satisfaction.[19,20] Our study did not look at type of medication ordered, so we are unable to discern if patients administered pain medication in our sample reported higher or lower satisfaction than patients receiving other forms of medications. In a recent study by Schwartz et al., there appeared to be no difference in patient satisfaction score (Press-Ganey) and administration of analgesic medication.[21] Our study found that patients who were feeling "the same" or "worse" at the time of their callback were less satisfied. It may be that managing expectations about when patients will feel better could lead to improved satisfaction.

Operational Factors

Of the operational factors studied, it is not surprising that the door-to-doctor wait time was one of the strongest predictors of satisfaction (Figure 2). This is in agreement with many previous studies, although others have suggested that the perception of wait time is what is important.[16,22-24] Interestingly, the linear relationship between wait time and satisfaction persists over the entire wait-time spectrum, and for two different kinds of wait time (door to doctor; doctor to disposition). The lack of thresholds may indicate that patients do not arrive with clear expectations regarding wait times. The regression line for door-to-doctor wait times as a predictor of patient satisfaction is much steeper than the regression line for doctor-to-disposition times (reduction of 0.34 points for a two hours door-to-doctor wait time vs. 0.04 for door to disposition). This lends credence to the "virtual room" approach from the perspective of patient satisfaction. When using virtual rooms, patients are evaluated by a physician immediately and a treatment plan is initiated. Patients then wait for test results in the waiting room. Additionally, we noted a significantly lower reported satisfaction among patients treated in the mental health area of our ED. This population has been infrequently studied and may have needs that are not well met in a traditional ED setting. The current version of HCAHPS specifically excludes patients discharged with a primary psychiatric diagnosis from the sampling pool.[2] O'Regan and Ryan did find a generally low level of satisfaction albeit with fewer patients (n=55).[25] These results raise questions about the effect patient dissatisfaction may have on psychiatric outcomes. Factors that did not impact satisfaction included the day of the week the patient was seen, weekday vs. weekend, month and quarter of the year, as well as the time of day.

LIMITATIONS

There are limitations to our research design that are important to highlight. The first potential limitation is the use of a telephone survey method for obtaining patient satisfaction results. This methodology relies on patients having an active telephone number and a willingness to complete a survey when contacted. However, responders and non-responders had similar baseline characteristics so material difference between groups may be limited. Second, patients may have been more apt to report higher levels of satisfaction than they would using a more anonymous survey method, like a mailed paper and pencil or anonymous online

Table 2. Univariate predictors of a one-unit increase in patient satisfaction score.

Predictor	OR (95% CI)	p-value
Age (years)		
<65	Ref	
≥65	1.36 (1.23, 1.49)	<0.001*
Sex		
Male	Ref	
Female	0.88 (0.83, 0.93)	<0.001*
Race		
Non-Hispanic White or other	Ref	
Non-Hispanic Black	1.25 (1.18, 1.32)	<0.001*
Hispanic	1.75 (1.58, 1.95)	<0.001*
10% increase in poverty		
n/a	1.03 (1.00, 1.06)	0.06
Primary language		
English or other	Ref	
Spanish	2.55 (2.15, 3.03)	<0.001*
Mode of arrival		
Private	Ref	
Ambulance	1.08 (1.00, 1.16)	<0.001*
Bus/walk	1.25 (1.12, 1.39)	<0.001*
Other	1.08 (0.94, 1.23)	<0.001*
Payor		
Commercial	Ref	
Medicaid	1.13 (1.06, 1.20)	<0.001*
Medicare	1.27 (1.17, 1.38)	<0.001*
Other	1.23 (1.03, 1.46)	<0.001*
Self-pay	1.17 (1.07, 1.29)	<0.001*
Day of the week		
Weekday	Ref	
Weekend	1.03 (0.97, 1.09)	0.35
Shift		
Non-night	Ref	
Night (11pm-7am)	0.84 (0.79, 0.89)	<0.001*
Wait time: door to doctor (hour)		
n/a	0.70 (0.67, 0.72)	<0.001*
Wait time: doctor to disposition (hour)		
n/a	0.96 (0.94, 0.98)	<0.001*
Treatment location		
Non-behavioral health	Ref	
Behavioral health	0.65 (0.56, 0.76)	<0.001*
Medication ordered prior to discharge		
No	Ref	
Yes	1.09 (1.03, 1.15)	0.002*

*Represents statistically significant figures.

Table 2. continued.

Predictor	OR (95% CI)	p-value
Self-assessed medical condition		
Better	Ref	
Unchanged	0.60 (0.57, 0.64)	<0.001*
Worsened	0.43 (0.38, 0.48)	<0.001*

Table 3. Multivariate analysis of a one-unit increase in patient satisfaction score.

Predictor	OR (95% CI)	p-value
Race and language		
Non-Hispanic White and all other	Ref	
Non-Hispanic Black	1.25 (1.17, 1.33)	<0.001*
English-speaking Hispanic	1.34 (1.17, 1.52)	<0.001*
Spanish-speaking Hispanic	3.30 (2.73, 3.99)	<0.001*
Mode of arrival		
All other	Ref	
Bus/walk	1.22 (1.09, 1.36)	<0.001*
Age and payor		
Age <65, not on Medicare	Ref	
Age ≥65, on Medicare	1.54 (1.39, 1.71)	<0.0001*
Age <65, on Medicare	1.14 (1.01, 1.27)	<0.0001*
Treatment location		
Non-Behavioral health	Ref	
Behavioral health	0.65 (0.55, 0.78)	<0.0001*
Wait time: door to doctor		
Per hour increase	0.67 (0.64, 0.69)	<0.0001*
Wait time: doctor to disposition		
Per hour increase	0.92 (0.91, 0.94)	<0.0001*
Medication ordered prior to discharge		
No	Ref	
Yes	1.12 (1.05, 1.18)	<0.001*
Self-assessed medical condition		
Better	Ref	
Unchanged	0.60 (0.56, 0.64)	<0.0001*
Worsened	0.39 (0.35, 0.44)	<0.0001*

*Represents statistically significant figures.

survey. Speaking with an actual person may have resulted in patients feeling less inclined to score providers lower. Due to patient privacy restrictions for HCAHPS results, we were not able to compare patient satisfaction scores on the HCAHPS survey responders to those obtained via our third-party telephone survey company. Third, phone interviews were conducted in English and Spanish, effectively excluding groups of patients who spoke other languages. Fourth, the study used a large, continuous case series covering a full calendar year. It completely describes patients seen in the recent past but may not be generalizable to a broader time range. Because the dataset was large and complete, no power calculation was done. Finally, generalizing our results to different patient populations in different geographic locations should be done with caution.

CONCLUSION

In summary, our study found several demographic factors significantly impacting satisfaction for our patients, including race/ethnicity, age, and patients on Medicare.

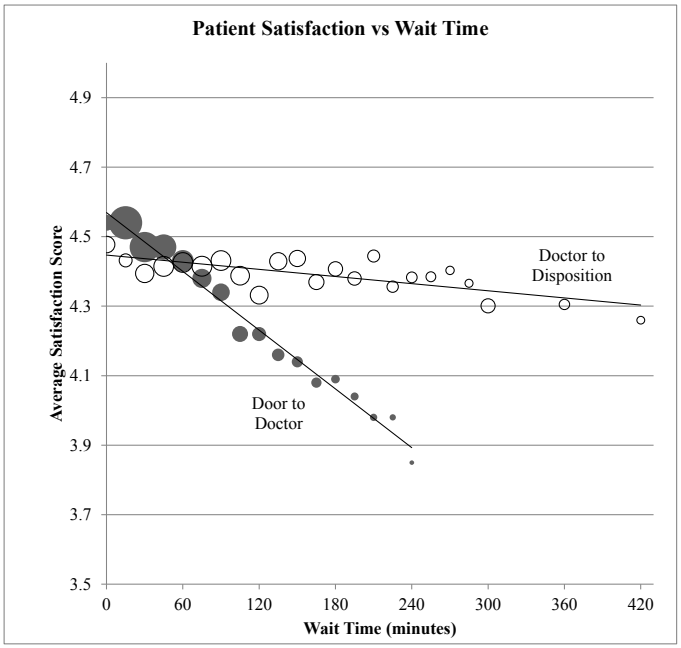

Figure 2. Patient satisfaction scores by wait time (minutes). Size of circle is proportional to sample size of patient with that waiting time.

As expected, longer wait times were associated with lower patient satisfaction. If reimbursement and ultimately physician compensation is impacted by patient satisfaction, institutions with higher proportions of certain demographic groups or that have shorter wait times may be at an advantage. Care factors, such as the number of laboratory or imaging tests ordered, were not associated with satisfaction; however, the number of medications administered during the visit and self-assessed improvement in the patient's condition were associated with greater patient satisfaction. Future interventional studies might look at strategies that manage patient expectations regarding necessity of medications and when they should expect their condition to improve. Lower satisfaction among behavioral health patients is an area warranting further study.

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Differences in Presentation and Management of Pediatric Facial Lacerations by Type of Health Insurance

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Introduction: Limited data are available regarding differences in presentation and management of pediatric emergency department (PED) patients based on insurance status. The objective of the study was to assess the difference in management of pediatric facial lacerations based on medical insurance status.

Methods: We conducted a retrospective cohort study with universal sampling of patients with facial lacerations who were treated in an urban PED (45K visits/year) over a one-year period. Demographic features and injury characteristics for patients with commercial (private) insurance and those with Medicaid or Medicare (public) insurance were compared.

Results: Of 1235 children included in the study, 667 (54%) had private insurance and 485 (39%) had public insurance. The two groups did not differ in age or gender, arrival by ambulance, location of injury occurrence, mechanism of injury, part of face involved, length or depth of laceration, use of local anesthetic, or method of repair but differed in acuity assigned at triage. Patients with public insurance were found less likely to have subspecialty consultation in bivariable (OR=0.41, 95% CI [0.24–0.68]) and multivariable logistic regression analyses (OR=0.45, 95% CI [0.25-0.78]). Patients with public insurance received procedural sedation significantly less often than those with private insurance (OR=0.48, 95% CI [0.29-0.76]). This difference was not substantiated in multivariable models (OR=0.74, 95% CI [0.40-1.31]).

Conclusion: Patients with public insurance received less subspecialty consultation compared to privately insured patients despite a similarity in the presentation and characteristics of their facial lacerations. The reasons for these disparities require further investigation. [West J Emerg Med. 2015;16(4):527-534.]

INTRODUCTION

Disparities in healthcare based on race and ethnicity have been investigated in a number of studies focusing on management of pain, emergency department (ED) triage and waiting time, screening for sexually transmitted diseases, diabetes, asthma, oral and dental care, cardiac care, dialysis, juvenile rheumatoid arthritis, cancer management and orthopedics care among others.[1-8] However, limited data are available addressing disparities in emergency care for pediatric patients based on the patients' insurance status.[9-13] It is important to assess whether insurance-based differences in presentation and management exist in order to identify areas for quality improvement.[14-21] While studies have demonstrated the limited availability of care for publicly insured patients and the diverse

reasons for use of the ED by these patients, there have been few reports investigating differences in medical management based on the patient's insurance status.[8,16,22-24]

The overall goal of this study was to identify whether there are disparities in the ED management of patients based on their insurance status. To optimally assess whether there is a difference in the ED management of a specific complaint, such a complaint would ideally require use of the ED irrespective of insurance status and should be a relatively common reason for utilization of the ED. Facial laceration was identified as a specific complaint to address this goal since pediatric patients with this diagnosis frequently require care in an emergency or urgent care setting rather than from their primary care physician.[25] Therefore, this study was specifically designed to assess the differences in management of pediatric facial laceration based on medical insurance status. Management aspects hypothesized, *a priori*, to be different between the two groups were sub-specialty consultation and use of procedural conscious sedation.

METHODS

Study design, setting and population

We conducted a retrospective cohort study of visits at an urban children's hospital pediatric emergency department (PED) and Level I trauma center with approximately 45,000 visits a year. We selected a universal sample of all patients presenting with facial lacerations from September 1, 2005, through August 31, 2006. Patients were identified based on discharge diagnosis through ICD-9 codes (870-873, and sub-categories under these codes). We performed a detailed chart review of computerized, scanned records for predetermined study variables.

Measurements and study protocol

Study variables included age, gender, total time of visit, triage level (based on the Emergency Severity Index (ESI) triage system, further described below), mode of arrival (ambulance or by private transportation), laceration characteristics (depth and length), specialty consultation obtained (yes/ no), use of procedural sedation (yes/ no), and management of laceration (physician working in the ED vs. consulting physician performing repair, use of local analgesia, method of repair).

Insurance status was extracted from a demographic sheet which is available in each patient's chart. We divided patients into two groups based on their insurance status, i.e., a private insurance group and a public insurance group. Public insurance patients were those with state Medicaid managed care program, Medicaid fee for service, or Medicare, as their expected source of payment. The private insurance group included all other commercial insurance groups (Blue Cross Blue Shield, Tufts, Aetna, etc). We excluded from the analysis those with unknown insurance status since, due to the retrospective nature of the data, their actual insurance status could not be verified.

Although data pertaining to patient race and ethnicity are typically recorded with the patient's data, this information is often of uncertain accuracy, as reported in a number of studies.[26,27] In our data set, approximately 24% of the race/ethnicity variable data was missing and it was uncertain if the available race/ethnicity information in the electronic record was reliable. Therefore, we decided not to include race and ethnicity data in the final analysis.

Location where the injury occurred, mechanism of injury, and intent of injury were coded by research assistants based on the National Electronic Injury Surveillance System All Injury Program data coding schema.[28] As a measure of injury severity, an acuity level is routinely assigned when the patient presents to the ED, and is based on the five-level ESI triage system created by the Agency for Healthcare Research and Quality.[29] We collapsed this acuity index into three categories: high (ESI 1 and 2), moderate (ESI 3) and low acuity triage levels (ESI 4 and 5). Triage categories were collapsed to allow for an adequate number of patients in each of the categories. For example, there were only three patients categorized as ESI 1 (none of which required sedation or had specialty consultation obtained for laceration repair).

Data pertaining to wound characteristics were extracted from the procedure notes and hence dependent on the recorded information. Wound description included location of injury on face, depth of the wound (superficial if not including the subcutaneous tissue), and length of the laceration (divided into three categories, less than 1cm, 1cm to 2cm, and greater than 2cm). We defined procedural sedation as use of intravenous medications at dosages to induce moderate or deep sedation and not for anxiolysis. In our ED, these included combination use of intravenous midazolam and ketamine.

The chart was reviewed to determine whether the laceration repair was performed by a physician based in the PED or by a specialty consultant. However, due to the retrospective nature of the study, data were lacking on the level of training of the physician performing the laceration repair. Physicians based in the PED could be an attending physician, a PED fellow, resident (emergency medicine, pediatrics, family practice), or a nurse practitioner. The consulting physician is typically a resident from either the plastic surgery or otorhinolaryngology (ENT) service and may be a resident training in the specific sub-specialty or a rotating resident from another sub-specialty, such as general surgery or emergency medicine, who is receiving subspecialty training in plastic surgery. Of note, in the PED every patient is evaluated directly by a PED attending physician who oversees (or, at times, performs) the laceration repair.

Institutional Review Board Status and Statistical Analysis

This study was approved by the local institutional review committee. We calculated sample size to detect a difference of 10% in use of conscious sedation and specialty

consultation between the two groups. For an alpha value of 5% and a power of 80%, at least 140 patients were required in each group. We decided to perform universal sampling for a duration of one year to oversample, thereby accounting for the possible limitation of missing information inherent to the retrospective nature of data collection. Data extraction was performed by a single trained research assistant who was not aware of the specific study question. The supervision of data collection and entry was conducted by the research coordinator. We analyzed data with SAS version 9.1.3 (SAS Institute, Inc, Cary, NC) and R.[30] Chi-square tests of independence and Mann-Whitney tests were used for bivariable models where appropriate. We employed logistic regression models to adjust for demographic and wound characteristic covariates that might predict specialty consultation and use of conscious sedation. Patients who had a scalp laceration were excluded from the multivariable analysis as these patients are very unlikely to have either specialty consultation or conscious sedation. We included self–pay patients (who comprised 7% percentage of all patients with facial lacerations) as a separate category in the multivariable regression analysis, thereby providing a model that was more robust.

RESULTS

For the study time period, 1,516 patients with facial lacerations were identified. Of these, we included 1,235 in the study after exclusion of patients with scalp lacerations (n=281). Six hundred sixty-seven (54%) had private insurance, 485 (39%) had public insurance, and 83 (7%) patients had no insurance documented at the time of services provided (considered to be self-pay). When comparing private and public insurance patients, median age and gender were similar (Table 1). The two groups also did not differ with respect to location where the injury occurred, the mechanism or intent of injury, or the mode of arrival at the hospital (Table 1). A significant difference was noted between the two insurance groups with respect to the triage level, with publicly insured patients more frequently assigned to the low acuity group (Table 1). In contrast, when laceration characteristics were assessed, no difference was found between groups in the following: part of the face affected, length, or depth of laceration (Table 1).

Twenty-one patients (4%) in the public insurance group had specialty consultation compared to 66 patients (10%) in the private insurance group, with bivariable analysis demonstrating that children with public insurance received significantly less specialty consultation (OR=0.41, 95% CI [0.24-0.68], p=0.0015). Similarly, there was a difference between groups in the physician performing the repair, with a specialty consultation team member repairing lacerations less often in the publicly insured group (p=0.04). Comparable results were noted for use of procedural sedation, with less use for public insurance patients (OR=0.48, 95% CI [0.29-0.76, p=0.007) than for those with private insurance (public insurance patients 5% [n=25], compared to private insurance patients 10% [n=68]; (Table 2). There was no difference in the total time spent in the ED for the two groups (Table 2).

We used a multivariable logistic regression analysis adjusted for age, gender, depth and length of laceration, and acuity to evaluate the effect of insurance status as a predictor of subspecialty consultation (Table 3). In the model assessing specialty consultation obtained, the public insurance group was less likely to have specialty consultation compared to the private insurance group (OR=0.45, 95% CI [0.25-0.78]). Specialty consultation was more likely to be obtained for female patients, those with deep or complex laceration, and those with high acuity assigned. For example, our model predicts that a two-year-old female patient with a superficial, 1-2cm long laceration, and intermediate acuity, had a 10% chance of specialty consultation if she had private insurance, compared to a 5% chance if she had public insurance.

We used a second model, adjusted for age, gender, specialty consultation, depth and length of laceration, acuity, and allowing for possible interactions between age and consultation, and between gender and consultation, to test the relationship between insurance status and use of procedural sedation (Table 3). In the adjusted model, the difference between private and public insurance was not found to be significant (OR=0.74; 95% CI [0.40-1.31]). Deeper lacerations or those with high acuity were found to be important variables for use of procedural sedation. The most important factor associated with the use of procedural sedation was specialty consultation (Table 3). The child in our example of a two-year-old female with superficial, 1-2cm long laceration, and intermediate acuity, the model would predict a 70% chance of procedural sedation use if a specialty consultation was obtained, compared to a 12% chance if specialty consultation was not obtained.

DISCUSSION

The purpose of this study was to identify differences in care of children presenting to the ED with facial lacerations based on medical insurance status. After adjusting for age, gender, wound characteristics and acuity, we found a modest but significant association between private insurance and use of specialty consultation. Since the baseline presenting characteristics of the two groups and their injuries were similar, it is unlikely that the differences in care can be attributed to differences in types of injuries sustained. These results are in contrast to those of another study that examined race and socio-economic levels as possible drivers of disparity in use of sedation and anxiolysis for laceration repair of pediatric patients and documented no difference.[31]

The significant difference in specialty consultation for patients in the two insurance groups is noteworthy. The ED studied is a Level I trauma center and is continuously staffed by pediatric emergency physicians who have received training

Table 1. Patient characteristics and presentation for facial lacerations based on insurance status.

Variable	Private insurance N=667, N (%)	Public insurance N=485, N (%)	p-value
Median age of the patient Years [IQR]	4.4 [2.39-7.86]	4.8 [2.80-7.72]	0.18
Gender			0.45
Male	430 (65)	323 (67)	
Female	237 (35)	162 (33)	
Emergency medical service arrival			0.05
No	598 (90)	419 (86)	
Yes	66 (10)	66 (14)	
Missing	3		
Location of injury			0.58
Home	389 (58)	295 (61)	
School	71 (11)	49 (10)	
Street	42 (6)	40 (8)	
Playground/park	27 (4)	21 (4)	
Sports activity (organized)	22 (3)	14 (3)	
Sports activity (unorganized)	16 (2)	13 (3)	
Other	75 (11)	39 (8)	
Missing	25	14	
Mechanism of injury			0.6
Fall	365 (55)	268 (55)	
Struck/against	267 (40)	190 (39)	
Cut/pierce	14 (2)	8 (2)	
Bite/animal/human	14 (2)	9 (2)	
Firearm/gun shot/BB gun/fire	5 (1)	9 (2)	
Missing	2	1	
Intent			0.4
Accidental	645 (97)	464 (96)	
Alleged assault/self-injury/legal	20 (3)	21 (4)	
Missing	2	0	
Acuity level assigned			<0.001
High	25 (4)	16 (3)	
Moderate	259 (39)	126 (26)	
Low	383 (57)	343 (71)	
Length			0.76
≤1cm	324 (49)	237 (49)	
>1cm or ≤2cm	232 (35)	169 (35)	
>2cm	101 (15)	68 (14)	
Missing	10	11	
Depth			0.58
Superficial/simple	321 (48)	243 (50)	
Deep/complicated	295 (44)	212 (44)	
Missing	51	30	

IQR in brackets, N (%) in parentheses.

in the repair of facial lacerations and are qualified to perform the majority of repairs that present to the pediatric ED. A decision to request specialty consultation, when made by the PED attending, may be based on a variety of factors, including characteristics of the wound, and at times, parental request, but is not thought to be driven by insurance status of the patient. When specialty consultation is obtained, the repair is most commonly performed by a resident in plastic surgery or ENT surgery. Of note, it is rare to have an attending ENT or plastic surgery physician perform a repair in the PED. It is important to note that in the study population, if specialty consultation was obtained, then the patient was extremely likely to have received procedural sedation. This points out an important aspect of ED resource utilization driven by specialty consultation.

Studies have shown that publicly insured or uninsured patients have less access to specialist care.[9] It is possible that the increased frequency of specialty consultation for the private insurance group in our study may have been

Table 2. Comparison of management of pediatric patients with facial laceration based on insurance status.

Variable	Private insurance N=667, N (%)	Public insurance N=485, N (%)	p-value
Local anesthetic used			0.46
No	200 (30)	162(33)	
Yes	460 (69)	318 (66)	
Missing	7	5	
Local anesthetic used as LET			0.88
No	286 (43)	207 (43)	
Yes	372 (56)	273 (56)	
Missing	9	5	
Local anesthetic used as lidocaine			0.06
No	280 (42)	238 (49)	
Yes	379 (57)	242 (50)	
Missing	8	5	
Specialty consultation obtained			0.0015
No	595 (89)	457 (95)	
Yes	66 (10)	21 (4)	
Missing	6	7	
Procedural sedation used			0.007
No	593 (89)	456 (94)	
Yes	68 (10)	25 (5)	
Missing	6	4	
Physician performing the repair			0.004
PED physician/fellow/resident	599 (90)	461 (95)	
Specialty consult physician	63 (10)	19 (4)	
Missing	5	5	
Median total time in PED Minutes [IQR]	180 [124-234]	175 [124-234]	0.11

LET, lidocaine, epinephrine, tetracaine mixture; *PED*, pediatric emergency department
IQR ranges in brackets, N (%) in parentheses.

driven by parental request. For example, the between-group difference noted in our study may be attributable to a lack of some parents' healthcare knowledge regarding the possibilities for specialty care of facial lacerations, and hence less frequent requests by publicly insured parents to obtain a "plastics consult."[32] However, we cannot rule out subtle biases on the health caregivers' part. The role played by these biases cannot be quantified, but conceivably could be the reason for differences between public and private insurance patients seen in this study. It is also noteworthy that when we controlled for specialty team consultation in the regression models, the use of conscious sedation was still greater in the private insurance group. This again may have been driven by parental requests for procedural sedation, although we do not have data specifically addressing this issue.

We also found a difference in the level of acuity assigned to patients in the two groups, with the private insurance group more likely to be assigned a moderate level of acuity and the public insurance group more likely to be assigned a lower level of acuity. This is, most likely, the result of the inter-relationship of a variety factors. Since, in our study, arrival via EMS was the same for the two groups, differences in acuity level assignment are unlikely to be attributable to arrival mode. One possibility is that acuity assigned may have been driven by parental request at triage for repair by a plastic surgeon. Since the ESI triage system is partially based on an estimation of anticipated resource utilization, an assessment by the triage nurse of need for subspecialty consultation or increased likelihood of procedural sedation may have resulted in a higher acuity level assignment in these patients. However, our data do not permit us to evaluate these possibilities. It is important to note, though, that in the multivariable model, including the acuity variable in the models did not change the findings related to use of specialty consultation and public insurance.

LIMITATIONS

The retrospective study design and use of electronic records employed here have inherent limitations. Additionally, this study cannot address the various subjective and interactive factors guiding the disparity in care based on insurance status. Further, differential documentation of facial laceration by physicians could potentially introduce bias in the study. Because of the retrospective nature of this study, we were unable to ascertain whether the requests for surgical

Table 3. Multivariate analysis for laceration management.

Variables	Specialty consultation obtained[Þ] OR (95% CI)	Procedural sedation use[¥] OR (95% CI)
Insurance status		
Private	1.0	1.0
Public	0.45 (0.25-0.78)	0.74 (0.40-1.31)
Self-pay	0.56 (0.18-1.46)	1.54 (0.53-3.86)
Age-years	1.04 (0.98-1.1)	-
Gender		
Male	1.0	-
Female	1.88 (1.15-3.07)	-
Depth		
Superficial/simple	1.0	1.0
Deep/complicated	1.94 (1.13-3.4)	2.47 (1.40-4.44)
Length		
≤1cm	1.0	1.0
>1cm or ≤2cm	0.93 (0.5-1.70)	1.45 (0.79-2.7)
>2cm	1.56 (0.78-3.10)	2.08 (0.98-4.36)
Acuity level assigned		
High level	1.0	1.0
Moderate level	0.27 (0.12-0.64)	0.54 (0.19-1.61)
Low level	0.1 (0.04-0.23)	0.16 (0.06-0.5)
Specialty consultation obtained		
No	-	1.0
Yes	-	17.1 (5.93-50.8)^

[Þ]Model 1: Consultation obtained=insurance status+age+gender+depth of laceration+length of laceration+acuity.
¥Model 2: Procedural sedation use=insurance status+age+gender+consult+depth of laceration+length of laceration+acuity+age*consult +gender*consult.
^Odds ratio for receiving procedural sedation calculated for a two-year old girl.

consultation originated from the parent or from ED staff. Similarly, we were unable to determine if the request for procedural sedation was driven by the parent or the surgical consultant. As noted, procedural sedation was highly likely to be used if specialty consultation is obtained. Many factors contribute to the decision to use procedural sedation, including both objective factors (laceration characteristics and age of patient), and other more subjective factors such as parental and provider perception of pain and provider comfort level for a specific procedure. There was limitation in identification of the level of training of the physician performing the procedure or the manpower available at the time of the repair, which may have guided the need to request assistance from the specialty resident. It seems possible that the level of training of the treating physician and comfort level based on clinical experience may have contributed to the decision to use sedation. Although there appears to be no reason to expect that there would be differences in this variable between physicians caring for children in the two insurance groups. Our data indicate that the two groups were equivalent with reference to the objective factors, although we were limited in our ability to quantify subjective features. Also, use of conscious sedation or repair by a specialty consultant does not necessarily translate into a better quality of care.

A lack of reliable data on the race and ethnicity of patients limits our ability to determine the extent to which these were confounding factors. Race and ethnicity have been found to be associated with disparities in care in several studies and are likely confounded with insurance status. Since we could not reliably document the exact race/ethnicity of the patients in our sample, we were unable to determine the extent to which they contributed to the disparities noted in our study. Of note, Brodzinski et al. noted no differences related to race in the use of procedural anxiolysis for laceration repair.[31] The racial/ethnic distribution for the state where the study was conducted is 82% Caucasian, 6% African American, and 12.5% of Hispanic ethnicity (United States Census 2010).[36]

This study documents disparity in care limited to a 2006 data set. There was a departmental policy change relating to consultant services providing coverage for facial injuries after 2007 that precluded continuation of the study beyond that point. Similarly, at the same time, there was a transition from scanned paper records to electronic records, which may have impacted the integrity of data during the transition period. Disparities in healthcare is an evolving factor and it is conceivable that there may have been changes since 2006 that could impact outcomes using more recent data. However, despite this limitation, this study brings attention to an important public health issue.

We did not examine whether the repairs performed by a specialty team member were cosmetically comparable to those performed by an ED team member, nor did we investigate the cosmetic impact of procedural sedation. These may be questions for future study. Similarly, it would be interesting to know the degree to which specialty consultation, sedation, or cosmetic factors influenced overall patient and parent satisfaction, although this was not determined in the present study. Nevertheless, prior studies have shown no differences in outcomes or parent satisfaction if laceration repairs are performed by trained nurses when compared to physicians, and other studies have shown that the gender of the physician performing the repair was considered more important by the parents or patients than the level of experience of the physician.[33-35]

In many locales, private insurance patients may have greater access than publicly insured patients to urgent care and secondary medical facilities. This could conceivably result in a difference in the types of facial lacerations that present to a tertiary care ED based on patient's insurance status. However, in the state where the study was conducted, public insurance patients have access to numerous urgent care facilities, and although patients seen in urgent care centers were not included in this study, the Level I PED used for data collection is the major resource in this state for pediatric patients seeking care for facial lacerations, regardless of insurance status, and especially if there is a need for procedural sedation.

CONCLUSION

Patients with public insurance received less frequent specialty consultation compared to privately insured patients, despite a similarity in the presentation and characteristics of their facial lacerations. While this may not mean that there is a difference in the quality of care provided, future investigation may help to clarify whether this association is the result of caregiver bias, parental expectations, or other unmeasured confounders.

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Predictors of Linkage to Care for Newly Diagnosed HIV-Positive Adults

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Introduction: Linkage to care following a human immunodeficiency virus (HIV) diagnosis is critical. In the U.S. only 69% of patients are successfully linked to care, which results in delayed receipt of antiretroviral therapy leading to immune system dysfunction and risk of transmission to others.

Methods: We evaluated predictors of failure to link to care at a large urban healthcare center in Philadelphia in order to identify potential intervention targets. We conducted a cohort study between May 2007 and November 2011 at hospital-affiliated outpatient clinics, emergency departments (EDs), and inpatient units.

Results: Of 87 patients with a new HIV diagnosis, 63 (72%) were linked to care: 23 (96%) from the outpatient setting and 40 (63%) from the hospital setting (ED or inpatient) ($p<0.01$). Those who were tested in the hospital-based settings were more likely to be black ($p=0.01$), homeless ($p=0.03$), and use alcohol or drugs ($p=0.03$) than those tested in the outpatient clinics. Patients tested in the ED or inpatient units had a 10.9 fold ($p=0.03$) higher odds of failure to link compared to those diagnosed in an outpatient clinic. When testing site was controlled, unemployment (OR 12.2;$p<0.01$) and substance use (OR 6.4;$p<0.01$) were associated with failure to link.

Conclusion: Our findings demonstrate the comparative success of linkage to care in outpatient medical clinics versus hospital-based settings. This study both reinforces the importance of routine opt-out HIV testing in outpatient practices, and demonstrates the need to better understand barriers to linkage. [West J Emerg Med. 2015;16(4):535-542.]

INTRODUCTION

Major advances in human immunodeficiency virus (HIV) treatments have reduced morbidity, improved survival, and resulted in millions of years of life saved.[1-2] Substantial efforts to prevent the spread of HIV and morbidity of those infected have relied on increasingly aggressive prevention strategies, including widespread testing. We now know that HIV-positive individuals receiving antiretroviral therapy (ART) are 96% less likely to infect their partners than individuals receiving primary care alone.[3] To benefit optimally from these advances, HIV-infected persons must know their HIV status, be successfully linked to outpatient care, adhere to ART, and remain engaged in care. Unfortunately only about half of those with HIV are engaged in care, and only 20% of the U.S. population with HIV is virally suppressed on ART.[4] Failure to link to high quality HIV care after diagnosis prevents the U.S. from achieving successful markers of HIV treatment and the possibility of eliminating HIV from the population.[5]

Delayed linkage to care is associated with delayed receipt of ART leading to immune damage and higher rates of failure to achieve virologic suppression.[6] Failure to achieve virologic suppression not only affects individual health outcomes, but has critical public health implications by contributing to a high HIV community viral load and allowing for secondary HIV transmission.[7] Additionally, it is common that newly diagnosed persons with HIV are diagnosed late in the disease process as measured by a low CD4 count (<200cells/μL) and/or an acquired immune deficiency syndrome (AIDS)-defining condition.[8] The U.S. National HIV/AIDS Strategy has set as goals to decrease the estimated 56,000 new cases of HIV annually by increasing HIV serostatus awareness to 90% and increasing linkage to care to 85% within three months of diagnosis by 2015.[9] To accomplish these goals, strategies to diagnose and ensure linkage of persons into HIV care are critical.

Drexel University College of Medicine (DUCOM) and Hahnemann University Hospital, a large urban healthcare center in Philadelphia, instituted non-targeted opt-out HIV testing programs in the emergency department (ED) in 2006 and subsequently in hospital inpatient units and outpatient primary care clinics in order to increase HIV awareness and capture HIV-positive patients. The aim of this study was to determine variables that are associated with failure to link to care. We examined socioeconomic and biomedical predictors of linkage to care for newly diagnosed HIV-positive adults. Model results are presented for prediction of failure to link to care, rather than successful linkage, because it is the failure to link that is critical to identify.

METHODS

We conducted a retrospective cohort study using medical records for persons newly diagnosed with HIV between May 2007 and November 2011 in both outpatient primary care clinics and in hospital settings (ED and inpatient units). All testing sites used antibody testing technology: an initial rapid HIV test followed by a confirmatory Western Blot test if positive. A positive Western Blot was presumed to equal HIV-positive in our study. All analysis was limited to persons who had reported a previous negative test or had reported never having been tested for HIV. Newly diagnosed patients were referred to the co-located DUCOM HIV clinic using one of two procedures: 1) an HIV case manager met the patient at the testing site, a follow-up appointment at the co-located HIV clinic was scheduled within one week of diagnosis and/or hospital discharge, and the HIV case manager met the patient at the first HIV clinic appointment; 2) alternatively, patients diagnosed by clinicians in the ED after clinical hours, when HIV clinic staff were unavailable, were given an appointment date and time in the HIV clinic within one week of diagnosis. An HIV outreach worker attempted to contact the patient by phone to confirm this appointment. Of note, all HIV-positive patients admitted to the hospital were seen by the inpatient HIV consult service, which is staffed by infectious disease specialists who work at the same outpatient HIV clinic. In addition, outreach workers and case management staff attempted to contact all patients who missed their initial or follow-up appointments.

Patients who were tested in all three locations were from the same urban geographic area and lived within a three-mile radius of the HIV clinic. Linkage to care was assessed at the co-located HIV clinic: successful linkage was defined by at least one visit with an HIV medical provider within six months of receiving an HIV-positive test result. Procedures followed were in accordance with the ethical standards of the Institutional Review Board at DUCOM.

Definition of Variables

All data were ascertained from patient medical records. Variables are defined as follows:

Homelessness: Patients who were living in a shelter or on the street at the time of diagnosis.

Substance Use: Patients with documented drug or alcohol use by positive urine screen, or documentation of substance use in patient medical record within the one year prior to diagnosis.

Mental Illness: Diagnosis was defined as those with documentation of a chronic mental illness. (The most common were schizophrenia, bipolar disorder, and major depression.) Episodic conditions such as a single depressive episode were not included.

CDC AIDS Category: This variable was dichotomously defined using the Centers for Disease Control and Prevention (CDC) 2008 revised surveillance case definitions: A documented AIDS diagnosis, report of any AIDS-defining condition within 24 months prior to or six months following a diagnosis of HIV, or a documented CD4+ T-lymphocyte count of <200cells/μL qualified a patient as having AIDS.[10] Those patients who did not have documentation of a CD4 count within six months of their diagnosis of HIV were classified as non-AIDS status.

Statistical Analysis

We compared demographic characteristics of patients tested in the two testing site types (outpatient versus inpatient) using chi-square tests to determine whether the sites served the same populations (Table 1). We then conducted logistic regression to assess the relationship between socioeconomic, demographic and biomedical factors and linkage to care. Socioeconomic and demographic factors assessed included gender, race, age, employment, housing and insurance. Biomedical factors included initial CD4 and viral load collected within six months of new diagnosis, current substance use, and diagnosis of mental illness.

We used simple logistic regression to test for associations between any single variable and the primary outcome variable, failure to link to care (Table 2). Those variables found to be significant at the univariate level ($p<0.05$) were subsequently included in the multivariate

Table 1. Demographic characteristics of HIV-positive patients tested in outpatient versus inpatient settings.

Variable	Total n (%), n=87	Outpatient (%), n=24	Inpatient and ED (%), n=63	Pearson chi-square test p-value
Sex				
Female	29 (33%)	9 (38%)	20 (32%)	0.61
Male	58 (67%)	15 (63%)	43 (68%)	0.61
Race				
Black	76 (87%)	17 (71%)	59 (94%)	0.01
White	7 (8%)	4 (17%)	3 (5%)	0.01
Other	4 (5%)	3 (13%)	1 (2%)	0.01
Age				
18-29	28 (32%)	11 (46%)	17 (27%)	0.09
30-65	59 (68%)	13 (54%)	46 (73%)	0.09
Unemployed	53 (61%)	13 (54%)	40 (63%)	0.43
Homeless	21 (24%)	2 (8%)	19 (30%)	0.03
Substance abuse	26 (30%)	3 (13%)	23 (37%)	0.03
Mental illness	17 (20%)	2 (8%)	15 (24%)	0.10
Uninsured	28 (32%)	4 (17%)	24 (38%)	0.06
AIDS	31 (36%)	6 (25%)	25 (40%)	0.06

HIV, human immunodeficiency virus; *ED,* emergency department; *AIDS*, acquired immune deficiency syndrome

models. In the first logistic regression analysis, we entered each of the significant variables from the univariate models singly into a two-predictor model and controlled for testing site. We employed an additional multivariate model that included all variables associated with failure to link to care in univariate analyses, including testing site (Table 3). Statistical testing was two-sided, and we considered ($p<0.05$) statistically significant. All models were tested using Pearson's goodness-of-fit tests, and considered satisfactory if the p-value for the test statistic was greater than 0.05.[11] Model results are presented for prediction of failure to link to care, rather than successful linkage, because it is the failure to link that is critical to identify. We omitted patients with missing data from the analyses. Analyses were performed using Stata IC Version 12.

RESULTS

Between May 2007 and November 2011, 5,886 tests were conducted in the hospital-based setting (ED and inpatient units); 682 tests were done in the DUCOM outpatient primary care clinics. Of the combined 6,568 patients, 96 were newly diagnosed with HIV, with an overall seropositivity rate of 1.46%. Of the 96 positives, 87 (63 inpatient and 24 outpatient) were eligible for the study. We excluded nine for the following reasons: seven had inadequate information in the medical records; one died prior to hospital discharge, one was discharged to hospice care (Figure).

Overall, 63 (72%) patients successfully linked to care following a new HIV diagnosis and 24 (28%) did not link to care. Of patients diagnosed in the outpatient setting 23 (96%) linked to care, and 40 (63%) from the hospital-based setting (ED or inpatient) linked to care ($p<0.01$).

Participants were largely male (67%), black (87%), and age 30 or older (68%). Fifty-three (61%) were unemployed, 21 (24%) were homeless, 26 participants (30%) were using drugs or alcohol, 17 (20%) had a history of mental illness, and 28 (32%) were uninsured (Table 1). Those who were tested in the hospital-based settings were more likely to be black ($p=0.01$), homeless ($p=0.03$), and use alcohol or drugs ($p=0.03$) than those tested in the outpatient clinics.

At the time of testing, 31 participants (36%) were diagnosed with AIDS. Of these 31 patients, 19 had clinical symptoms. There were nine cases of pneumocystis jirovecii pneumonia, three cases of HIV wasting syndrome, two cases of esophageal candidiasis, and one case of each of the following: cryptosporidiosis, cryptococcal meningoencephalitis, toxoplasmosis of the central nervous system, Kaposi's sarcoma, and Burkitt's lymphoma. Only three of the symptomatic patients had CD4+ T-lymphocyte counts above 200cells/μL, and all patients with AIDS had a CD4+ count under 300cells/μL. The remaining 12 patients with AIDS were asymptomatic, but had CD4+ T-lymphocyte counts below 200cells/μL. Eighteen patients did not have a documented CD4 count or known AIDS-defining illness, and thus were combined with the HIV+ but non-AIDS patients.

On a univariate level, unemployment (OR: 11.4, 95% CI [2.46-54.41], $p<0.01$), homelessness (OR: 3.38 95%, CI [1.19-9.55], $p=0.02$), current substance use (OR: 7.88, 95% CI [2.75-22.55], $p<0.01$), mental illness (OR: 3.20, 95% CI

Table 2. Linkage to care in single logistic regression.

Variable	Linked to care (%) n=63*	Did not link to care (%) n=24*	Pearson chi-square test p-value	OR (95% CI)
Sex				
Female	19 (66%)	10 (34%)	0.31	1.65 (0.62,4.38)
Male	44 (76%)	14 (24%)	0.31	reference
Race				
White	6 (86%)	1 (14%)	0.30	reference
Black	53 (70%)	23 (30%)	0.30	2.60 (0.30,22.87)
Other	4 (100%)	0 (0%)	0.30	N/A
Age				
>30 years	39 (68%)	18 (32%)	0.25	1.85 (0.64,5.30)
≤30 years	24 (80%)	6 (20%)	0.25	reference
Unemployed				
Yes	31 (58%)	22 (42%)	<0.01	11.4 (2.46,54.41)
No	32 (94%)	2 (6%)	<0.01	reference
Uninsured				
Yes	19 (68%)	9 (32%)	0.51	1.39 (0.52,3.72)
No	44 (75%)	15 (25%)	0.51	reference
Homeless				
Yes	11 (52%)	10 (48%)	0.02	3.38 (1.19,9.55)
No	52 (79%)	14 (21%)	0.02	reference
Substance abuse				
Yes	11 (42%)	15 (58%)	<0.01	7.88 (2.75,22.55)
No	52 (85%)	9 (15%)	<0.01	reference
Mental illness				
Yes	9 (53%)	8 (47%)	0.045	3.20 (1.05,9.72)
No	54 (78%)	16 (23%)	0.045	reference
AIDS				
Yes	26 (84%)	5 (16%)	0.76	1.23 (0.32,4.72)
No	32 (86%)	5 (14%)	0.76	reference
Testing site				
Outpatient	23 (96%)	1 (4%)	<0.01	reference
Hospital (ED or inpatient)	40 (63%)	23 (37%)	<0.01	13.2 (1.67, 104.47)

ED, emergency department; *AIDS*, acquired immune deficiency syndrome
*72% linked to care, 28% did not link to care.

[1.05-9.72], p=0.045), and testing site (hospital based verses outpatient clinic) (OR: 13.2, 95% CI [1.67-104.47], p<0.01) were all associated with failure to link to care (Table 2).

Results from the full multivariate model indicated that patients diagnosed with HIV in the hospital ED and inpatient units had higher odds of failure to link to care (OR: 10.9, 95% CI [1.26-94.01], p=0.03) than patients diagnosed in the outpatient clinics. Additionally, unemployment was significantly associated with failure to link to care (OR: 6.50, 95% CI [1.13-37.32], p=0.04). When testing site was controlled in the two-predictor model, however, the odds of failure to link to care were significantly increased by unemployment (OR: 12.2, 95% CI [2.54-58.16], p<0.01) and current substance use (OR: 6.44, 95% CI [2.15-19.30], p<0.01) (Table 3).

Of the eligible patients, 59 (67.8%) met with a representative from the HIV clinic and received an appointment for follow up at the time of their diagnoses, and

Table 3. Correlates of unsuccessful linkage to care in multivariate models.*

	Multivariate (controlled for ED/inpatient testing site)			Multivariate (full model)		
Variable	OR	95% CI	p-value	OR	95% CI	p-value
Unemployment	12.2	2.54, 58.16	<0.01	6.50	1.13, 37.32	0.04
Homelessness	2.50	0.85, 7.40	0.10	1.18	0.34, 4.07	0.80
Substance use	6.44	2.15, 19.30	<0.01	2.72	0.75, 9.90	0.13
Mental illness	2.36	0.74, 7.50	0.14	1.06	0.28, 4.02	0.93
Testing site (not outpatient)	-	-	-	10.9	1.26, 94.01	0.03

ED, emergency department
*All variables used had p<0.05 in the single logistic regression.

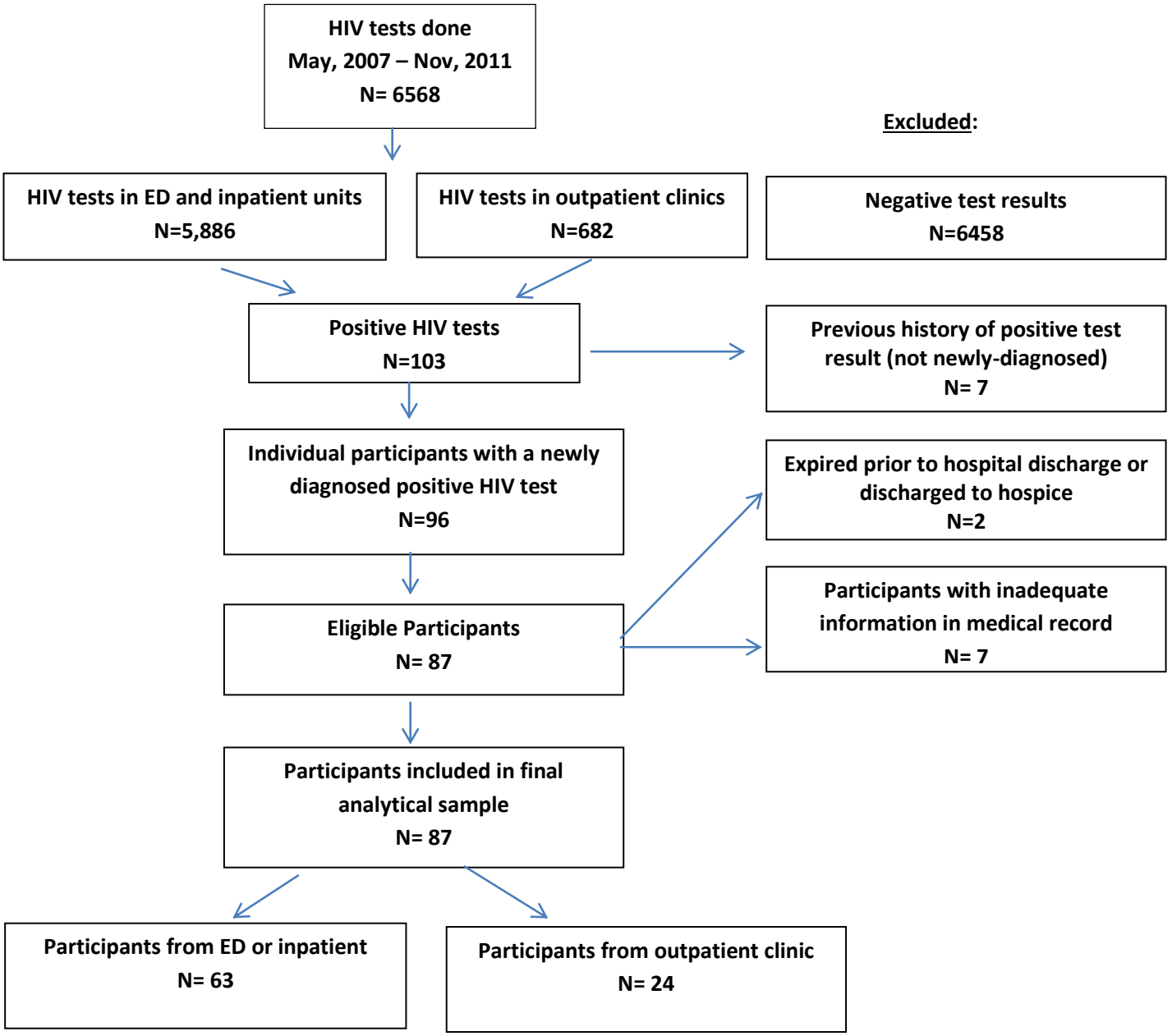

Figure. Subject disposition.
HIV, human immunodeficiency virus; *ED,* emergency department

28 (32%%) were given a follow-up appointment without meeting a representative from the HIV clinic. Those who met with an HIV representative at diagnosis were equally likely to fail to link to care (27.1% vs 28.6%, p=0.89). The ED patients linked to care at a similar rate (65%) as those who were inpatients (56%) (p=0.56).

DISCUSSION

In the present study, receiving a new HIV diagnosis in a hospital-based setting (inpatient unit or ED) as compared to an outpatient medical setting, was associated with failure to link to care. Overall, 72% of patients successfully linked to care following a new HIV diagnosis, while 28% did not link, which is similar to previous findings.[4] Nearly all patients (96%) from the outpatient setting linked to care, compared to 63% of patients from the hospital-based setting. Our findings are in contrast to those of a large meta-analysis, in which EDs and urgent care centers had higher linkage rates than community-based settings.[11] The community-based testing sites, however, were rather heterogenous, which makes a direct comparison between our findings difficult.

Our two populations differed in that patients who tested in the hospital-based setting were more likely than those who were tested in the out-patient clinic to be black, homeless, and use alcohol or drugs. Of these individual variables however, only being homeless was found to be significant in predicting linkage to care at the multivariate level. When testing site was controlled, unemployment and substance use were found to be associated with failure to link, which is consistent with previous work.[12-15] While female gender, racial/ethnic minority, lack of insurance, and mental illness have been identified as predictors of failure to establish HIV care in other studies[16-18] our evaluation did not show such a relationship. Other potential barriers, such as poverty, fear of death, stigma, and violence from a domestic partner,[16] were not specifically explored in our study, but such issues could have impacted why those who tested in the hospital were less likely to link to care.

Our results indicate that a health disparity may exist between those who access care in the ED and those who access care in the outpatient setting. Patients tested in the outpatient setting were presumably familiar with Drexel staff, accessing outpatient clinics, and following administrative procedures. It may be that this familiarity with the outpatient setting is an important factor in linkage to care, and may have fostered such success in linkage to HIV care compared to those tested in the hospital where there was no established relationship. Unfortunately, neither of the interactions that involved meeting of case managers or HIV consult service with newly-diagnosed patients from the ED or inpatient units appeared to impact rates of linkage to HIV care, suggesting that such "face-time" between patients and clinic staff was not sufficient to engage new patients. Our results demonstrate the acceptability and benefit of opt-out testing in an outpatient setting with 96% successful linkage to care. Additionally, the rate of linkage to care from the ED (65%) indicates that this setting has the potential to have successful linkages with enhanced interventions in place.

A sizable proportion of persons with HIV in the U.S. are not achieving successful HIV treatment due to failures at early steps along the HIV treatment cascade.[4] While entry into care after an HIV diagnosis, defined as a visit with an HIV care provider authorized to prescribe ART, has been associated with improved survival,[19] only 69% of those who know that they are infected with HIV are linked to care.[20] Efforts to link patients must address structural barriers identified in this study such as homelessness, unemployment, substance use, and mental illness. The International Association of Physicians in AIDS Care has developed guidelines for improving entry into and retention in care for persons with HIV. These guidelines recommend brief strengths-based case management interventions, intensive outreach for individuals not engaged in care within six months of a new HIV diagnosis, and use of peer patient navigators as a model of care coordination as ways to improve linkage and retention into HIV care.[21] In our study, we utilized case management and outreach personal to engage those with a new HIV diagnosis and those who missed appointments within six months of the new HIV diagnosis. While linkage rates were positive in this study, using strengths-based case management interventions and peer patient navigators may have further improved these rates. Strength-based case management encourages patient participation in setting treatment goals and works to resolve patient-identified barriers to treatment. [Substance Abuse and Mental Health Services Administration National Registry of Evidenced based programs and practices: Brief Strengths-Based Case Management http://www.nrepp.samhsa.gov/ViewIntervention.aspx accessed April 21, 2015.]

In this study, a high percentage of persons with a new HIV diagnosis had a diagnosis of AIDS (36%). The likelihood of having AIDS did not differ between the inpatient or outpatient setting, and having an AIDS diagnosis did not predict linkage to care. These results are consistent with U.S. numbers in that 32% of persons found to have HIV in 2008 received a diagnosis of AIDS within 12 months of their initial HIV diagnosis.[22] Late presentation for HIV medical care results in considerable morbidity and mortality with a 9-14 fold increased one-year mortality among patients with initial CD4 counts less than 200 cells/µl.[23] Our study demonstrates the importance of testing in medical settings in order to achieve more timely testing and linkage to care.[24]

LIMITATIONS

There are several limitations to this study that may limit the generalizability of the results. Because of the small sample size and low sero-positivity rate (1.46%), the actual number of individuals detected and included in the study is low. The final results may have differed if we

were able to include the seven excluded patients who had inadequate information in the medical records. We were also unable to determine if those patients who did not keep appointments at the co-located HIV clinic attained care at another HIV clinic or with a primary care provider, perhaps underestimating linkage rates. Additionally, there were differences in patient demographics between the outpatient and hospital-based testing groups, in particular there were higher rates of homelessness in the ED. This may have impacted the primary outcome of linkage to care between the two settings. It would be useful to know if those patients who were diagnosed at the hospital-based site had a primary care provider, so that barriers to testing could be further explored (ie: Why were they not tested in their clinics?). The number of participants from the outpatient clinics was smaller than the hospital-based participants. It would be beneficial for future studies to examine the linkage rate of the differing populations between the ED and the inpatient unit in order to explore interventions that may be unique to each of these setting. Additionally, future studies would benefit from a larger sample size to further clarify the role of the ED as an entry point to care.

Although the protocol for screening was an opt-out model, there may have been differences in the screening process at the different sites. For example, the low numbers of tests employed in the outpatient clinics bring into question the true employment of "opt-out" testing at these sites.

CONCLUSION

As the United States struggles with the challenges of successful linkage to care of newly diagnosed HIV individuals, models of testing in outpatient medical clinics need to be considered. The comparative success of 96% successful linkage to care in the outpatient medical setting as demonstrated in this study highlights the opportunity and benefit of routine opt-out testing in primary care practices. The coordination of personnel in the ED with co-located HIV clinics to facilitate linkage to care is recommended. Further research is needed to better understand perceived barriers that prevent effective linkage and engagement in care for this largely vulnerable population. To decrease the rate of HIV transmission in the U.S., increased HIV testing and linkage to care must be strengthened. The results from this study will inform and provide direction for future research in HIV linkage to care. To fully maximize the benefits of expanded HIV testing will require careful implementation, adaptation, and evaluation of linkage-to-care programs.

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How do Medical Societies Select Science for Conference Presentation? How Should They?

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Introduction: Nothing has been published to describe the practices of medical societies in choosing abstracts for presentations at their annual meetings. We surveyed medical societies to determine their practices, and also present a theoretical analysis of the topic.

Methods: We contacted a convenience sample of large U.S. medical conferences, and determined their approach to choosing abstracts. We obtained information from web sites, telephone, and email. Our theoretical analysis compares values-based and empirical approaches for scoring system development.

Results: We contacted 32 societies and obtained data on 28 (response rate 88%). We excluded one upon learning that research was not presented at its annual meeting, leaving 27 for analysis. Only 2 (7%) made their abstract scoring process available to submitters. Reviews were blinded in most societies (21;78%), and all but one asked reviewers to recuse themselves for conflict of interest (96%). All required ≥3 reviewers. Of the 24 providing information on how scores were generated, 21 (88%) reported using a single gestalt score, and three used a combined score created from pooled domain-specific sub-scores. We present a framework for societies to use in choosing abstracts, and demonstrate its application in the development of a new scoring system.

Conclusions: Most medical societies use subjective, gestalt methods to select research for presentation at their annual meetings and do not disclose to submitters the details of how abstracts are chosen. We present a new scoring system that is transparent to submitters and reviewers alike with an accompanying statement of values and ground rules. We discuss the challenges faced in selecting abstracts for a large scientific meeting and share the values and practical considerations that undergird the new system. [West J Emerg Med. 2015;16(4):543-550.]

INTRODUCTION

Medical research is usually first shared publicly as a summary, called an "abstract," presented at a scientific meeting. Abstract presentation is a crucial means by which the community exchanges information. Half of abstracts lead to formal publication.[1-2]

We became interested in abstract scoring during a planned update to the abstract scoring system of the Society for Academic Emergency Medicine. We began with a review of prior studies to determine how societies evaluated abstracts. Some prior research has evaluated scoring systems of individual societies according to inter-rater reliability.[3-7] Additional studies have investigated the validity and sensibility of specific scoring methods for

individual societies.[3,8] The value of blinding has been studied as well.[9] These approaches represent calibration of various measurement tools, and evaluation of individual scoring systems. But we were unable to identify any studies that compared procedures from one society to the next, or provided any descriptive overview of common practices.

This paper analyzes approaches to scoring abstracts for large medical conferences. The evaluation had an empirical component and a theoretical component. In the empirical portion, we surveyed a convenience sample of large U.S. medical societies to determine their approach to choosing abstracts for their annual meetings. In the theoretical portion of the study, we present a framework for understanding how a medical society might choose a scoring system. We present an example of how these empirical and theoretical considerations were used to develop a scoring system.

METHODS

Survey Methods

For the survey portion of the project, we contacted 32 medical societies, chosen at convenience and based on their attendance size. We chose the societies at convenience by reviewing a list of medical societies and choosing large societies that, in our opinion, would be relevant comparators.[10] We began with the list of the 50 largest medical conferences and eliminated ones that did not seem to be relevant comparators. For example, we included only academic medical conferences and excluded industrial conferences. We conducted a survey consisting of one qualitative and four quantitative data points: whether the scoring system was publicly available (vs. confidential), whether reviewers were blinded, whether reviewers could recuse themselves for conflicts of interest, the number of reviewers per abstract, and whether the final score represented a combined score created from pooled domain-specific sub-scores, or a single gestalt score. Study investigators chose these data points based on their pertinence and importance to the abstract scoring process. While there were many possible data to explore, we believe that when examined in aggregate, these data points provide a clear picture of how societies select abstracts at annual meetings.

We gathered data systematically. First, we examined each society's annual meeting website. When data were unavailable via the internet, we contacted societies via telephone and email to collect all remaining information. These phone calls and emails were typically directed towards the director or associate director of operations for the society's annual meetings. A specific telephone script or email template was not used, as we were merely trying to obtain the aforementioned five data points. We did not seek to infer population characteristics from the sample, and our sample was not random. Therefore, use of inferential statistics would not be appropriate, and we refrain from reporting confidence intervals or stochastic and inferential measures. We did not seek institutional review board review of this research project, as it was not human-subjects research. After data collection was complete, all surveyed societies were emailed this manuscript to confirm the accuracy of the data. We received responses from eight of the 27 (30%) with varying degrees of requested modification to our description of their approach to adjudicating abstracts.

Theoretical Portion of the Project

For the theoretical portion of the project, we worked with thought leaders to enunciate the criteria deemed relevant for the abstract selection process. We divided these criteria into value-based criteria and empirical criteria. We discuss the relative importance of value-based vs. empirical scoring systems.

Development of a Scoring System for the Society for Academic Emergency Medicine

We designed a scoring system that incorporated all value-based criteria, and report the criteria and the scoring system here. We also describe empirical criteria, though we have not yet applied them to the new scoring system. This effort was led by the Scientific Subcommittee of the Program Committee of the Society for Academic Emergency Medicine. In addition, various thought leaders who were prominent published researchers in the field and had previously provided feedback about the society's scoring processes also reviewed the developing criteria and provided their input. The end result was an informal consensus-building process.

RESULTS

Results of the Survey Portion of the Project

We surveyed 32 medical societies, and obtained data on 28 (response rate 88%). We excluded one of these societies because abstract presentations were not a part of their annual meeting, leaving 27 for analysis.

Table 1 displays the survey results. A minority of societies publish their scoring systems, with only 2 (7%) reporting that their scoring systems were available to submitters. In two cases (the American Heart Association's Scientific Sessions, and the American Diabetes Association's Scientific Sessions), the explicit scoring system are not made available, but submitters are informed regarding the domains used to evaluate their submission. The American Heart Association's Scientific Sessions uses four evaluation domains: scientific merit, organization, presentation, and technical quality. The American Diabetes Association's Scientific Sessions inform submitters that "originality of work, adequacy of data, and clarity of exposition" are evaluated during the selection process.

Reviews were blinded in most, but not all, societies (21 of 27, or 78%). In fact, we were interested to learn that the submitters' reputation is an explicit criterion for one society, which requested anonymity.

Table 1. Abstract selection by medical and scientific societies.

Conference	Scoring system publicly available?	Reviewers blinded?	Number of reviewers/ abstract	Recusal for conflict of interest?	Pooled domains or single gestalt?
American Academy of Dermatology	Yes	Yes	≥4	Yes	Single gestalt
American Academy of Family Physicians	No	Yes	8	Yes	Pooled domains
American Academy of Ophthalmology*	No	Yes	≥8	Yes	Single gestalt
American Academy of Pediatrics: Section on Emergency Medicine	No	Yes	5	Yes	Single gestalt
American Academy of Pediatrics: Section on Hospital Medicine	No	Yes	12	Yes	Single gestalt
American Association for Cancer Research Annual Meeting	No	No	4-5	Yes	Single gestalt
American Association of Neurological Surgeons	No	Yes	≥5	Yes	Single gestalt
American College of Cardiology	No	Yes	≥6	Yes	Single gestalt
American College of Emergency Physicians	No	Yes	≥3	Yes	Single gestalt
American College of Rheumatology	No	Yes	Did not disclose	Yes	Did not disclose
American Diabetes Association	No	Yes	6-7	Yes	Single gestalt
American Heart Association: International Stroke Conference	Yes	Yes	≥8	Yes	Single gestalt
American Heart Association: Scientific Sessions	No	Yes	8-10	Yes	Did not disclose
American Psychiatric Association	No	No	≥3	Yes	Single gestalt
American Public Health Association	No	Yes	≥3	Yes	Pooled domains
American Society of Anesthesiologists	No	No	3-4	Yes	Single gestalt
American Society of Clinical Oncology	No	Yes	4-11	Yes	Did not disclose
American Society of Hematology	No	Yes	6	Yes	Single gestalt
American Society of Nephrology - Renal Week	No	Yes	4	Yes	Single gestalt
American Speech-Language-Hearing Association	No	No	≥3	Yes	Single gestalt
American Thoracic Society - International Conference	No	Yes	5-15	No	Single gestalt
American Urological Association	No	Yes	3-5	Yes	Single gestalt
Digestive Disease Week (AGA, AASLD, ASGE, SSAT)	No	Yes	4.5	Yes	Single gestalt
Heart Rhythm Society - Scientific Session	No	Yes	≥3	Yes	Single gestalt
Infectious Diseases Society of America	No	No	3-5	Yes	Single gestalt
Radiological Society of North America**	No	Yes	≥3	Yes	Pooled domains
Society for Neuroscience	No	No	4-6	Yes	Single gestalt

AGA, American Gastroenterological Association; *AASLD*, American Association for the Study of Liver Diseases; *ASGE*, American Society for Gastrointestinal Endoscopy; *SSAT*, Society for Surgery of the Alimentary Tract

*The American Academy of Ophthalmology has a two-staged review. Five general reviewers conduct the first review, and the second review has 3 subspecialty reviewers that take the first-round score into account and make a final judgment in a conference call.

**The Radiological Society of North America allows the chairperson of each subspecialty to interpret his or her own grading scale. In other words, this society has a gestalt scoring system with the option to create a more nuanced, pooled domains system. The chairperson personalizes the scoring system based on the criteria and themes that are important to the subspecialty in any given year.

The number of reviewers per abstract varied, but all reported that each abstract is reviewed by ≥3 reviewers. The American Thoracic Society had the largest number of reviewers per abstract, ranging from five to 15. All but one of the societies asked reviewers to recuse themselves for conflict of interest (96%).

Regarding how scores are created, all but three of our respondents provided information on this. Of the 24 providing information on this topic, most (21, or 88%) reported using a single gestalt score. This ranged from a simple accept/reject vote (as with the Society for Neuroscience), to a 10-point scale (as with the American College of Cardiology).

The remaining three (12%) used a final score created from pooled domain-specific sub-scores. Some societies had different scoring systems for different areas of research (e.g. American Public Health Association), while other societies used a single scoring system for all areas of research (e.g. American Academy of Family Physicians). The scoring system of the American Public Health Association exemplified more complex approaches, and is summarized in Figure 1. The scoring system of the American Academy of Family Physicians exemplified a simple approach to creating a combined score from pooled domain-specific scores; they scored the following criteria and assigned them a score from 1 to 5: relevance to family medicine, originality/innovative nature of project or question, statement of purpose/goals, project description, evidence-based nature of content, validity of conclusions, and the impact on future work.

Results of the Theoretical Portion of the Project

In the theoretical portion of this project, we enumerated criteria that could be used to rank abstracts, and we explored other aspects of the abstract selection process. This theoretical work involved discussions among stakeholders. We enunciated potential criteria for abstract selection, and these are listed in Table 2, which divides them into values-based criteria and empirical criteria. Table 3 presents additional considerations that are relevant to the process.

Development of a Scoring System for the Society for Academic Emergency Medicine

Our consensus led to prioritization of the following values: transparency, fairness, practicality, reviewer qualification, and objectivity. Regarding the other two values listed in Table 2, ease of use and depth, we considered these to be functional opposites, which had to be balanced. In developing our criteria, we had to operationalize our chosen values. We operationalized transparency as public availability of the scoring system and its rationale; hence the present publication.

We operationalized fairness in two ways. First, we felt that reviewers should be blinded so that submissions would be judged on their merits, not based on fame or favoritism. This choice would also prevent bias against more-junior investigators, who are more often unknown to reviewers. Second, we felt that all methodological approaches should be valued equally. Thus, for example, randomized trials should not be given precedence over bench research or qualitative studies. Equal valuation of all methodological approaches was an easy value to enunciate but less easy to enforce with individual reviewers. We used two approaches to cultivate this aspect of fairness. First, we stated this value explicitly in our instructions to reviewers. Second, we developed the scoring criteria with a strategy that explicitly guided reviewers to assign ratings based on merits of the work, not choice of methods (Appendix).

We operationalized practicality by considering the context of the abstract scoring process. Many abstracts must be scored, and then, the accepted abstracts must be published. To facilitate the scoring of many abstracts, we designed a single scoring system that could be applied to any abstract by a qualified reviewer (in contrast to more complex systems, such as that shown in Figure 1). We also kept the scoring system fairly concise. As another effort toward practicality, we included a specific rating for publication readiness, which considers such things as clarity, grammar, and punctuation. The practical value of this for the society is obvious: after acceptance, each abstract must be converted into a publishable piece, and time is saved by starting with a good product.

We operationalized reviewer qualification by determining that each reviewer should have a reasonable degree of training or experience in medical research. This, in turn, was operationalized as having been first author of at least two peer-reviewed research papers, or having a non-clinical postgraduate degree such as MPH or PhD.

We operationalized the counterbalancing values of ease of use vs. depth by creating a scoring system that was capable of evaluating several dimensions of each abstract (i.e. domains), but was not unduly cumbersome to use. We strove to limit the scoring system to a one-page document.

Table 2. Criteria for the creation of scoring systems.

Value-based criteria	Empirical criteria
Transparency	Inter-rater reliability
Ability to accommodate plurality of opinion	Normality of score distribution
Fairness (no favoritism; equal consideration for all methodologies)	Time required to assign a score
Practicality	Generalizability of score from reviewers to conference attendees
Reviewer qualification	Popularity
Objectivity	Predictive value for an abstract resulting in a peer-reviewed publication
Ease of use	Predictive value for an abstract resulting in a grant
Depth	

Table 3. Other considerations in abstract presentation.

Additional Considerations
Does the society do anything to confirm that abstracts have not been presented previously?
Does the society do anything to seek undeclared conflicts of interest among reviewers?
Is there an initial system for "triaging" abstracts that do not require formal scoring?
Can reviewers return an abstract to the submitter for correction?
Is there a formal process for feedback about the scoring system?
Is the scoring system reviewed and updated according to any pre-specified schedule?

Operationalization of the concept of objectivity was perhaps most challenging. We felt that a rating system based on a single gestalt evaluation would be entirely subjective. In contrast, a score based on pooled domain-specific scores that were created with explicit ground rules would be relatively objective. Our literature review suggested that objective scoring systems demonstrate greater inter-rater reliability, although the extent to which inter-rater reliability is a goal in and of itself is debated below.[11-12]

Having arrived at these values and their operationalization, we set out to create a scoring system, and we now discuss how we reduced these ideas to practice in the creation of an actual document. An integral part of the scoring system was an introduction, which made the values explicit, and was directed at submitters and reviewers alike. The final result is shown in Appendix. The significance of this is that the scoring system is not presented in isolation, but instead comes with an enunciation of values and basic ground rules. By referencing the enhancing the quality and transparency of health research (EQUATOR) network (bottom of first page), it provides an avenue for further self-directed learning. Another noteworthy feature of the first page of this document is the explicit statement that some abstracts may be triaged for no further review.

The first characteristic of this document is its transparency. It begins by enunciating the values underlying the scoring process, and explicitly stating its goals. Next, it describes in detail the administrative process used to get the abstracts scored. It states explicitly what the criteria are for reviewer qualification.

Returning to the value of practicality discussed above, this document then moves on to explain the requirements of the target journal, *Academic Emergency Medicine*. Knowing the rules ahead of time makes the job easier for the submitters, and saves time for journal staff later. It also makes the abstracts more stylistically similar and thus easier for reviewers to adjudicate *en masse*.

The second page of the document provides the scoring system itself. It asks reviewers to assign zero, one, or two points for each of seven domains. This is largely self-explanatory but certain features merit emphasis. Each domain includes a title, followed by an explanation of what is most highly valued in the domain. This is followed by text that illustrates how a reviewer would arrive at a particular score. The wording of all of these segments is designed to be equally applicable to all research methodologies. The validity criterion goes farther, by providing not only general criteria that apply to all abstracts (in the first column on the far left), but also specific examples of how to score various types of research presentations. The statistics and scope scores are not applicable to certain study designs, and this is acknowledged and a "not applicable" option is provided. The final score is a proportion calculated from the points assigned divided by the maximum number of points. The denominator varies according to whether one or two "not applicable" selections are made.

The importance of the scope score may not be as self-evident as the other criteria. A large-scope study is one that has a large sample drawn from multiple locations. Our inclusion of a scope criterion means that a perfectly-designed and perfectly-executed single-center study will score lower than an equivalent multicenter study. Our decision to include this reflects our belief that large-scope studies have already been legitimized by the large funding streams and multiple involved parties necessary to make them happen, and are more likely to be published in the peer-reviewed literature. However, it is important to emphasize that the scope score would not trump the other scores: a large-scope study that was ill-conceived and invalid would still be outscored by a small-scope study of higher quality.

The last criterion is publication readiness. This reflects our value of practicality in developing the scoring system. Abstracts that are sloppy or contain many bizarre abbreviations will be penalized relative to their more-professional counterparts. As mentioned with regard to scope, this score would not trump other scores, and thus it functions as a discriminator at the margin, not an overall test of worth.

DISCUSSION

No prior research has described how science is selected at medical society meetings across the U.S. We surveyed a convenience sample survey of large U.S. medical conferences, and found that most medical conferences choose abstracts for presentation based on a process that is confidential, is subjective, and is based on a single gestalt rating.

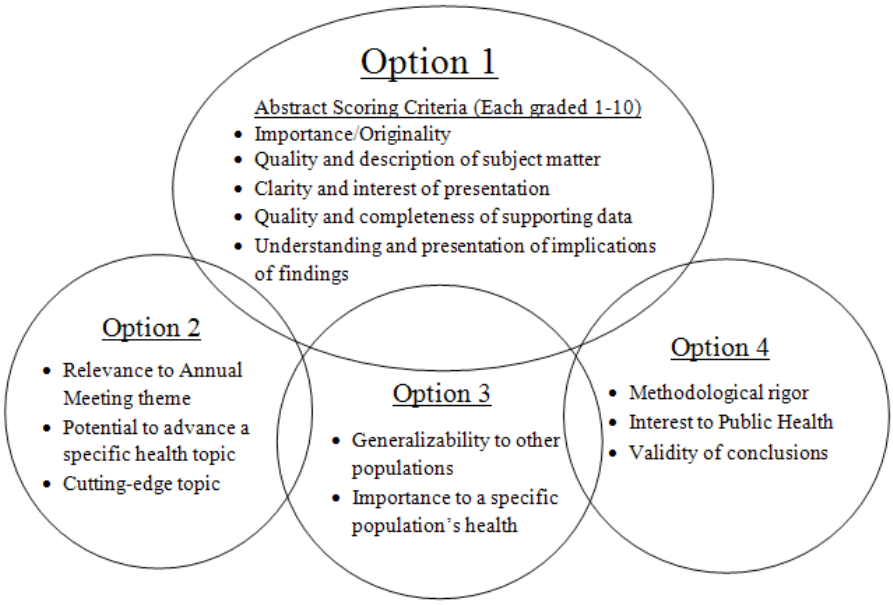

Figure 1. American Public Health Association annual meeting abstract scoring system.

While we conducted this survey, we also developed a theoretical framework for understanding how a medical society might decide how to rank and choose abstracts. Inter-rater reliability is a tempting metric for a scoring system due to its simplicity and objectivity. But this is deceptive because empirical criteria, such as inter-rater reliability, may be superficially relevant as well as prohibitively expensive to collect. More importantly, some empirical criteria may actually conflict with values. For example, it can be argued that reviewers will have different opinions regarding parameters like "importance of the science," and that thus scoring systems eliciting homogenous reviews would betray plurality of opinion. Similarly, normality of score distribution sounds attractive, but the reality may be that there are many poor-quality abstracts and few good ones, or some other non-normal distribution. Thus, over-emphasis on empirical/objective criteria can be naïve. Table 3 highlights related concerns. The first two points address the extent to which societies rely on an "honor system." We are aware of no society that routinely audits submissions for prior publication or reviewers for conflicts of interest. While this is understandable based on the difficulty of the proposition, we suggest that with the current modernization of computer technology and library science, cost-effective solutions might not be as far away as we think.

The third point addresses whether an abstract can face summary rejection, i.e. be "triaged." This use of the term "triage" derives from the National Institutes of Health, which scores some submitted grants but rejects some forthwith, in a process known colloquially as "triaging." Why would summary rejection be a desirable option? The simplest case would be an abstract that was submitted to the wrong conference. For example, a researcher might submit an abstract relating to the physics underlying magnetic resonance imaging (MRI) technology to an emergency medicine conference, thinking that MRI is part of the scope of emergency care. This type of misunderstanding regarding what is appropriate for the conference is likely to become more common as more and more international research is submitted to U.S. conferences. It would be unfortunate for 3 or more reviewers to spend time puzzling over such an abstract, and trying to score it.

The fourth point raised in Table 3 is one we did not address in our survey: whether two-way communication between submitters and reviewers is allowed. For example, most peer-reviewed journals have administrative staff who will notify submitters when a table is missing or formatting is incorrect. In contrast, our sense is that most medical conferences send submitted abstracts directly to the reviewers. In our proposed system, we have planned for the ability of a reviewer to return an abstract to the submitter when a remediable defect is identified.

The next point raised in Table 3 is whether submitters get any feedback. We did not include this question in our survey, but we assume most societies take the same stance on this issue as we do: there are simply too many abstracts to evaluate and there would be no practical way to provide constructive feedback to so many submitters. The last point in Table 3 is very mundane, but important. When should a medical society evaluate its selection process for scientific presentations at its meeting? Societies that value simplicity above all else can and will continue to use simple "yes/no" votes to select their abstracts. Other, more complex systems may have less longevity.

Abstract scoring does not take place in isolation, but rather is embedded in a context of practical consideration and values. We developed a system for scoring abstracts that is transparent, relatively objective, and based on domain-specific criteria (Appendix). We provide the scoring system

to submitters and reviewers alike, and introduce it with an explicit enunciation of the underlying values and expectations.

LIMITATIONS

The greatest difficulty underlying this discussion is the tension between values-based vs. empirical criteria. Given that our goal is to provide an ordered ranking of objects in a scientific domain, there is an obvious pull to use objective, scientific criteria. The most obvious objective empirical criterion to use to evaluate rating systems is inter-rater reliability, and this has been used previously to evaluate abstract scoring systems.[3-7] Inter-rater reliability is a standard metric in any medical research involving ratings. However, for the present purpose, its desirability as a criterion is mitigated by two considerations. The first is cost. Developing two or more systems and comparing them across multiple raters would be a significant research project in its own right. And where would this lead? After the study, would the documented inter-rater reliability be "good enough?" Would this change over time? Establishing and monitoring inter-rater reliability would be an expensive project and one with no clear endpoint. The second consideration is desirability. As discussed above, we strove to make our new scoring system objective, but it would be wrong not to acknowledge that it retains substantial subjectivity. It remains inevitable that criteria such as "importance" will be judged differently by different raters, and therefore inter-rater consistency would not be expected or desired. The dilemma raised is one of plurality versus homogeneity. We remain unsure as to whether this dilemma can be resolved with finality. Nevertheless, we would be interested to know more about the empirical performance characteristics of our scoring system, such as inter-rater reliability, normality of scores, and generalizability to other disciplines. The scope of the present effort was limited and these questions will have to be pursued in future projects. Furthermore, we acknowledge that there is, and can be, no objective gold standard for what is the best way to select abstracts for presentation. Part of the process is the simple appearance of fairness and objectivity, and for this reason we chose a system that was based upon scores within explicit domains, instead of choosing a gestalt system.

A theoretical limitation is that comparing societies from disparate medical specialties, ranging from nephrology to psychiatry, might be seen as arbitrary. However, in order to have a reasonably large sample of societies, it was necessary not to restrict our convenience sample to one specialty or a narrow group of similar specialties. Also, it bears mentioning that we were not studying the content of the societies' research, but rather the method by which the research was adjudicated.

CONCLUSION

We surveyed a convenience sample of large U.S. medical conferences, and found that most do not disclose their criteria to submitters. Most use a single subjective gestalt rating. Laudably, most valued avoidance of favoritism, although reputation was considered a relevant criterion by one society. We developed a scoring system that is transparent, anonymous, and user-friendly. Its objectivity is bolstered by its use of guided domain-specific scoring criteria. Practicality is maximized by clarity of ground rules, provision of a summary rejection procedure, and explicit information about what constitutes a publication-ready abstract.

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Validation of ICD-9 Codes for Stable Miscarriage in the Emergency Department

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Introduction: International Classification of Disease, Ninth Revision (ICD-9) diagnosis codes have not been validated for identifying cases of missed abortion where a pregnancy is no longer viable but the cervical os remains closed. Our goal was to assess whether ICD-9 code "632" for missed abortion has high sensitivity and positive predictive value (PPV) in identifying patients in the emergency department (ED) with cases of stable early pregnancy failure (EPF).

Methods: We studied females ages 13-50 years presenting to the ED of an urban academic medical center. We approached our analysis from two perspectives, evaluating both the sensitivity and PPV of ICD-9 code "632" in identifying patients with stable EPF. All patients with chief complaints "pregnant and bleeding" or "pregnant and cramping" over a 12-month period were identified. We randomly reviewed two months of patient visits and calculated the sensitivity of ICD-9 code "632" for true cases of stable miscarriage. To establish the PPV of ICD-9 code "632" for capturing missed abortions, we identified patients whose visits from the same time period were assigned ICD-9 code "632," and identified those with actual cases of stable EPF.

Results: We reviewed 310 patient records (17.6% of 1,762 sampled). Thirteen of 31 patient records assigned ICD-9 code for missed abortion correctly identified cases of stable EPF (sensitivity=41.9%), and 140 of the 142 patients without EPF were not assigned the ICD-9 code "632"(specificity=98.6%). Of the 52 eligible patients identified by ICD-9 code "632," 39 cases met the criteria for stable EPF (PPV=75.0%).

Conclusion: ICD-9 code "632" has low sensitivity for identifying stable EPF, but its high specificity and moderately high PPV are valuable for studying cases of stable EPF in epidemiologic studies using administrative data. [West J Emerg Med. 2015;16(4):551-556.]

INTRODUCTION

Early pregnancy failure (EPF), commonly known as miscarriage, is frequently diagnosed in the emergency department (ED).[1] In the United States, approximately 500,000 visits for vaginal bleeding during early pregnancy constitute 1.6% of all ED encounters each year, and recent trends have seen increasing numbers of ED visits nationally for symptomatic early pregnancy.[2] The use of national or population-based databases for studying EPF management is limited by the ability to identify patients presenting with different classifications of EPF, which ultimately can dictate the treatment options available to these patients.[3-4] Specifically, women presenting with cases of stable EPF, also known as missed abortion, are candidates for multiple treatment options, including expectant management, medical management, or uterine evacuation either at the bedside in the ED or as an outpatient.[5]

To date, International Classification of Disease, Ninth Revision (ICD-9) diagnosis codes have not been validated for identifying cases of missed abortion, where a pregnancy is no longer viable, but the cervical os remains closed. These women tend to be more stable than those presenting with inevitable or incomplete abortion, where an open cervical os and active bleeding may prompt providers to prioritize urgent medical or surgical options to abate bleeding or infection risks. The ability to identify patients presenting with this specific subclass of EPF would allow for quality improvement and research initiatives targeting this common condition. Additionally, whether emergency providers and billing coders diligently or correctly label patients' types of miscarriage (stable vs. inevitable vs. incomplete vs. complete abortion) has yet to be studied. Finally, the advent of the ICD-10 code classification system does not nullify the utility of future studies validating ICD-9 codes, as the medical field will undoubtedly continue to use large state- or government-sponsored databases of ICD-9 codes to retrospectively investigate clinical questions based on patient data coded during the ninth revision of the ICD system. Hence, ICD-9 codes continue to hold importance in the field of medical investigation. We therefore aimed to establish the ability of ICD-9 codes to identify patients with missed abortion in a single urban tertiary care hospital.

METHODS

Study Design and Data Sources

We completed a retrospective cohort study of patients who presented to the ED of a tertiary care urban academic center. Our goal was to determine the ability of diagnostic codes to identify patients presenting with stable non-viable pregnancy (i.e. missed abortion or stable early pregnancy failure) to the ED. We analyzed data from two perspectives in order to evaluate both the sensitivity and the positive predictive value (PPV) of ICD-9 code "632" for missed abortion in identifying stable miscarriages and retained products of conception following miscarriage.

We identified the population of interest from the hospital's electronic medical record (EMR) based on chief complaint and ICD-9 codes from patient encounters between June 1, 2011 and May 31, 2012, and performed chart reviews of these encounters.

Prior research has illustrated that emergency medicine residents and attending physicians can accurately determine gestational age in first trimester pregnancy using bedside ultrasound studies.[6] Estimated gestational age of pregnancy was determined by either an ultrasound evaluation conducted by an emergency medicine resident or attending physician at patient bedside, or by formal ultrasound completed by an ultrasound technologist with interpretation by a radiologist, where crown-rump length was correlated with gestational age based on averages of fetal size by weeks.

This study was approved by local institutional review.

Nomenclature and Definitions

The term fetal demise refers to the process by which embryonic tissue begins to develop but then loses viability or dies.[7] We defined missed abortion as pregnancy failure in patients with a previously identified pregnancy, a positive pregnancy test and a closed cervical os on bimanual exam, with the absence of fetal cardiac activity on ultrasound exam at six weeks or greater gestational age.[8] This definition of missed abortion diverges slightly from the textbook definition of missed abortion, which originated prior to ultrasound diagnosis and was defined as fetal demise recognized eight weeks prior without passage of products of conception, and where the use of the word 'missed' referred to an abnormal pregnancy where the uterus had missed that the intrauterine contents needed to be expelled.[3,7] In the absence of ultrasound, the only means of diagnosis was a discrepancy between uterine size and menstrual cycles.[7] With the current use of ultrasonographic parameters in diagnosing pregnancy failure, the textbook definition with recognized pregnancy failure eight weeks earlier is not commonly fulfilled, and ED visits are nevertheless coded as missed abortion with ICD-9 codes following a single visit.[9] Women with retained products of conception following a previously identified miscarriage were also included in our cohort.

Inclusion and Exclusion Criteria

We studied female patients ages 13 to 50 years presenting to the ED with early pregnancy failure. We excluded patients whose ultrasound examinations identified a fetal pole with gestational age less than six weeks (due to the difficult nature of definitively diagnosing a failed pregnancy this early), as well as women with pregnancies over 22 weeks gestation. Women whose cervical os status was not included in their patient record were also excluded, as absence of this information precluded the determination of whether the patient's miscarriage was imminent or in progress (open os), or stable (closed os). The presence of vaginal bleeding was not a determining factor for study eligibility.

Analysis

We performed a retrospective validation of ICD-9 code

"632" for cases of missed abortion. We first aimed to determine the sensitivity of the ICD-9 code "632" (code diagnosis includes missed abortion with fetal death before 22 weeks of completed gestation, and retained products of conception not following elective abortion) in correctly identifying patients with true cases of stable miscarriage or retained products of conception following miscarriage. We identified patients who presented to the ED with a chief complaint of "pregnant and bleeding" or "pregnant and cramping" from June 1, 2011 through May 31, 2012 and pulled their records from the EMR. Using a random number generator (randomization tool Research Randomizer 4.0 [Urbaniak, GC & Plous, 2013]), we randomly selected two months of patient visits for review. Once cases meeting the study definition of missed abortion were identified, we calculated sensitivity of ICD-9 code "632" for identifying true cases of stable EPF.

With the goal of determining the predictive value of using ICD-9 code "632" to accurately identify cases of stable EPF, we aimed to determine the PPV of ICD-9 code "632" in correctly identifying patients who presented with missed abortion or retained products of conception following miscarriage. We queried the EMR over the same 12 months to identify patients whose encounters were labeled with ICD-9 code "632." For this portion of the analysis, the limited number of charts labeled with ICD-9 code "632" prompted us to review 12 months of patient encounters instead of the random two-month sample that was used to evaluate the ICD-9 code's sensitivity and specificity. We reviewed these records to determine which patients had actual cases of stable EPF, as well as which pregnancy-related ICD-9 codes were used to code these patient visits. The PPV of ICD-9 code 632 for capturing cases of stable miscarriage or retained products was then calculated.

We considered our definition of missed abortion to be the standard against which the accuracy of the ICD-9 codes assigned to the patient encounters should be judged. Descriptive statistics were calculated. We used frequencies and proportions to summarize categorical variables and means, and interquartile ranges were used to summarize continuous variables. ICD-9 codes and true diagnoses were tabulated, and sensitivities, specificities and PPVs were calculated. We made all tabulations and calculations using Stata 12.0 (Stata Corporation, College Station, TX).

A single reviewer who uses the EMR in regular clinical practice trained a second reviewer to use the EMR and conduct chart reviews. Both reviewers evaluated patient charts and used a single template to record ICD-9 codes and ultrasound results with documented viability of pregnancy and cervical os status, and to categorize patients as either having a stable miscarriage or another type of pregnancy failure.

RESULTS

Sensitivity and Specificity Findings

A total of 1,762 women with chief complaints of "pregnant and bleeding" or "pregnant and cramping" presented to the ED over the 12-month period. Of these, 310 patient records (a random sample of 17.6%) were reviewed, and 173 patients met study criteria for stable early pregnancy failure. The majority of subjects were black, with an average age of 26 years (Table 1). Just under thirty percent of these patients had previously experienced at least one miscarriage. No patients were found to have multiple gestations, and 31.2% of patients had visited an ED for a pregnancy-related complaint within one month of presentation to our academic medical center.

Of the 173 patient records meeting study inclusion criteria, 31 charts were assigned the ICD-9 code "632" for missed abortion, and medical chart review revealed 13 of these patients to have actual cases of stable EPF (sensitivity=41.9%). Of the 142 patients who did not have stable miscarriages, 140 patients were assigned ICD-9 codes other than code "632" (specificity=98.6%). These findings are illustrated in Table 2.

The majority of patient charts were labeled with ICD-9 codes for unspecified hemorrhage in early pregnancy (38.9%) or threatened abortion (27.8%). Table 3 illustrates the ICD-

Table 1. General demographics of patients presenting with chief complaint of "pregnant and bleeding" for sensitivity and specificity analysis (n=173).

Variable	n (% or range)
Age, mean, years	26 (14-43)
Race	
Black	146 (84.4%)
Caucasian	8 (4.6%)
Latina	4 (2.3%)
Asian	11 (6.4%)
Arab	4 (2.3%)
Gravida, mean (±SD)	3.4 (±2.2)
Patients with at least one previous miscarriage	
Yes	51 (29.5%)
No	122 (70.5%)
Presence of vaginal bleeding*	
Yes	139 (80.3%)
No	33 (19.1%)
Unknown	1 (0.6%)
Estimated gestational age, mean (range)	9 weeks 2 days (21-122d)
Patients with emergency department visit to any hospital for pregnancy-related complaint within 1 month of presentation	
Yes	54 (31.2%)
No	119 (68.8%)

*Not all charts had presence of vaginal bleeding listed.

Table 2. Sensitivity and specificity findings.

	Patient presentation met definition of ICD-9 "632" code	
Patient encounter assigned ICD-9 code "632"	Yes	No
Yes	13	2
No	18	140
	Sensitivity=41.9%	Specificity=98.6%

ICD-9, International Classification of Disease, Ninth Revision
*Non-viable pregnancy or retained products of conception with closed cervix.

Table 3. Pregnancy-related ICD-9 codes for patients with missed abortion but whose chart was labeled with ICD-9 code other than "632" (n=18).

ICD-9 code	ICD-9 diagnosis	n (%) of missed abortion with ICD-9 code other than "632"
640.93	Unspecified hemorrhage in early pregnancy, antepartum condition or complication	7 (38.9%)
640.03	Threatened abortion	5 (27.8%)
631	Other abnormal product of conception	1 (5.6%)
633	Ectopic pregnancy	1 (5.6%)
634.9	Spontaneous abortion without mention of complications – unspecified stage	1 (5.6%)
640.83	Other specified hemorrhage in early pregnancy	1 (5.6%)
641.93	Unspecified antepartum hemorrhage, antepartum condition or complication	1 (5.6%)
649.53	Spotting pregnancy, antepartum condition or complication	1 (5.6%)

ICD-9, International Classification of Disease, Ninth Revision

9 diagnosis codes other than "632" that were assigned to patients who had actual cases of missed abortion.

Positive Predictive Value Findings

Of 1,762 women with chief complaints of "pregnant and bleeding" or "pregnant and cramping" presenting to the ED over the 12-month period, we identified 62 patient visits with ICD-9 code "632" for missed abortion. Fifty-two of these subjects were eligible for inclusion in the study, with nine excluded for lack of cervical os status mentioned in their record, and one whose pregnancy gestation was too young to determine viability via ultrasound and was therefore excluded. The majority of subjects were black, with an average age of 28 years (Table 4). Just under thirty percent of these patients had previously experienced at least one EPF, and 42.3% of patients had been seen at an ED for a pregnancy-related complaint within one month of presentation to our hospital.

Of the 52 study subjects whose visit was assigned ICD-9 code "632," 39 patients had stable miscarriages (PPV=75.0%), as illustrated in Table 5. Most patients whose charts were incorrectly labeled with ICD-9 code "632" actually had cases of incomplete abortion (53.9%), where an open cervical os indicates an active expulsion of products of conception (Table 6).

Table 4. General patient demographics for positive predictive value analysis (n=52).

Variable	n (% or range)
Age, mean, years	28 (17-44)
Race	
Black	41 (78.9%)
Caucasian	4 (7.7%)
Latina	2 (3.9%)
Asian	5 (9.6%)
Gravida, mean (±SD)	3.6 (±2.8)
Patients with at least one previous miscarriage	
Yes	12 (28.6%)
No	30 (71.4%)
Presence of vaginal bleeding*	
Yes	42 (80.8%)
No	9 (17.3%)
Unknown	1 (1.9%)
Estimated gestational age, mean (range)	9 weeks 4 days (39-122d)
Patients with emergency department visit to any hospital for pregnancy-related complaint within 1 month of presentation	
Yes	22 (42.3%)
No	29 (55.8%)
Unknown	1 (1.9%)

DISCUSSION

In this study we examined the ability of ICD-9 diagnostic codes to correctly identify patients with stable EPF. For patients presenting to an ED with symptomatic pregnancy, the ICD-9 code "623" for missed abortion, when defined as

Table 5. Positive predictive value analysis.

	Patient presentation met definition of ICD-9 "632" code		
Patient encounter assigned ICD-9 code "632"	Yes	No	
Yes	39	13	PPV=75.0%
No	0	0	NPV=not applicable

ICD-9, International Classification of Disease, Ninth Revision; *PPV*, positive predictive value; *NPV*, negative predictive value
*Non-viable pregnancy or retained products of conception with closed cervix.

Table 6. Pregnancy-related diagnoses and corresponding ICD-9 codes for patients without missed abortion but whose chart was labeled with ICD-9 code "632" (n=13).

ICD-9 Code	ICD-9 diagnosis	n (%)
634.91	Spontaneous abortion without mention of complications - incomplete	7 (53.9%)
634.92	Spontaneous abortion without mention of complications - complete	2 (15.4%)
633	Ectopic pregnancy	1 (7.7%)
637	Unspecified abortion, retained products of conception following abortion	1 (7.7%)
637.9	Abortion (complete, incomplete, inevitable or with retained products of conception)	1 (7.7%)
639	Genital tract and pelvic infection, including endometritis	1 (7.7%)

ICD-9, International Classification of Disease, Ninth Revision

vaginal bleeding or abdominal cramping in the setting of a previously recognized pregnancy, is only 41.9% sensitive for accurately identifying cases of stable EPF. Conducting research on missed abortions with administrative data where ICD-9 code "632" is used to identify patients therefore has the potential to grossly underestimate the true number of patients seen in EDs with this diagnosis. However, a specificity of 98.6% and a PPV of 75.0% indicate that researchers can identify true cases of stable miscarriage by ICD-9 code "632" with a low rate of false positives. As such, the varying treatments, responses to treatment and complications of stable EPF can be studied in large epidemiologic studies when identifying subjects by diagnostic codes.

To the best of our knowledge, there have been no validations of miscarriage-related ICD-9 codes within the field of emergency medicine. This study is important for future epidemiologic research as well as quality-improvement initiatives for EPF treated in the ED setting. The relevance of these initiatives increase as more hospitals adopt the practice of having obstetrician gynecologist consultants treat miscarriage with uterine aspiration at the patient bedside in the ED. Furthermore, numerous ICD-9 codes exist for varying types of EPF (Table 7), and the presenting symptoms, level of critical acuity, management options, and associated costs are varied.

The 41.9% sensitivity we found for ICD-9 code "632" in accurately identifying cases of stable EPF begs the question as to why the sensitivity was found to be so low. Table 3 illustrates that most cases where missed abortions were classified under ICD-9 codes other than "632" were coded with either "640.93" (unspecified hemorrhage in early pregnancy, antepartum condition or complication) or "640.03" (threatened abortion). One commonality among these diagnosis codes is that they do not require the care provider to commit to deeming a pregnancy non-viable. This is perhaps owing to either a knowledge gap that ED providers may have in parameters for diagnosing EPF, especially following a single ultrasound study, or potentially an

Table 7. Miscarriage-related ICD-9 codes.

ICD-9 code	ICD-9 diagnosis
631	Other abnormal product of conception
632	Missed abortion (early fetal death before 22 completed weeks of gestation), retained products of conception, not following spontaneous or induced abortion or delivery
634.9	Spontaneous abortion without mention of complications - unspecified stage
634.91	Spontaneous abortion without mention of complications - incomplete
634.92	Spontaneous abortion without mention of complications - complete
637	Unspecified abortion, retained products of conception following abortion
637.9	Abortion (complete, incomplete, inevitable with or without retained products of conception)
637.91	Unspecified abortion, without mention of complication - incomplete
637.92	Unspecified abortion, without mention of complication - complete
640	Threatened abortion
640.8	Other specified hemorrhage in early pregnancy
640.9	Unspecified hemorrhage in early pregnancy
641.93	Unspecified antepartum hemorrhage
646.83	Other specified complications of pregnancy
649.53	Spotting complicating pregnancy, antepartum condition or complication

ICD-9, International Classification of Disease, Ninth Revision

avoidance of making an EPF diagnosis owing to a perceived medical-legal risk of deeming a pregnancy failed if a provider is unsure of his or her abilities to do so. A third possibility is that emergency providers may leave the diagnosis of EPF to their obstetrician gynecologist consultants and may therefore document in a way that is non-committal with regards to the viability of the pregnancy. As this study was not designed to answer these questions, we can only postulate that these factors may have played a role in our findings, but more studies are needed to explore these possibilities.

LIMITATIONS

Our study has multiple limitations. We reviewed charts of patients whose pregnancies had been identified prior to presentation; therefore, our findings may not be representative of populations of women whose miscarriages are diagnosed in the ED. All ICD-9 codes in this study were assigned by medical coders after the patient encounters had come to a close. Though this limits the generalizability of the study findings to hospitals that do not use coders and instead have care providers select or determine the ICD-9 codes themselves, we assumed that there would likely be less variability between people who assign ICD-9 codes as a profession than between residents and attending providers. Our subjects were collected from a single institution, which may limit the generalizability of our findings to other hospitals, though our data may still be useful when considering other academic tertiary care EDs where medical coders assign ICD codes. For our computation of the sensitivity and specificity of ICD-9 code "632," we selected two months of patient visits out of a 12-month period, so it is possible that secular trends may have biased results. Additionally, by identifying patients for inclusion in the study on the basis of presenting with a chief complaint of either "pregnant and bleeding" or "pregnant and cramping," we likely missed a small number of cases of missed abortion in patients who presented to the ED without either of those chief complaints, which may have increased the sensitivity of our results. Including more symptoms associated with miscarriage, such as back pain or abdominal pain, could have afforded a more compete sample of miscarrying patients. This study illustrates the importance for emergency providers of performing and documenting an accurate cervical exam when appropriate, as cervical os status has implications for the management options available for different classifications of pregnancy failure. Finally, the inter-rater reliability of chart reviewers was not evaluated, which had the potential to bias results if one reviewer had stricter standards for determining a stable miscarriage. However, the definition of a missed abortion was objective and equal for both reviewers, which we believe tempered any subjectivity in determining cases of missed abortion.

CONCLUSION

The ICD-9 code "632" for missed abortion has a low sensitivity for identifying women with stable EPF, which limits its use in benchmarking the number of cases when using administrative databases. Another approach to identifying missed abortion using ICD-9 codes is therefore needed. However, the high specificity and moderately high PPV of ICD-9 code "632" for identifying women presenting to the ED with missed abortion illustrate its utility in identifying true cases of stable miscarriage, so that subsequent interventions and complications can be examined in future epidemiologic studies.

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Importance of Decision Support Implementation in Emergency Department Vancomycin Dosing

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Introduction: The emergency department (ED) plays a critical role in the management of life-threatening infection. Prior data suggest that ED vancomycin dosing is frequently inappropriate. The objective is to assess the impact of an electronic medical record (EMR) intervention designed to improve vancomycin dosing accuracy, on vancomycin dosing and clinical outcomes in critically ill ED patients.

Methods: Retrospective before-after cohort study of all patients (n=278) treated with vancomycin in a 60,000-visit Midwestern academic ED (March 2008 and April 2011) and admitted to an intensive care unit. The primary outcome was the proportion of vancomycin doses defined as "appropriate" based on recorded actual body weight. We also evaluated secondary outcomes of mortality and length of stay.

Results: The EMR dose calculation tool was associated with an increase in mean vancomycin dose ([14.1±5.0] vs. [16.5±5.7] mg/kg, p<0.001) and a 10.3% absolute improvement in first-dose appropriateness (34.3% vs. 24.0%, p=0.07). After controlling for age, gender, methicillin-resistant *staphylococcus aureus* infection, and Acute Physiology and Chronic Health Evaluation II score, 28-day in-hospital mortality (odds ratio OR 1.72; 95% CI [0.76-3.88], p=0.12) was not affected.

Conclusion: A computerized decision-support tool is associated with an increase in mean vancomycin dose in critically ill ED patients, but not with a statistically significant increase in therapeutic vancomycin doses. The impact of decision-support tools should be further explored to optimize compliance with accepted antibiotic guidelines and to potentially affect clinical outcome. [West J Emerg Med. 2015;16(4):557–564.]

INTRODUCTION

Vancomycin is a glycopeptide antibiotic that exhibits time-dependent killing. It has been used for more than five decades to treat resistant organisms, such as methicillin-resistant *Staphylococcus aureus* (MRSA), and in the empiric treatment for severe sepsis and septic shock. Efficacy is often predicted by the ratio of the area under the antibiotic concentration curve and the minimum inhibitory concentration of the infecting pathogen (AUC/MIC ratio). An AUC/MIC ratio of ≥400 with trough serum concentrations of 15-20mg/L are recommended to achieve clinical effectiveness and limit the development of resistant microorganisms.[1] MRSA

vancomycin treatment failures are occurring with increasing frequency, and vancomycin-intermediate *Staphylococcus aureus* (VISA) has emerged as a leading cause of vancomycin failures and poor clinical outcomes.[2-3]

Inappropriate vancomycin dosing is associated with the emergence of VISA.[4-6] Conventional dosing practices initiate vancomycin at 1000mg every 12 hours.[7] Due to the association of conventional dosing and subtherapeutic vancomycin trough levels, however, current guidelines advocate for weight-based dosing algorithms.[1,8]

The emergency department (ED) plays a critical role in the management of life-threatening infection.[9] There is also an increased awareness of the ED's role in antimicrobial initiation, with an increased interest in antibiotic stewardship beginning in the ED.[10] ED antibiotic initiatives include both appropriate usage and timely administration. Prior data suggest that ED dosing of vancomycin is frequently inappropriate, yet vancomycin administered in the ED is often continued into the inpatient course.[7,11] This suggests that the ED is highly influential on overall antibiotic therapy, regardless of dosing or indication appropriateness.[7] This practice pattern has the potential for developing antibiotic resistance, as organisms such as VISA are invariably associated with vancomycin exposure and subtherapeutic dosing strategies.[4]

Appropriate antibiotic selection and dose optimization is a prime determinant of outcome in critically ill patients.[12] ED clinical pharmacists improve appropriate antibiotic dosing, yet fewer than 5% of EDs have an ED-based pharmacist.[10,13] Therefore, an electronic medical record (EMR) based antibiotic stewardship strategy could be a generalizable intervention with a measurable effect on antibiotic selection and dosing across many EDs in the community.

The primary objective of this analysis was to assess the impact of an EMR intervention on vancomycin dosing accuracy in critically ill ED patients. We hypothesized that an EMR intervention would be associated with improvement in vancomycin dosing accuracy. Secondary objectives were to assess the impact of vancomycin dosing on mortality, hospital length of stay, acute kidney injury, and the impact of obesity on vancomycin dosing accuracy.

METHODS

Patients and Setting

This study was a retrospective before-after cohort study (March 2008–May 2009 [before] and November 2009–April 2011 [after]) conducted in the ED of a Midwestern academic Level I trauma center with an annual ED census of 60,000 patient visits.

Intervention

We included all patients treated with vancomycin in the ED and admitted to an intensive care unit. For patients who received vancomycin on multiple ED visits during the study period (2%), only the first visit was included in the analysis. The post-intervention period began after weight-based vancomycin dosing guidance was incorporated into computerized physician order entry (CPOE) to correspond to updated guidelines from the Infectious Diseases Society of America in 2009.[1,14] The EMR intervention included an automatic dose calculation tool included in the CPOE order, and an educational campaign (e-mail notification to all EM staff and a presentation by a research team member to EM residents and attending physicians) accompanied the rollout. The automatic dose calculation tool recommended a vancomycin dose of 20mg/kg actual body weight (as recorded in the medical record). The calculated dose was rounded to the nearest 250mg and did not recommend greater than 2 gram in a single dose (Figure 1). A six-month run-in period was excluded from analysis *a priori* to assure that all providers had time to acclimate themselves to the new automatic dose calculation tool.

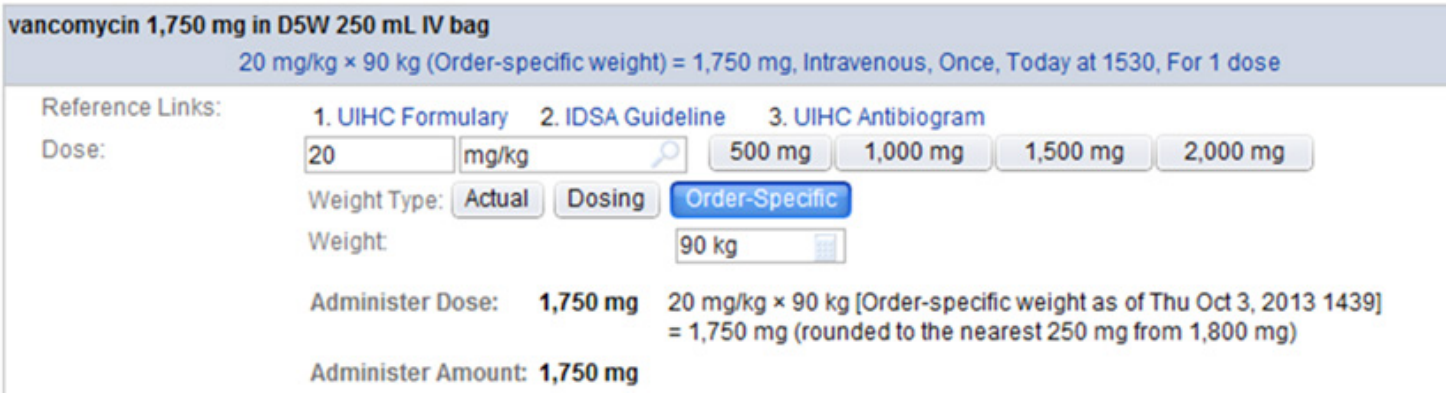

Figure 1. Revised order in EMR. Providers see the recommended dose based on the computer calculation. The computer recommended first dose is 20mg/kg actual body weight with maximum dose 2 grams.
EMR, electronic medical record; *IDSA*, Infectious Diseases Society of America; *UHC*, University Health System Consortium

Data Abstraction

We abstracted vancomycin dosing and clinical variables from the EMR using both database query and manual data collection by two trained data abstractors (KD, BP). The two data abstractors were blinded to the study hypothesis and received formal training in proper data abstraction techniques. After data abstraction, 15% of charts were randomly selected for review by a third independent investigator (BAF) to validate data accuracy and abstraction techniques. We defined all variables *a priori* and recorded them in an electronic database for analysis.

Definitions

Appropriate vancomycin dose was defined as 15-20mg/kg in accordance with guideline recommendations.[1] We based obesity categorization on the definitions by the World Health Organization as underweight (body mass index (BMI) <18.5), normal (18.5-24.99), overweight (25.0-29.99) and obese (≥30).[15] Mortality was assessed at 28 days after hospital admission. Subjects discharged alive before 28 days were coded as alive. We defined acute kidney injury as increase in serum creatinine by 0.3mg/dL within 48 hours or increase to 1.5 times baseline.[16] We calculated Acute Physiology and Chronic Health Evaluation II (APACHE-II) scores based on clinical data collected within 24 hours of hospital admission. Parameters not recorded were imputed to be normal for the purposes of APACHE-II calculation. Vancomycin levels were collected during each patient's hospital stay.

Outcomes

The primary outcome was the proportion of vancomycin doses defined as "appropriate" based on recorded actual body weight. Secondary outcomes included 28-day in-hospital mortality, hospital length of stay and acute kidney injury (safety outcome). We also measured the impact of obesity and the sustained effect of the intervention (stratified in four-month intervals). Overweight and obese patients who received the maximum dose of 2 gram were categorized in the "appropriate" group even though the calculator recommended larger doses based on the actual weight.

We conducted univariate analysis using t-test, chi-squared test, or ANOVA, as appropriate. Multivariable logistic regression analysis was used to estimate the effect of the EMR intervention on 28-day in-hospital mortality, controlling for potentially confounding covariates (age, sex, MRSA, BMI, APACHE II score, acute kidney injury, vasopressor administration, mechanical ventilation and history of hemodialysis). We prespecified variables included in the model based on *a priori* knowledge and defined a statistical threshold of $p<0.20$. Collinearity and statistical interactions were measured. All tests were two-tailed and a p-value <0.05 was considered statistically significant. We conducted all analyses using SAS® software (version 9.3, SAS System for Microsoft, SAS Institute Inc., Cary, NC, USA). The institutional review board approved the study protocol.

RESULTS

We included 278 subjects in the study (Figure 2).[17] Baseline characteristics are shown in Table 1. Mean vancomycin dose increased after the intervention ([14.1±5.0] vs. [16.5±5.7]mg/kg, $p<0.001$). First-dose appropriateness increased from 24.0% to 34.3%, $p=0.07$. Overall, 30.6%

Table 1. Patient demographics, outcomes and vancomycin dosing before and after an electronic medical record intervention.

		EMR intervention		
	Total	Before	After	p-value
Total, n(%)	278	100 (36.0)	178 (64.0)	
Age, y (SD)	57.2 (17.7)	57.5 (17.5)	57.1 (17.8)	0.85
Male, n(%)	172 (61.9)	58 (58.0)	114 (64.0)	0.32
BMI, kg/m^2 (SD)	30.1 (13.1)	31.9 (18.8)	29.1 (9.0)	0.18
APACHE II, score (SD)	17.7 (5.3)	17.8 (5.4)	17.6 (5.2)	0.84
Vancomycin dosing				
Total, mean (SD)	1253.6 (381.2)	1115 (283)	1331.5 (407)	<0.0001
mg/kg, mean (SD)	15.7 (5.6)	14.1 (5.0)	16.5 (5.7)	0.0003
Patients given 1 gram, n(%)	166 (59.7)	84 (84.0)	92 (51.7)	<0.0001
Appropriate dose, n(%)	85 (30.6)	24 (24.0)	61 (34.3)	0.0745
MRSA in culture, n(%)	29 (10.4)	5 (5.0)	24	0.03
Acute kidney injury, n(%)	90 (32.4)	34 (34.0)	56	0.66
28 day in-hospital mortality, n(%)	40	10 (10.0)	30	0.12

EMR, electronic medical record; *APACHE*, acute physiology and chronic health evaluation; *MRSA*, methicillin-resistant *Staphylococcus aureus; BMI*, body mass index

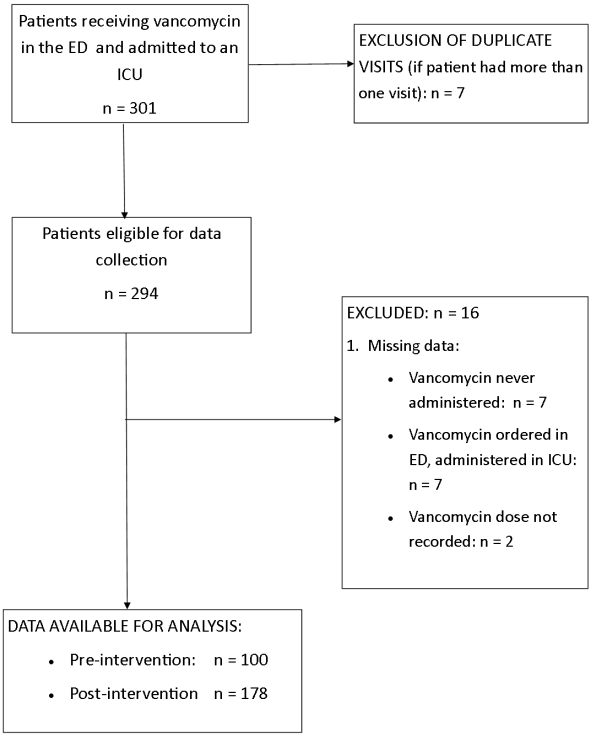

Figure 2. Pre- and post-intervention vancomycin administration and eligible patients for analysis flow diagram.
ICU, intensive care unit

of patients received an appropriate dose (Table 2). The proportion of patients receiving a dose of 1g decreased (84% vs. 52%, p<0.001). Vancomycin trough levels were obtained in 157 patients (56%), and median trough levels did not change during the study period (13.3, IQR [10.6-22.4]) vs. 13.8, IQR [9.4-18.3], p=0.59)

Twenty-eight day mortality (10.0% vs. 16.9%, p=0.12) did not change with the intervention. In univariate analysis, mortality was not associated with the intervention period (Table 3). Using multivariable logistic regression to adjust for age, sex, MRSA infection status, and APACHE-II, 28-day mortality was not associated with the EMR intervention (adjusted odds ratio 1.72 [0.76-3.88], p=0.12). The intervention did not significantly increase the risk of acute kidney injury in the post intervention group (34.0% vs. 31.5%, p=0.66). The appropriateness of the vancomycin dose did not have a significant effect on hospital length of stay for the pre- and post-intervention groups (Table 2).

Obesity had a significant effect on the appropriateness of vancomycin dosing (Figure 3). Overweight (55.2% vs. 34.1%) and obese (63.6% vs. 34.1%) subjects were more likely to be underdosed (p<0.0001), and no underweight patients were underdosed. Underweight patients were more like to receive an inappropriately high dose than the normal weight patients (72.7% vs. 28.6%, p<0.0001).

The prevalence of MRSA identified as an infectious agent from a blood culture or bronchoalveolar lavage increased between study periods from 5.0% to 13.5% (p=0.03). Among subjects without MRSA, neither inappropriately low nor high doses were associated with survival (Table 3).

DISCUSSION

As a recommended therapy for critically ill patients with life-threatening infection, vancomycin is frequently administered in the ED. Although other investigators have examined the role of vancomycin dosing on clinical outcomes, our study evaluated systematically the effect of an EMR intervention on the clinical outcome of patients admitted from the ED to an intensive care unit. This is an important finding because it highlights both the role of quality improvement initiatives and their unintended consequences on clinical outcomes.

In our cohort, the EMR intervention increased the dose of vancomycin (14.1±5.0mg/kg vs. 16.5±5.7mg/kg, p<0.0001). The increase in the mean vancomycin dose was relatively small; however, the proportion of patients who received a dose recommended by Infectious Diseases

Table 2. Patient demographics and outcomes by appropriateness of vancomycin dose (n=278).

	Appropriateness of vancomycin dose			
	Underdosed (n=138)	Correct (n=85)	Overdosed (n=55)	p-value
Age, y (SD)	60.9 (16.1)	54.8 (16.8)	51.8 (20.7)	0.0015
Male, n(%)	93 (67.4)	41 (48.2)	38 (69.1)	0.0078
BMI, kg/m^2 (SD)	32.9 (12.9)	28.3 (9.2)	25.9 (16.8)	0.0015
APACHE II, score (SD)	18.2 (5.1)	17.1 (5.2)	17.1 (5.7)	0.22
Acute kidney injury, n(%)	47 (34.0)	28 (32.9)	15 (27.3)	0.66
Post-EMR intervention, n(%)	72 (52.2)	61 (71.8)	45 (81.8)	0.0001
Length of stay, days (SD)	11.5 (13.7)	11.2 (11.5)	9.5 (9.3)	0.56
28 day in-hospital mortality, n(%)	18 (13.0)	13 (15.3)	9 (16.4)	0.81

APACHE, acute physiology and chronic health evaluation; *EMR,* electronic medical record; *BMI*, body mass index

Table 3. Unadjusted and adjusted odds of 28-day in-hospital mortality among patients receiving vancomycin (n=278) and adjusted odds of 28-day in-hospital mortality among those without methicillin-resistant *Staphylococcus aureus* (MRSA).

	28-day in-hospital mortality				
	No[1]	Yes[2]			
	n (%)	n (%)	p-value[3]	OR (95% CI)	Adjusted OR (95% CI)[5]
Age, y [SD]	56.0 [17.5]	64.7 [17.1]	0.0040	1.03 (1.01-1.05)	1.03 (1.01-1.06)
Sex					
Female	96 (40.3)	10 (25.0)	0.06	1.0 (ref)	1.0 (ref)
Male	142 (59.7)	30 (75.0)		2.03 (0.95-4.34)	2.29 (1.02-5.14)
MRSA					
No	213 (89.5)	36 (90.0)	0.92	1.0 (ref)	1.0 (ref)
Yes	25 (10.5)	4 (10.0)		0.95 (0.31-2.89)	0.76 (0.24-2.41)
BMI, kg/m^2 [SD]	30.4 [11.8]	28.1 [19.4]	0.47	0.98 (0.94-1.02)	
SBP, mmHg [SD]	115.7 [29.3]	113.9 [34.6]	0.73	1.0 (0.99-1.01)	
APACHE II, score [SD]	17.4 [5.4]	19.2 [4.4]	0.05	1.07 (1.00-1.14)	1.04 (0.96-1.11)
Acute kidney injury					
No	165 (69.3)	23 (57.5)	0.14	1.0 (ref)	
Yes	73 (30.7)	17 (42.5)		1.67 (0.84-3.31)	
Vasopressors					
No	213 (89.5)	33 (82.5)	0.20	1.0 (ref)	
Yes	25 (10.5)	7 (17.5)		1.81 (0.72-4.51)	
Intubation					
No	201 (84.5)	29 (72.5)	0.06	1.0 (ref)	
Yes	37 (15.5)	11 (27.5)		2.06 (0.95-4.48)	
History of dialysis					
No	221 (92.9)	39 (97.5)	0.49[4]	Unable to calc	
Yes	17 (7.1)	1 (2.5)			
Post-EMR intervention					
No	90 (37.8)	10 (25.0)	0.12	1.0 (ref)	1.0 (ref)
Yes	148 (62.2)	30 (75.0)		1.82 (0.85-3.91)	1.72 (0.76-3.88)
Appropriate vancomycin dose					
Underdosed	120 (50.4)	18 (45.0)	0.81	0.83 (0.38-1.80)	0.60 (0.26-1.41)
Correct	72 (30.3)	13 (32.5)		1.0 (ref)	1.0 (ref)
Overdosed	46 (19.3)	9 (22.5)		1.08 (0.43-2.74)	0.88 (0.33-2.37)
Vancomycin dosing					
Total, mean [SD]	1260.5 [384.8]	1212.5 [360.5]	0.46	1.0 (0.999-1.001)	
Mg/kg, mean [SD]	15.5 [5.6]	16.6 [5.2]	0.24	1.04 (0.98-1.10)	

APACHE, acute physiology and chronic health evaluation; *EMR,* electronic medical record; *BMI*, body mass index
Brackets denotes standard deviation. Parenthesis denotes percentage.
[1]n=238.
[2]n=40.
[3]Chi-square test for categorical variables and student's t-test for continuous variables.
[4]Fisher's exact test.
[5]Model is adjusted for all variables that have an adjusted odds ratio reported.

Society of America (IDSA) guidelines increased in the post-intervention group. Sixty-six percent of patients received a dose recommended by the algorithm but outside the IDSA-recommended vancomycin range because the rounding pushed doses inappropriately high for some patients. Even though we decreased "traditional" (1 gram) dosing, a button on the vancomycin order still permitted easy prescribing of this dose, so the rate of traditional dosing still remained over 50%.

The only clinical predictor that had a significant effect on vancomycin dosing in the post-intervention group was patient weight. Overweight and obese patients were more likely to be underdosed. This occurred even with our analysis categorizing overweight and obese patients as receiving the "appropriate" dose if they received the maximum 2 gram dose even though the calculator recommended a higher dose based on their actual body weight. Another factor

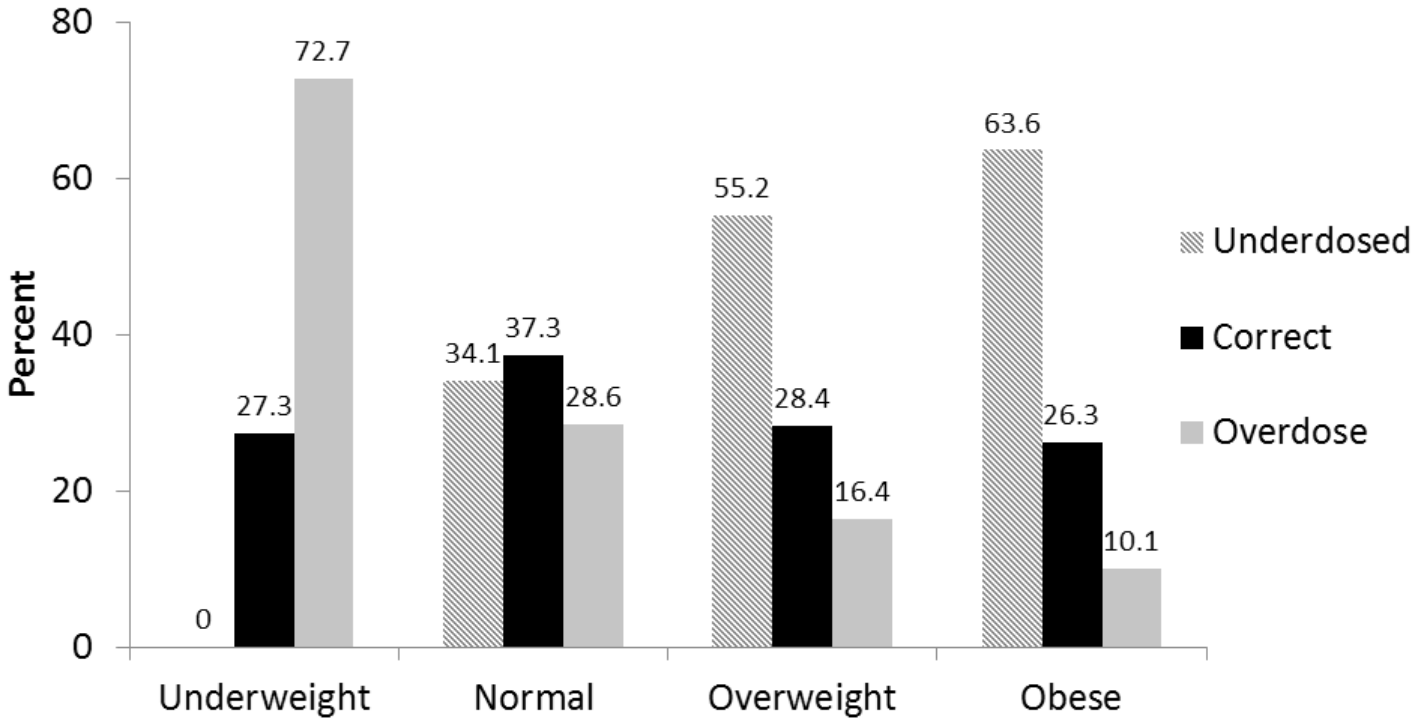

Figure 3. Appropriateness of vancomycin dose by patient weight.

contributing to underdosing may be the fear of nephrotoxicity. A main objective of vancomycin dosing is to achieve therapeutic trough levels rapidly. A recent meta-analysis reported the incidence of nephrotoxicity between 5% and 43%, and suggested that the rate is low without concomitant administration of other nephrotoxins.[18] In our patient population, increased patient weights led to unreliable dosing.

The EMR intervention increased the dose of vancomycin but failed to have significant effects on clinical outcomes. The increased dose in the post-intervention group did not have a significant effect on mortality, hospital length of stay or increase the risk of acute kidney injury. There was a trend towards increased mortality in the post-intervention group (as reported in a prior study) but this did not reach statistical significance.[7]

One of the most speculative aspects of our study is the association of mortality with a change in drug dosing. A prior study suggested that higher vancomycin dosing was associated with higher mortality.[7] Two interpretations of this observation are possible: either sicker patients were treated with higher doses (bias), or vancomycin actually impairs survival among patients without vancomycin-treated infection. Interestingly, most reports of increased effectiveness of aggressive vancomycin dosing enroll only patients with documented vancomycin-susceptible infection (e.g., MRSA).[8,20] If vancomycin improves survival among MRSA patients but harms patients without MRSA, the population prevalence of MRSA would be the primary determinant of effectiveness in a study. Furthermore, such a model would suggest that vancomycin only benefits population survival if the local incidence of MRSA exceeds a threshold. Although our study does not confirm the prior finding, it was not powered to detect a difference in mortality.[7] The nonsignificant effect estimate, however, closely mirrors the effect size of increased mortality with higher vancomycin dosing in the previous study. The before-after methodology of this analysis better limits the potential for bias. Based on these data, it is imperative that real time diagnostics are developed to avoid exposure to unnecessary therapies in critically ill patients.

Instituting an EMR intervention can significantly decrease dosing errors and improve compliance with recommended dosing.[21] However, EMR interventions can also have unintended consequences, including dosing errors. An unintended effect of our intervention was that it increased the proportion of patients receiving a dose higher than recommended. Fortunately, the higher doses did not result in an increase in adverse events. In our study, administering modestly higher doses did not increase acute kidney injury, but inpatient dosing regimens were not characterized.

LIMITATIONS

Our study has several important limitations. First, this was a retrospective data analysis, which introduces a risk of bias due to poor documentation or incomplete information. We selected variables that would have been available at the time of the ED visit and were likely to be documented accurately in the EMR. Even with these

measures, some relevant factors may not have been captured. Second, our study was carried out at a single center with a relatively low risk of MRSA. The prevalence of MRSA in our study did increase between study periods, which is consistent with other reports in the United States.[22] Since the primary outcome was provider behavior, our findings are likely valid.[6] Third, we used a run-in design which excluded a six-month time frame used for education for the EMR intervention and a systematic shift to weight-based dosing. By excluding this time frame we could have underestimated early adverse effects of the clinical change. Fourth, we were unable to gauge appropriateness of the indication for vancomycin in our ED. One study evaluated the appropriateness of vancomycin in the ED and found that 40% of the patients in the study did not warrant vancomycin administration.[6] Last, based on the recommendations from the IDSA clinical practice guideline for the treatment of MRSA, we elected to cap the dose of vancomycin at 2 grams for all patients in the intervention group.[14] Vancomycin pharmacokinetics (volume of distribution, protein binding, and clearance) can be altered in obese patients; however, the variability does not mean that obese patients require higher total daily doses to attain target trough concentrations.[23-24]

CONCLUSION

In conclusion, the prevalence of therapeutic vancomycin dosing (goal 15-20mg/kg actual body weight) did not change after the implementation of a decision support system and an automated EMR dose calculator. Higher vancomycin dosing post-intervention was not associated with acute kidney injury or 28-day in-hospital mortality. Additional specific decision-support interventions (including removing the option to select non-recommended dosing) should be explored to further increase compliance with accepted guidelines to improve antibiotic dosing practices in the ED.

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Point-of-care Ultrasound to Identify Distal Ulnar Artery Thrombosis: Case of Hypothenar Hammer Syndrome

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Hypothenar hammer syndrome (HHS) is a rare condition of distal ulnar artery injury and thrombosis secondary to repetitive blunt trauma to the hypothenar area. We present a case of HHS for which point-of-care ultrasound (POCUS) was used as the initial means of imaging, prompting management and disposition without further imaging studies ordered in the emergency department (ED). This case demonstrates the utility of POCUS to aid the Emergency Physician in the diagnosis and management of patients with extremity vascular issues in the ED, and details a rarely seen clinical entity in the ED. [West J Emerg Med. 2015;16(4):565-567.]

INTRODUCTION

First described by Von Rosen in 1934 and coined by Conn et al. in 1970, hypothenar hammer syndrome (HHS) is a rare condition of distal ulnar artery injury and thrombosis secondary to repetitive blunt trauma to the hypothenar area.[1-2] The condition typically occurs in middle-age men with occupations that expose the hand to repeated trauma.[3] Affected patients present with signs and symptoms of hypoperfusion to digits perfused by ulnar artery branches (digits 3-5). We present a case of a patient with distal ulnar artery thrombus diagnosed by point-of-care ultrasound (POCUS) in the emergency department (ED), ultimately determined to be most consistent with a case of HHS. Treatment and disposition were determined based on POCUS imaging alone, without additional studies ordered through the ED.

CASE REPORT

A 27 year-old man with a history of endocarditis and mechanical aortic valve replacement presented to the ED with a chief complaint of numbness and coldness to his right 4th and 5th digits for 2 weeks. The patient reported his symptoms started by noting a painful area of swelling to his right hypothenar area, followed over the course of the next week by development of the numb and cold sensations to his 4th and 5th digits. The swelling had since resolved, but the hypothenar area was still painful. The patient denied trauma to the area or a history of similar symptoms in the past. The patient reported inconsistent compliance with taking warfarin for his mechanical valve. The patient's social history was significant for smoking tobacco and working as a mechanic; he denied current recreational drug use. The patient denied significant family medical history. On exam, the patient's 4th and 5th digits were pale, cool to the touch, and exhibited prolonged capillary refill. The patient also reported decreased sensation to the affected digits. A 2x2mm eschar area was noted to the distal 4th digit on the volar surface. No other digital lesions, petechiae, or nodules were noted. The hypothenar area on the affected hand was tender to touch, although no swelling was appreciated. A loud S2 click was audible on cardiac auscultation; no additional murmurs were appreciated. Vital signs were notable for a temperature of 38.3°C and tachycardia to 110 beats per minute. The remainder of the exam was unremarkable.

Blood work sent was remarkable for a mild leukocytosis of 12.9 x10^9/L and a subtherapeutic international normalized ratio (INR) of 0.9. A POCUS of the right distal ulnar artery was performed using a high frequency linear transducer and noted an area of mixed echogenicity within the lumen of the ulnar artery extending from the ulnar-carpal junction into the hypothenar area, suspicious for occlusive thrombus (Figure 1). The vessel was noted to retain compressibility proximal to the mixed echogenic focus, but it was incompressible over the area of the

suspected thrombus. Color Doppler confirmed a lack of flow at the area of suspected thrombosis (Figure 2, Video). Based on the clinical and POCUS findings, Hand Surgery was consulted and the admitting Medicine team was notified. Both services agreed with the diagnostic finding of ulnar artery thrombosis and appreciated the need for further evaluation into its etiology on the inpatient service. In the ED, the patient was started on a heparin infusion and antibiotics until recurrent endocarditis could be ruled out. The following day, the patient underwent a computed tomography angiogram (CTA) of the right upper extremity which confirmed localized thrombus at the ulnar artery at the level of the carpals with diminished flow to the 4th and 5th digits. A transesophageal echocardiogram was also performed which noted no valvular vegetative lesions. Blood cultures remained negative for growth after 48 hours. Following the patient's inpatient evaluation and supported by the patient's occupational history of being a mechanic, the clinical scenario was determined to be consistent with HHS. Interventional Radiology was consulted who recommended no immediate intervention as the patient exhibited no evidence of progressive or severe ischemia. The patient resumed his home dose of warfarin, was started on aspirin and nifedipine, was advised to stop smoking, and was discharged for outpatient follow up. At his first appointment 2 weeks after discharge, the patient reported no worsening of his symptoms, and was recommended to continue medical therapy and follow up in 4-6 weeks. The patient did not keep his next appointment.

DISCUSSION

HHS is a rare syndrome of digital ischemia caused by damage to and thrombosis of the distal ulnar artery as it courses through Guyon's canal and around the hook of the hamate bone.[3-4] The damage to the artery typically results from recurrent blunt trauma to the hypothenar area of the hand. HHS predominantly occurs on the dominant hand of middle-age men.[5] Certain occupations pose a particular risk to the development of HHS, including individuals working as auto mechanics, blacksmiths, metal workers, and butchers.[5] It has also been noted in athletes that expose the hand to repeated trauma (e.g. hockey, softball, football, badminton).[6-8] Affected patients typically complain of symptoms of pain, numbness, tingling, cold intolerance, and weakness of their 3rd-5th digits.[3,9] Signs of HHS may include digital pallor, cyanosis or mottling, a palpable hypothenar mass (representing thrombus), atrophy of distal finger pads, and fingertip findings, such as splinter hemorrhages, ulcerations, and gangrene.[10] The male predominance, occupational exposure, and asymmetric distribution help to distinguish it from other vascular disorders (i.e. Raynaud's phenomena, thoracic outlet obstruction, arterial emboli).[3] Management for mild cases is largely supportive including lifestyle modification (i.e. smoking cessation, using gloves during work), antiplatelet and anticoagulant medications, and calcium channel blockers to reduce vasoconstriction.[3,10] More severe cases or those that fail conservative management may require operative repair including vessel resection with ligation, grafting, or thrombolysis.[3]

Allen's test can be useful to assess for ulnar artery patency when evaluating for HHS, although has been reported to be normal in up to 14% of cases.[3] Arteriography is considered the traditional "gold standard" for diagnosis, often noting a characteristic "corkscrew" appearance of the affected portion of the artery as it courses along the hook of the hamate, and may be useful for operative planning.[3] However, its invasiveness and high cost make it impractical to order as the initial test for evaluation. Therefore, CTA and Ultrasound are the primary imaging modalities used for evaluation of HHS. While CTA provides excellent imaging of the artery and can be useful to assess digital perfusion, drawbacks include higher cost

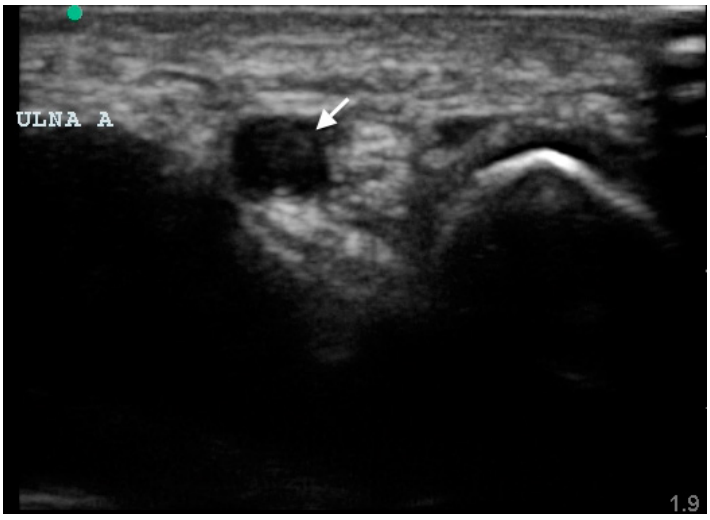

Figure 1. Ultrasound image of the distal ulnar artery in transverse plane noting echogenic thrombus (arrow) within the vessel lumen.

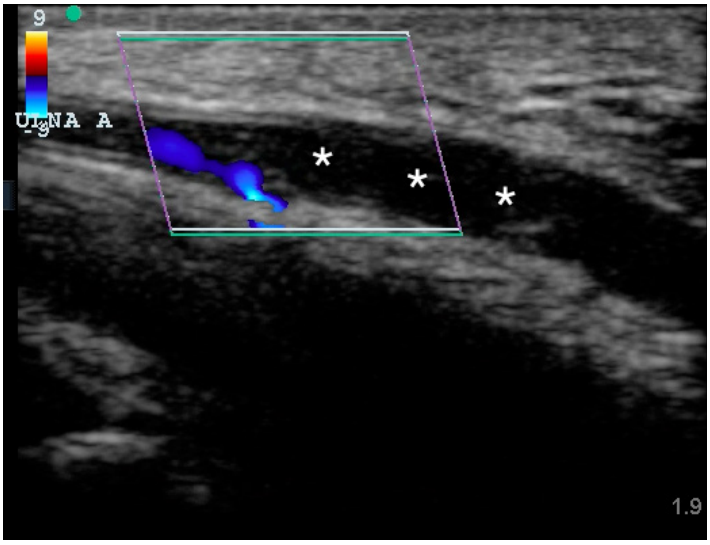

Figure 2. Ultrasound image of the distal ulnar artery in longitudinal plane noting reduced flow proximal to the thrombus with absent flow distally and echogenic thrombus (asterisks) within the lumen.

and patient exposure to ionizing radiation. POCUS has been proven as an effective means of evaluation of various vascular pathologies including thrombosis, aneurysm, pseudoaneurysm, and dissection.[11-14] While HHS has been previously described in Emergency Medicine literature, none of these reports highlight the potential usefulness of POCUS for its evaluation.[15-16] In the described case, we used POCUS to identify the area of transition of the ulnar artery from normal to occluded vessel, occupied by a visualized thrombus. Non-compressibility of the vessel sealed the diagnosis of thrombotic occlusion. While the evaluation into the possible etiology of the occlusion would warrant admission and further workup (given the patient's risk factors of previous endocarditis, mitral valve replacement, subtherapeutic INR, smoking and occupational histories), the results of the POCUS study allowed for the expedition of medical management and disposition. This case highlights the value in utilizing POCUS as the initial imaging study of potential extremity vascular issues.

CONCLUSION

HHS is a condition of distal ulnar artery injury and thrombosis secondary to repetitive trauma to the hypothenar area. In this case report, we demonstrate the convenience and utility of using POCUS as the initial diagnostic test for distal extremity arterial thrombosis. Based on our POCUS findings, we were able initiate medical management and collaborate with the consulting and admitting teams quickly. While the patient had multiple risk factors for other etiologies of ulnar artery occlusion, (e.g. emboli from recurrent endocarditis and mechanical valve replacement, smoking history) an exhaustive work-up ruled these out and the etiology was ultimately determined to be most consistent with HHS. Although HHS is a rare entity, emergency physicians (EPs) should be vigilant of the condition during the evaluation of signs and symptoms of digital ischemia, particularly when they are in the ulnar artery distribution. Additionally, EPs should incorporate POCUS into their evaluation of these complaints as this affords a rapid and effective means of diagnosis and can hasten treatment.

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Video. Ultrasound clip of the distal ulnar artery in longitudinal plane noting reduced pulsatile flow proximal to the thrombus with absent flow distally and echogenic thrombus within the lumen.

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Choledochal Cyst Mimicking Gallbladder with Stones in a Six-Year-Old with Right-sided Abdominal Pain

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Choledochal cysts are rare but serious bile duct abnormalities are found in young children, usually during the first year of life.[1] They require urgent surgical intervention due to the risk of developing cholangiocarcinoma.[2] Clinicians should consider this diagnosis and perform a point-of-care ultrasound (POCUS) when a child presents to the emergency department (ED) with findings of jaundice, abdominal pain, and the presence of an abdominal mass. We present the case of a six-year-old child presenting only with abdominal pain upon arrival to our ED and was ultimately diagnosed by POCUS to have a choledochal cyst. [West J Emerg Med. 2015;16(4):568–571.]

INTRODUCTION

Choledochal cysts are rare congenital abnormalities usually found in infants and children. They require urgent surgical intervention due to a 10% risk of cholangiocarcinoma.[2] These cysts are developmental anomalies in which there is a disproportionate dilatation of the biliary ductal system.[3] The incidence of choledochal cysts averages one in two million births with a three times greater predominance in females. Over 60% are diagnosed during the first year of life.[1] The classic triad includes pain, jaundice, and the presence of an abdominal mass; however less than 20% of patients will have all three findings. In addition, there are no specific laboratory tests to help identify these cysts, making it even more of a challenging emergency department (ED) diagnosis.[4] We present a case of a six-year-old patient with a choledochal cyst, identified on ultrasound in the ED.

CASE REPORT

A six-year-old female of Asian descent born full term by spontaneous vaginal delivery with no past medical or surgical history presented to the ED with right-sided abdominal pain that started five days prior to presentation. The patient described the pain as sharp, intermittent, and located in the right upper quadrant and epigastric region of the abdomen without any aggravating or alleviating factors. She had a decreased appetite, constipation, and fatigue. However, she and her family denied nausea, vomiting, changes in stool or urine color, fevers, or weight loss. The patient was seen by her pediatrician earlier that day and had been sent to the ED for evaluation of possible appendicitis.

Her physical examination revealed the following vital signs: pulse rate of 138 beats per minute; respiration rate of 20 breaths per minute; temperature of 35.9 degrees Celsius orally; oxygen saturation of 98% on room air; and weight of 22.6kg. The patient was alert, well appearing, and in no apparent distress. The head, eyes, ears, nose, and throat exam was unremarkable. The heart sounds were normal and the lungs were clear. The abdomen was soft, with normal bowel sounds, and mild tenderness in the right upper quadrant with no rebound, guarding, or radiation. No masses or hernias were appreciated. The spleen and liver were normal in size. No lymphadenopathy was appreciated. Gait was normal with mild abdominal discomfort appreciated when the child was asked to jump. Skin was normal with no rashes or jaundice. The neurologic exam was within normal limits.

The patient's urinalysis was normal, and an ultrasound was performed at the bedside using a low frequency (2-6 MHz), curvilinear probe oriented in a transverse then sagittal plane fanning superiorly then inferiorly, medially then laterally

along the child's right upper quadrant along her subcostal margin. The point-of-care ultrasound (POCUS) demonstrated what initially appeared to be a distended gallbladder with shadowing stones (Figure 1). However, with continued scanning, a small contracted gallbladder with stones versus polyps was identified adjacent to the originally visualized larger cystic structure. A complete abdominal ultrasound performed by the radiology department showed normal echogenicity and echotexture of the liver with no masses and a small amount of perihepatic free fluid. There was mild intrahepatic biliary ductal dilatation due to a large cystic mass with internal echoes and debris measuring 6.4x5.1x5.3cm and originating from the common bile duct (CBD). The gallbladder was visualized with multiple gallbladder stones or polyps, the largest measuring 4mm (Figure 2). The pancreas, spleen, and kidneys appeared unremarkable and the appendix was not visualized; however, a small amount of free fluid was seen in the right lower quadrant. Based on this sonographic appearance, the diagnosis of choledochal cyst was made.

After the POCUS was performed the patient was transferred to the children's hospital for surgical management and an magnetic resonance imaging of the abdomen that showed findings similar to the ultrasound. The CBD cyst measured 6.7x4.8x8.0cm and extended from the porta hepatis to the pancreatic head. There were multiple small stones in the cyst but no solid components. The extrahepatic portal vein was mildly deviated to the left due to a mass effect. There was mild gallbladder dilatation with stones. The remainder of the study was negative. These results were consistent with a Todani type Ic bile duct cyst. The patient underwent open resection of the choledochal cyst, cholecystectomy, and a hepaticoduodenostomy biliary bypass. The patient tolerated the procedure well, was extubated shortly after surgery, and was discharged home six days after surgery.

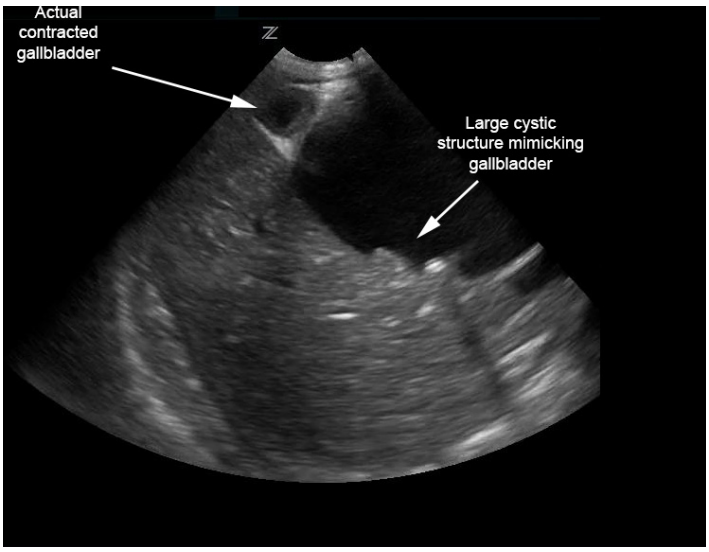

Figure 1. Biliary choledochal cyst mimicking distended gallbladder with multiple stones; however, contracted gallbladder is actually adjacent.

Final pathology report showed that the cystic tissue had rough fibrous connective tissue and friable mucosa consistent with reactive changes. The gallbladder tissue was smooth with a congested dark red serosal surface consistent with chronic cholecystitis. At the two-month follow up, the patient had regained her appetite, was doing very well, and was pain free.

DISCUSSION

While choledochal cysts are most commonly found in children under the age of 10, up to 20% are diagnosed at adulthood.[1] Some cysts have been detected before birth by prenatal ultrasounds as early as 15 weeks. While some believe these cysts are congenital, there have also been reports of new cysts diagnosed in patients older than 80. Overall these cysts are believed to be as rare as one in two million births with a 4:1 predominance in females.[5] The incidence is higher in the Asian population of which about two-thirds of cases are reported from Japan.[6]

Choledochal cysts are generally classified into five subtypes by the Todani classification developed in 1977. Since then, several other classification systems have been developed, but Todani's is still widely accepted. Type 1 cysts are extrahepatic cysts in the CBD. These are further subdivided into types a-c. A type 1a cyst consists of diffuse CBD dilatation, a type 1b cyst has focal segmental dilatation, and a type 1c has fusiform dilatation of the CBD as in our patient. Type 2 cysts are extrahepatic duct diverticula. Type 3 cysts are intraduodenal or intrapancreatic ductal dilatations. Type 4 cysts are multiple bile duct cysts and type 5 cysts are intrahepatic cysts also referred to as Caroli disease.[3]

There is no definite explanation for the pathogenesis

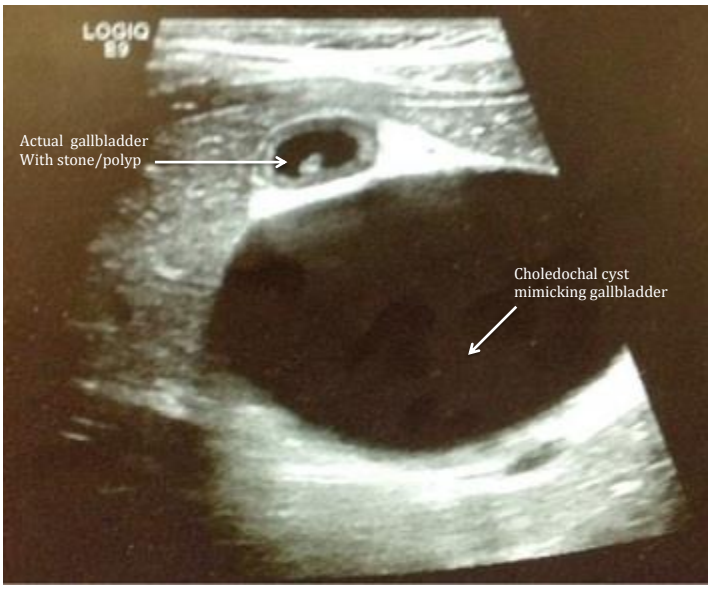

Figure 2. Follow-up radiologic ultrasound showing presence of mild intrahepatic biliary ductal dilatation as well as a large cystic mass with internal echoes and debris confirmed as a choledochal cyst. The gallbladder with multiple gallbladder stones or polyps is also pictured above.

of these cysts; however, multiple studies suggest they may be formed due to prolonged reflux of pancreatic enzymes and bile stasis leading to chronic inflammation.[7-8] This chronic inflammation may be one factor responsible for the development of cholangiocarcinoma in patients with bile duct cysts. Other factors shown to cause malignant transformation of these cysts include cell regeneration and DNA dysplasia.[2] Cystic fluid after removal has also been found to have an elevated amylase and lipase in up to 65% of cases[8] and pancreatic reflux can cause K-ras mutations and cellular atypia leading to carcinogenesis. The incidence of cholangiocarcinoma in patients with choledochal cysts ranges from 2.5% to 26% with an increasing risk with age.[2]

Malignant changes in the epithelium of the bile duct can occur even after cyst excision, sometimes years after cyst removal. These patients therefore need to be followed for recurrent symptoms. Some of these malignant transformations have been seen in areas distant from the CBD cyst.[9] Common locations for developing malignancy are the bile duct in 50% of patients, the gallbladder in 43%, and the periampullary region in 2.5%.[10]

Classic findings include jaundice, pain, and an abdominal mass; however, less than 20% of patients will have all three findings. Classic findings are more common at a younger age with 85% of children having at least two of the three findings and only 25% of adults having two out of three findings. Laboratory results including liver enzymes are generally normal.[4]

Because of the lack of radiation, abdominal ultrasound should be the primary imaging modality used in young children with right upper quadrant pain presenting to the ED. Ultrasound has been shown to be superior to computed tomography (CT) in identifying gallbladder pathology and avoids exposing the patient to unnecessary radiation. Emergency bedside ultrasound by trained physicians has both a sensitivity and specificity of greater than 88% for detecting gallbladder pathology.[11] It has a sensitivity of 71–97% specifically for choledochal cyst detection.[12] Other modalities that have been shown to be highly sensitive in the diagnosis of biliary cysts include hepatobiliary scintigraphy using technitium-99 hepatobiliary iminodiacetic acid (HIDA scan), which has a sensitivity of 100% for type I bile duct cysts, and magnetic resonance cholangiopancreatography, which is the most sensitive diagnostic modality.[12] CT and magnetic resonance imaging are helpful after diagnosis to help create a management and treatment plan. Due to the high rate of malignancy all biliary duct cysts require surgical removal.

Historically, cystenterostomy was considered the best surgical treatment for patients with choledochal cysts. However, this approach was found to be associated with a high risk of malignancy in the remaining cyst wall with up to 30% of adults developing malignancy after cyst removal.[13] Therefore, biliary diversion after excision is now the recommended surgical treatment and can be done by hepaticoduodenostomy as in our patient, or via hepaticoappendicoduodenostomy, or hepaticojejunostomy.

Because a choledochal cyst is a serious condition in which a delay in diagnosis can lead to a worse clinical outcome, young patients suspected of having this condition should undergo an abdominal ultrasound and if a choledochal cyst is found, the patient should have early surgical removal in order to avoid complications and prevent malignancy. Thus, emergency point-of-care ultrasound as a first-line diagnostic tool may prove to be a life-saving measure in detecting rare but potentially fatal pediatric abnormalities such as a choledochal cyst.

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Video. Point of care ultrasound for Figure 1.

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Prochlorperazine-Induced Hemidystonia Mimicking Acute Stroke

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Prochlorperazine is frequently used in the treatment of refractory nausea and migraines. Known side effects include extrapyramidal symptoms such as akathisia and dystonia. We report a pregnant patient taking prochlorperazine for hyperemesis gravidarum who developed hemidystonia, which triggered an acute code stroke response from prehospital, emergency medicine and neurology providers. We suspect this report to be the first case of prochlorperazine-induced hemidystonia as a stroke mimic. [West J Emerg Med. 2015;16(4):572-574.]

INTRODUCTION

Stroke is a leading cause of death and permanent disability among adults in the developed world.[1] Intravenous fibrinolytics improve outcomes in patients with ischemic stroke.[2] However, the efficacy of fibrinolytic therapy is highly time-dependent, which has driven efforts to reduce the time to diagnosis, imaging, and medication administration.[3-4]

In the push to administer fibrinolytic therapy, healthcare providers must not circumvent a thorough assessment of the contraindications to therapy as well the potential for a stroke mimic.[5] The search for stroke mimics might be especially important when off-label use of fibrinolytic stroke therapy in pregnancy is being considered.[6]

We report a case of a pregnant woman who presented to the emergency department (ED) with recent-onset hemiplegia that was initially thought to be an acute ischemic stroke. Only when further signs developed that suggested a dystonic reaction and a culpable medication was identified did we entertain the possibility of a stroke mimic. The resolution of her neurological symptoms shortly after administration of diphenhydramine confirmed the most likely diagnosis of dystonia. We believe this is the first case of prochlorperazine-induced hemidystonia as a stroke mimic reported in the literature.

NARRATIVE

Our ED received a stroke activation from the field. The initial report was of a 32-year-old woman with unilateral stroke-like symptoms. This G3P1 10-week pregnant woman arrived to the ED via ambulance complaining of sudden-onset slurred speech and left chest, shoulder, and neck pain that began 40 minutes prior to ED arrival. This was followed by severe left arm and leg weakness and paresthesias. Her past medical history included a laparoscopic appendectomy four days prior and hyperemesis gravidarum during this pregnancy.

Her vital signs were blood pressure 114/79mmHg, heart rate 106 beats/min, respiratory rate 25 breaths/min, temperature 36.9°C, and oxygen saturation 100% on room air. On exam, the patient was alert and oriented with intermittent slurred speech. She was repeatedly crying "help me," but was directable and able to follow commands. Her face was symmetric and her tongue was midline with a small amount of accumulated saliva. The patient's left arm and leg were described as being weak and she was unable to lift them during exam. The rest of the motor and sensory exam were normal.

As all suspected strokes are co-managed with the admitting neurology team at our institution, an in-house "code stroke" was activated, and head computed tomography (CT) was ordered per hospital stroke protocol. Subsequent laboratory values

including chemistry panel, liver function tests, coagulation panel, and complete blood count were unremarkable.

Within five minutes the admitting neurology resident arrived and agreed with the need for emergent head CT. While the patient was being prepared for the scan, we observed that her tongue was beginning to protrude and roll repetitively, raising suspicion for extrapyramidal symptoms (EPS). Upon reviewing the bedside chart, we noted that the patient's only medications were ondansetron and prochlorperazine. When additional medication history was elicited, we discovered that prochlorperazine was a new medication that had been initiated one day before presentation. The patient reported taking a total of four 10mg doses of prochlorperazine by mouth, with the last dose taken one hour prior to symptom onset. The patient's weight at the time of the visit was 67kg.

We administered a 50mg dose of intravenous diphenhydramine and the patient's motor symptoms rapidly resolved. However, she still complained of residual left upper and lower extremity weakness, although her neurological exam was now normal, with a National Institute of Health Stroke Scale of 0. On serial exams her strength gradually improved, but per patient, her strength did not immediately return to baseline. She was immediately taken for magnetic resonance imaging, which revealed no evidence of an acute stroke. She was admitted to the hospital for observation and during the night experienced a second episode of dystonia that again responded to 50mg of intravenous diphenhydramine. All of the patient's symptoms resolved by the next day and she was discharged from the hospital without any long-term sequelae. Seven months later the patient had an uneventful delivery of a healthy term baby.

DISCUSSION

Stroke mimics are common in emergency medicine. In a single-center study of consecutive patients presenting to an urban teaching ED with stroke-like symptoms, 31% (109/350) of patients with suspected stroke were later determined to have a stroke mimic.[7] The most common mimics were seizures, sepsis, and toxic/metabolic causes. The authors did not elaborate on toxic causes or differentiate medication effects. In another single-center review, acute ischemic stroke misdiagnosis occurred in 10.4% (56/539) of presentations with conversion disorder, migraines, and seizures being the most common mimics.[8] Dystonic reactions have been described as sequelae of acute stroke and brain injury,[9] but hemidystonic drug reactions mimicking stroke have not been reported.

Our patient experienced an EPS, specifically dystonia, which was precipitated by the appropriate use of prochlorperazine for nausea. Dystonia is defined as a disorder causing involuntary muscle contractions, repetitive movements, or contracted postures. It is important to note that our patient reported pain preceding and during the dystonic reaction. Hemorrhagic and less likely ischemic stroke may present with a severe headache, but neither stroke should cause other body pain. In contrast, one of the most common complaints in patients with dystonia is pain in the affected region.[10] However, during stroke evaluation of a patient with hemiplegia and limited history in the acute setting, the presence or absence of pain may be too non-specific to rule out a stroke or other emergent vasculopathy.

Diagnostic momentum may have been at play in this case.[11] When the emergency responders first encountered the patient in the field they administered the Cincinnati Stroke Scale, which was abnormal on two parameters (slurred speech and left arm paralysis).[12] The emergency responders appropriately activated the stroke response per city protocol. In the ED, these findings were confirmed with a rapid history and neurological exam. To complicate the initial evaluation, the patient answered at first that she was not taking any medications, undoubtedly due to the distressing situation she was in. Further, additional stress was placed on the care team since the patient was pregnant and guidelines for treating pregnant women with stroke are limited.[6] The incoming neurology resident joined a "moving train" when they arrived in the ED just as the patient was being prepared for the scan. The limited available history and the patient's lateralized decreased movement were enough to persuade the resident to agree with the provisional diagnosis and the need for an urgent scan. As the bed was unlocked for transport to the scanner, the bedside emergency medicine clinical pharmacist pointed out to the team the repetitively protruding tongue movements that had not been apparent initially. This observation led to additional history taking and medication verification with the patient's husband. It was only at this time that the momentum was paused and team consensus was reached to attempt a quick trial of a reversal agent.

The most significant potential harm for a patient misdiagnosed with an ischemic stroke is receiving intravenous thrombolytics developing an intracranial hemorrhage. While a single-center study found a favorable safety profile for administration of thrombolytics to patients with stroke mimics,[8] our patient had an additional level of complexity due to pregnancy. Studies describing the use of thrombolytics in pregnant patients are limited to individual case reports with some concern about effects both to the mother and the fetus.[6] Any discussion about risks and benefits of thrombolytics in pregnancy remains speculative at this time.

While there is no perfect method to establish the causality of an adverse drug event, the commonly used Naranjo criteria estimate the probability of medication causing an adverse event.[13] The Naranjo score for our case was seven, which would classify this event as a probable adverse drug reaction.

Emergency clinicians should be aware of EPS in patients taking antidopaminergic agents. Other than the more common presentations of EPS, such as acute akathisia and dystonia/torticollis that may be seen from single doses of antidopaminergics (e.g., metoclopramide, prochlorperazine) given in the ED, emergent acute airway

obstruction due to supraglottic dystonia has also been reported.[14] In addition to obtaining a list of medications that may contraindicate thrombolytic use, emergency clinicians need to remain vigilant of antidopaminergic agents that may mimic common stroke-like symptoms, especially in the elderly, who may be more sensitive to these agents. Empiric administration of anticholingeric agents in every patient with stroke-like symptoms is certainly not warranted and may confound subsequent neurological exams. However, if antidopimenergics are on the medication list during an acute evaluation of stroke, clinicians should broaden the differential to include the possibility of EPS as part of the rapid initial evaluation of a patient with suspected stroke.

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Esophageal Intubation of an Infant

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A 68-day-old former 30-week infant presented with listlessness, apnea and bradycardia. The patient was intubated for airway protection. After intubation, breath sounds were auscultated bilaterally and a Pedi-Cap carbon dioxide detector had color change from purple to yellow. A nasogastric tube (NGT) was placed and a post-procedural chest radiograph was obtained (Figure).

There are several features of esophageal intubation: low lung volumes, esophageal and gastric distention despite NGT placement and juxtaposition of the endotracheal tube (ETT) relative to the NGT.[1-2] Other findings of esophageal intubation not seen here are identification of the ETT distal to the carina or outside of the tracheal-bronchial air column.[3] Due to high success rates of endotracheal intubation in the emergency department,[4-5] these findings are rare and may be overlooked. In this case, misleading clinical evidence was obtained through auscultation of bilateral breath sounds, visualization of endotracheal tube condensation, positive change on the carbon dioxide colorimeter and post-procedural hemodynamic and oxygenation stability. Previous literature, however, has demonstrated false-positive colorimetric change from swallowed air with pre-intubation positive pressure ventilation,[6-7] hence the importance of radiographic identification of ETT location. In this patient, esophageal intubation was recognized after continuous capnography revealed absence of waveform.

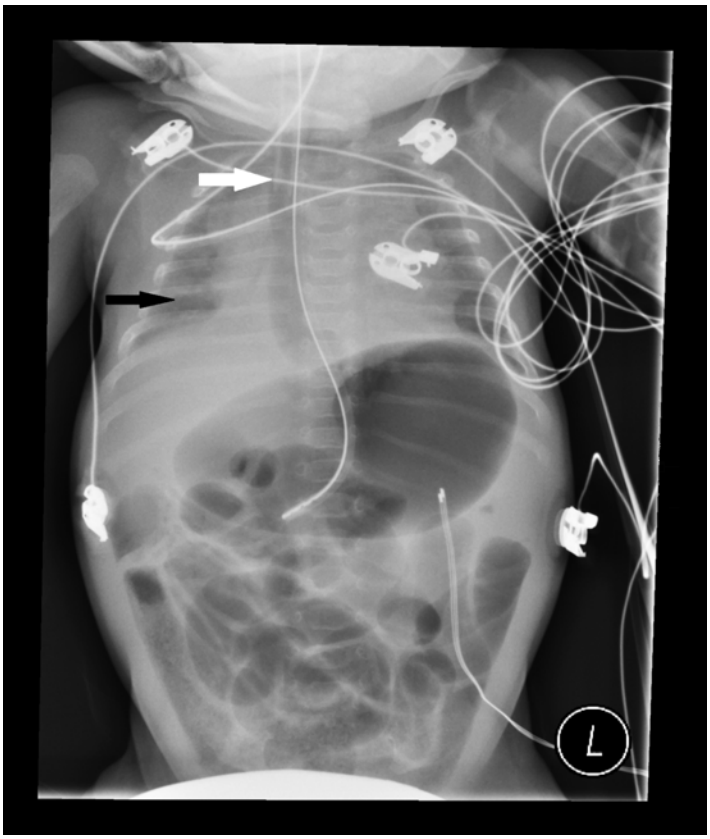

Figure. Infant with endotracheal tube in the esophagus; nasogastric tube present in the stomach. White arrow indicates endotracheal tube tip. Black arrow indicates low lung volumes.

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Massive Hematochezia from Ascending Colonic Varices

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A 54-year-old man with a history of alcohol use presented with hematochezia and syncope. Upon arrival to the hospital, his bleeding had stopped. He was hemodynamically stable with hemoglobin of 11g/dL, international normalized ratio of 1.8 and platelets of 37K/mcL. Nasogastric aspirate found bilious gastric contents without blood. Esophagogastroduodenoscopy revealed mild gastritis without evidence of bleeding. Colonoscopy discovered a purple-colored semi-circumferential ascending colon lesion that inflated and deflated spontaneously, without arterial pulsation. The lesion would disappear completely upon deflation, except for a visible fibrin plug, indicative of recent bleeding.

Computed tomography further delineated the structure as varices, surrounding the right colon (Figure). Nearly 36 hours after presentation, the patient developed recurrent substantial hematochezia. He required intubation and massive transfusion for a hemoglobin nadir of 5g/dL. During emergent transjugular intrahepatic portosystemic shunt (TIPS) placement, large ascending colonic varices feeding from the superior mesenteric vein were confirmed and embolized. Bleeding ceased and he was ultimately discharged to alcohol rehabilitation.

Esophageal and gastric varices are frequent complications of advanced liver disease. Ectopic varices (ECV), those not found in the esophagus and stomach, are less common; reported locations of ECV include the small bowel, gallbladder, colon, and rectum.[1] Non-cirrhotic causes of ECV include congenital venous anomalies, splenic vein thrombosis, superior mesenteric vein obstruction and congestive heart failure.[2]

Given their often-obscure location, ECV can be difficult to identify. Once located, the ideal therapeutic intervention is unknown. Endoscopic options include band ligation and injection of tissue adhesives.[1] TIPS with angiographic variceal embolization represents another approach for portal decompression in the setting of hemorrhage.

Although scarcely reported in the literature, ECV should be considered a source of gastrointestinal bleeding, especially in a patient with liver disease. As seen in this case, colonic varices can cause profound hemorrhage, requiring prompt evaluation and intervention.

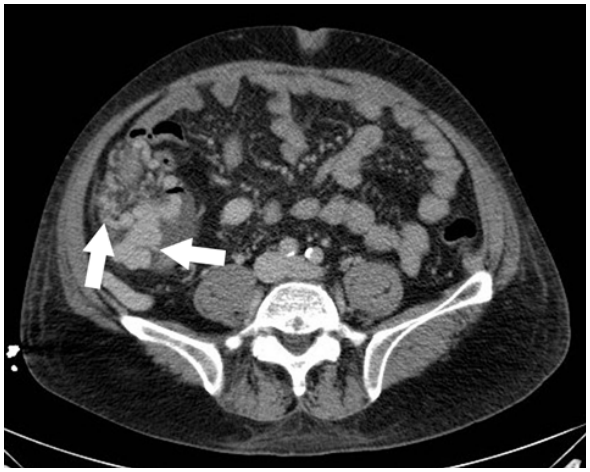

Figure. Computed tomography, axial view. Arrows indicate varices.

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Open Ring Sign Diagnostic of Multiple Sclerosis in the Emergency Department

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A 26-year-old female presented to the emergency department with a chief complaint of dizziness. Further history revealed that she was experiencing generalized weakness and intractable vomiting for three days, without complaint of abdominal pain or lower gastrointestinal symptoms. Physical examination uncovered mild dehydration with stable vital signs and non-fatigable, horizontal nystagmus consistent with internuclear opthalmoplegia. Computed tomography of her brain was ordered and revealed an "open ring sign" as displayed in the figure.

The "open ring sign," or open ring enhancement of a lesion on neuroimaging, has been found to be highly specific for demyelinating diseases and can help differentiate them from malignant and infectious neurological disorders, where ring enhancement is more often closed.[1-2] The open ring is typically crescent-shaped and open to the basal ganglia or, as in our patient, the cortex, with the enhanced area resembling acutely inflamed white matter while the unenhanced area resembles more chronic inflammation.[1] A retrospective case series has found that open ring enhancement has a specificity of 84.4-93.8% for demyelinating conditions, with a likelihood ratio of 5.2 and 17.2 for demyelination over malignancy and infection, respectively.[1-2] In our patient, a demyelinating condition was suspected based on this image, and the diagnosis of multiple sclerosis was ultimately confirmed by the presence of oligoclonal bands on cerebrospinal fluid analysis.

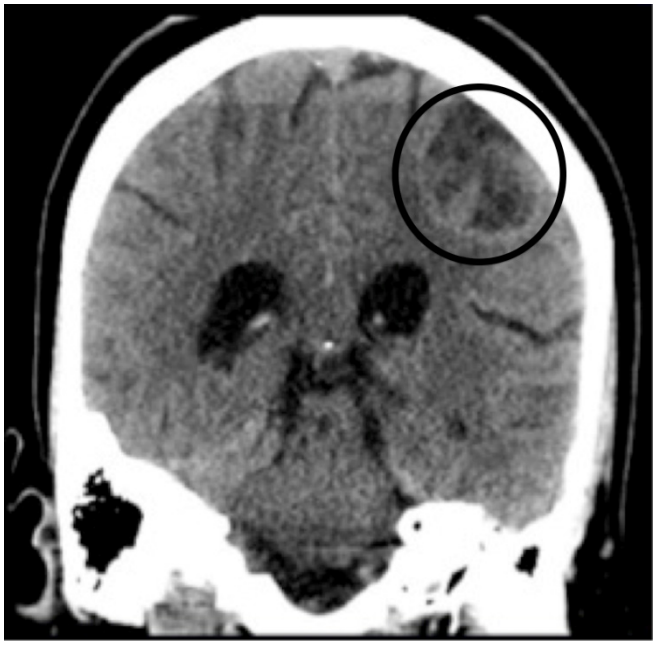

Figure. Computed tomography of brain with "open ring sign" indicated by circle.

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Adult Intussusception Secondary to Inflammatory Fibroid Polyp

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A 30-year-old man presented to the emergency department for two weeks of diffuse abdominal pain and an episode of emesis. He denied fever, prior surgery, or any other illnesses. The patient reported going on a "crash diet regimen" one month prior, resulting in an intentional weight loss of 25lbs in 30 days. He also reported two episodes of melena-type bowel movements prior and had an esophagogastroduodenoscopy eight days earlier, which was noted to be normal. On physical examination he was mildly ill-appearing with diffuse abdominal tenderness without peritoneal signs. Computed tomography of his abdomen and pelvis showed a small bowel obstruction in the jejunum. A diagnostic laparoscopy was performed. Operative findings revealed 2.5cm lesion at distal portion of thickened small bowel and intussusception 10-12cm proximal to this. He underwent laparotomy with small bowel resection. Pathological examination of the specimen revealed a 4.0cm inflammatory fibroid polyp.

Intussusception is rare in adults, accounting for 5% of all cases of intussusceptions and 5% of bowel obstructions in adults (Figure 1 and Figure 2).[1] Approximately 90% of cases of intussusception in adults are secondary to a pathologic condition that serves as a lead point for the intussusception, such as carcinomas, polyps, or Meckel's diverticulum, etc.[2]

Inflammatory fibroid polyps (IFPs) are rare, benign tumors that can arise throughout the gastrointestinal tract.[3] The most common site is the gastric antrum (66-75%), followed by the small bowel (18-20%) and colorectal region (4-7%).[4] Gastric and colon IFPs are typically identified incidentally, whereas small intestinal lesions can present with chronic abdominal pain, lower gastrointestinal bleeding, anemia and rarely small bowel obstruction due to intussusception.[5] Although IFPs are rare and benign conditions, surgery is the only solution in case of bowel obstruction.[4] The patient's postoperative course was

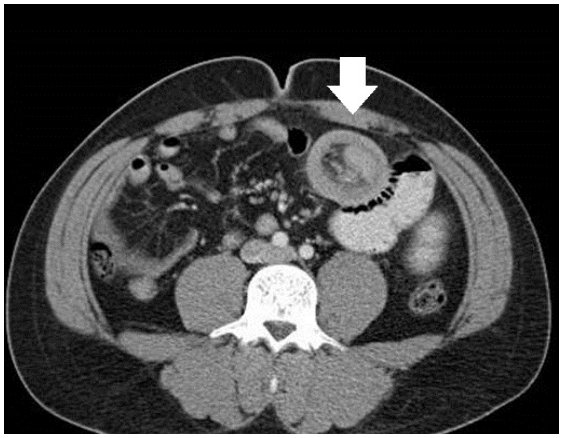

Figure 1. Axial image-donut sign (arrow) indicative of intussusception: fat, vessels and a segment of small bowel (the intussusceptum) prolapsed into the lumen of another segment of small bowel (the intussuscipiens, the outer ring or donut).

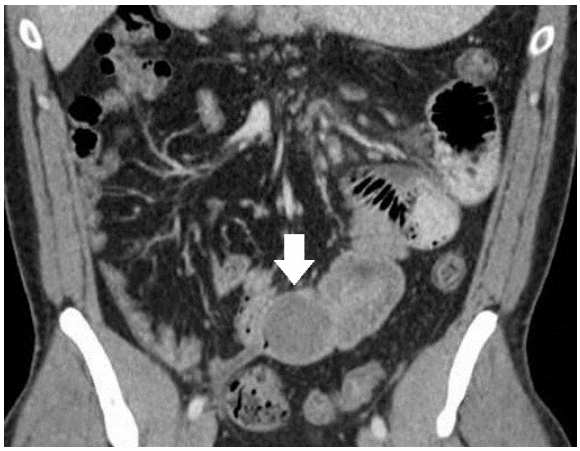

Figure 2. Coronal image: 4cm benign inflammatory polyp (arrow) at the distal intussusceptum, the lesion that served as the lead point for the intussusception.

unremarkable, and he was discharged on postoperative day 4.

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Leriche Syndrome Presenting with Multisystem Vaso-Occlusive Catastrophe

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INTRODUCTION

Leriche syndrome, also referred to as aortoiliac occlusive disease, has been described as a triad of claudication, impotence and decreased femoral pulses.[1] The syndrome results from thrombotic aortoiliac occlusion and was first described by a French surgeon, Rene Leriche, in 1940.[1-2] The disease most commonly occurs in men, and risk factors include hypertension, diabetes, hyperlipidemia, and smoking.[3] Advanced diagnostic imaging techniques such as abdominal ultrasonography and computed tomography (CT) angiography assist the clinician in confirming the diagnosis. Treatment is primarily surgical and consists of aortoiliac endarterectomy and aortobifemoral bypass. Alternative procedures described are percutaneous transluminal angioplasty with stenting, and axillofemoral bypass.[4-5]

CASE REPORT

A 56-year-old male was brought to the emergency department by paramedics for a syncopal episode and inability to move his lower extremities. He complained of abdominal pain and inability to move his legs beginning five hours prior to arrival. He awakened from a nap that afternoon and experienced numbness in both legs, which progressed to paralysis. At baseline, he was ambulatory without any history of weakness and was last ambulatory hours prior. He endorsed occasional pain in his legs when walking at baseline.

He also complained of abdominal pain with nausea and vomiting for two days. He had a history of alcohol use and reported dark-colored emesis and last bowel movement three days prior. On review of symptoms the patient denied any history of headache, dizziness, chest pain, back pain, trauma, fevers, or extremity weakness. He walked longer than a mile the day prior. History from the patient's wife revealed that he had an episode of altered level of consciousness while on the couch and that finding combined with his abdominal pain and paralysis prompted her to call 911. The patient's past medical history was significant for hypertension, peripheral arterial disease, and myocardial infarction 10 years prior. His past surgical history included "abdominal stents" and a left carotid stent. His social history was significant for a 25-pack/year history of smoking and daily alcohol. His medications included atenolol and ranitidine.

Physical exam showed an oral temperature of 36.7°C, blood pressure 107/65mmHg, heart rate 99 beats/minute and a respiratory rate of 30 breaths/min, with oxygen saturation on 15L non-rebreather mask of 94%. His weight was 72.5kg and he appeared older than his stated age. He was alert, cooperative and in moderate distress, primarily complaining of pain and cramping in his lower extremities and repeatedly asking staff to straighten out his legs although they were already lying straight and motionless on the gurney. His head exam was unremarkable with the exception of a dry oropharynx. Cervical spine, cardiac, and lung exams were unremarkable. His abdomen was firm and diffusely tender to palpation with generalized rebound and guarding. An irreducible left inguinal hernia was present. He had vomiting, and placement of a nasogastric tube revealed 1.5 liters of coffee-ground emesis. Lower extremities were thin, cool, and without any palpable or Dopplerable pulses in bilateral femoral, popliteal or pedal distribution. There was trace non-reproducible sensation to the mottled lower extremities, and no sensation distal to the ankles. Motor exam was significant for lower extremity paralysis.

Laboratory data consisted of sodium 121mEq/L (135-145), potassium 6.8mEq/L (3.3-4.8), chloride 89mEq/L (101-111), CO_2 18mEq/L (25-34), BUN 31mg/dL (8-26), creatinine 1.5mg/dL (0.5-1.3), and blood glucose 367mg/dL (70-115). White blood cell 19.1thous/mcL (4.0-10.5), hemoglobin 12.8g/dL (13.5-16.9), lipase 107U/L (22-51),

hematocrit 38.8% (39.5-50.0), and platelets 165thous/mcL (150-400). There was a left shift in the neutrophils 16.2thous/mcL (85%) (2.0-8.1). Alkaline phosphate 88IU/L (26-110), AST 84IU/L (8-40), ALT 38IU/L (0.0-60), total bilirubin 1mg/dL (0.0-1.4), total protein 5.4g/dL (6.1-8.2), albumin 2.6g/dL (3.2-5.5). Lactate 7.2mmol/L (0.7-2.1). ABG showed pH of 7.25 (7.38-7.42), pCO_2 31.6mmHg (36-42), pO_2 123.6mmHg (80-104), bicarbonate 13.5mmol/L (21-27). PT was 17.3sec (9.5-12.3), PTT 45.9sec (24.1-35.1), and INR 1.62 (0.87-1.14). B-type natriuretic peptide 1,950pg/mL (<100). Troponin 2.75ng/mL (<0.03).

Chest radiograph was unremarkable. Electrocardiogram (ECG) showed sinus rhythm at 95 beats/minute with ST elevation inferiorly, anteriorly and laterally (Figure 1). Bedside ultrasound to evaluate the abdominal aorta was limited. Vascular surgery was consulted prior to CT for concern of a vascular catastrophe. Cardiology was consulted for the patient's ECG findings consistent with myocardial infarction. The patient went for a non-contrast head CT that was unremarkable and a CT angiogram of the chest, abdomen and pelvis, which was significant for the abdominal aorta with no contrast opacification 2.2cm superior to the bifurcation (Figure 2), high-grade stenosis of the right common iliac artery, complete occlusion of the left common iliac artery, stents in the celiac artery and superior mesenteric artery (SMA), evidence of occlusion of the proximal SMA and inferior mesenteric artery (IMA), hepatic, splenic, bilateral renal infarctions, left inguinal hernia, bowel obstruction, pneumatosis intestinalis with evidence of ischemic bowel, and aspiration in the right lower lung. General surgery was consulted.

Patient's Hospital Course

The cardiology service stated that the patient was not a candidate for cardiac catheterization and to start anticoagulation and low-dose aspirin if there was no contraindication or planned surgery. They also recommended thrombolytics for the diffuse thrombotic disease. The patient did have an echocardiography study that revealed an ejection fraction of 35% and multiple regional wall motion abnormalities. General surgery recommended comfort measures as he was not a surgical candidate. Vascular surgery commented that bypass would be futile and if patient survived, would be a candidate for extra-anatomical axillo-bifemoral bypass in the future. The patient was admitted to the medical intensive care unit for broad-spectrum antibiotics and a heparin drip and succumbed to his illness the following day.

DISCUSSION

This patient presented with the complaint of sudden onset of lower extremity paralysis and was found to have severe vascular occlusive disease affecting the distal aorta, iliacs, SMA, and IMA, resulting in limb-threatening lower extremity infarction, hepatic, spleen, renal infarctions, and ischemic bowel. The patient had a STEMI, suggesting a completely occlusive thromboembolic event in the coronary(ies). He was also found to have a left inguinal hernia, bowel obstruction with pneumatosis intestinalis, and laboratory findings

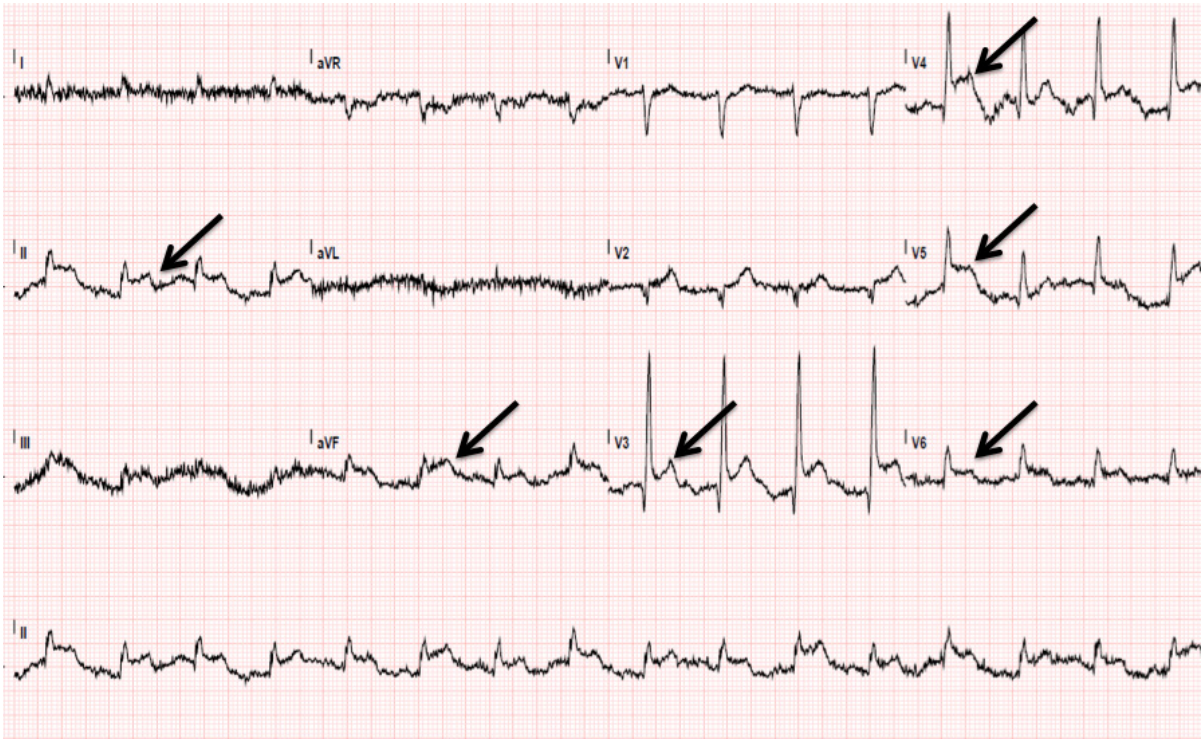

Figure 1. Electrocardiogram of patient with Leriche syndrome, demonstrating diffuse ST-segment elevation.

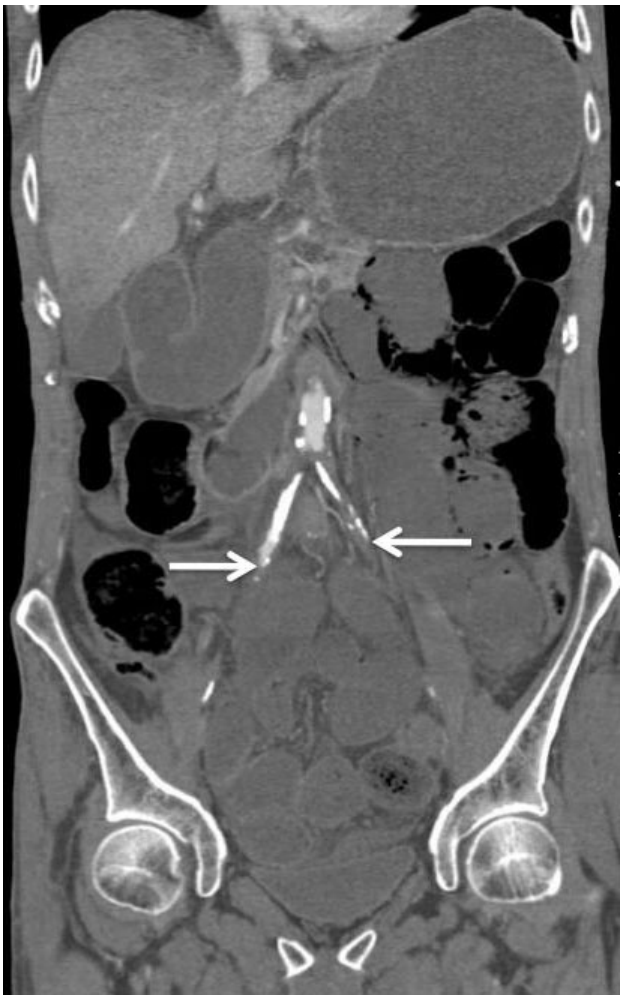

Figure 2. Coronal computed tomography demonstrating aortoiliac vascular occlusion.

consistent with pancreatitis and acute kidney injury. These findings represent the end stage of the pathophysiologic basis of Leriche syndrome. To our knowledge, there is no published literature describing Leriche syndrome resulting in multisystem ischemia/infarction including the lower limbs, bowel, liver, spleen, kidneys, and myocardium.

Leriche syndrome was originally described as the syndrome of thrombotic obliteration of the aortic bifurcation.[1] The typical presentation occurs in male patients with the clinical triad of intermittent claudication involving the low back, buttocks, hip or thigh, impotency and weak or absent femoral pulses.[5-6] It mostly occurs in men in the third to sixth decades of life.[6] The lower extremities can present with pallor, coldness and weakness. Our patient's clinical presentation was compatible with the most severe end-stage clinical manifestations of this disease with complete aortoiliac occlusion and lower extremity paralysis. The patient did report a history that was consistent with intermittent claudication prior to the day of presentation and physical exam findings revealed absent femoral pulses. Although a history of impotence was not asked, the CT angiography findings of aortoiliac occlusion was consistent with an inability to maintain penile erection. Risk factors for this syndrome consist of hyperlipidemia, hypertension, diabetes mellitus and smoking.[3] Our patient had a history of hypertension and smoking and laboratory findings with elevated blood glucose.

When this condition was first described in the 1940s, a clinician could make the provisional diagnosis of Leriche syndrome in a patient with the triad of claudication, impotence and decreased femoral pulses. Today, advanced diagnostic imaging techniques such as abdominal ultrasonography and CT angiography assist the clinician in diagnosis confirmation. Measurement of the ankle-brachial index aids in screening and is an indicator for peripheral arterial disease.

Aortoiliac occlusive disease mainly occurs in those patients with peripheral arterial disease. Atherosclerotic plaques cause symptoms by obstructing blood flow, and the unstable ones are prone to embolization to distal vessels. In advanced cases, although rare due to the chronic nature of the occlusive process, ischemia can occur. Thus, the underlying pathology of Leriche syndrome results from obstructing plaques due to atheromatous formation in the infrarenal aorta and iliac arteries.[6-7]

The syndrome begins at the distal aorta or common iliac arteries and progresses both proximally and distally over time.[8] The same pathology that caused the classic findings of Leriche syndrome in this patient resulting in claudication, paralysis, and absent femoral pulses was present systemically as evidenced by infarction of the patient's bowel, liver, spleen, kidneys, and heart.

The treatment for Leriche syndrome is primarily surgical and consists of aortoiliac endarterectomy and aortobifemoral bypass; alternative procedures described are percutaneous transluminal angioplasty with stenting, and axillofemoral bypass.[4-5]

The ideal yet rare surgical candidate for chronic aortoiliac thrombosis is the patient with negligible atherosclerotic involvement of the remainder of the vasculature.

CONCLUSION

Leriche syndrome is a triad of claudication, impotence and decreased femoral pulses as a result of aortoiliac occlusion. The disease takes several decades to develop and if not recognized can lead to significant morbidity and mortality. This report is the first to our knowledge describing a patient with Leriche syndrome resulting in ischemia/infarction of the lower extremities, bowel, liver, spleen, kidney, and myocardium.

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Norwegian Scabies

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PATIENT PRESENTATION

A 48-year-old male presented with body aches and a chronic rash. He had no medical history aside from two unsuccessful treatments for presumed scabies and a recent diagnosis of psoriasis. Physical exam revealed hypotension, tachycardia, and profound, diffuse yellow crusting of the skin with erythematous erosions covering non-crusted areas (Figure). The patient was resuscitated and treated for septic shock while microscopic evaluation of scrapings of the crusted skin was performed (Video).

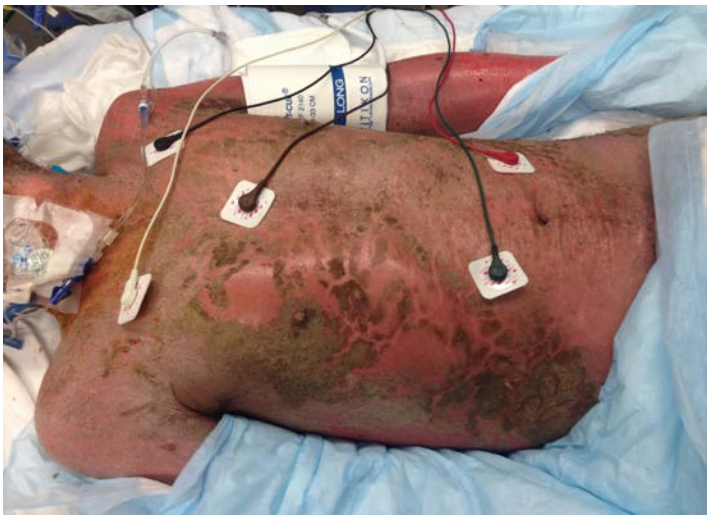

Figure. Photograph of the patient's skin exam demonstrating diffuse crusting lesions and erythema.

DIAGNOSIS

The patient had crusted (Norwegian) scabies with associated Enterobacter sepsis.

Crusted scabies is a rare skin infestation caused by *Scarcoptes scabiei* with parasitic loads in the thousands to millions.

In contrast to common scabies infections, it tends to affect immunosuppressed or debilitated patients and pruritus is not prominent. Patients present with scaly, hyperkeratotic, gray to erythematous plaques. Given its similarity to other dermatologic processes, misdiagnosis is common. Clinical diagnosis is aided by microscopic identification of scabies mites, eggs or feces in skin scrapings or under fingernails. Occasionally videodermatoscopy or biopsy is necessary. Skin breakdown can lead to cellulitis and systemic bacterial infection.[1-2]

Treatment for mild cases is the same as for uncomplicated scabies infections. For severe cases, oral or intravenous (IV) ivermectin should be given.[1]

After resuscitation, the patient was admitted with broad-spectrum IV antibiotics and ivermectin as well as topical permethrin. A Human Immunodeficiency Virus test sent from the emergency department came back positive. After a prolonged hospital course with multiple complications from his skin breakdown and sepsis, he was discharged with full eradication of his scabies infestation.

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Video. Videodermatoscopy of moving scabies mite.

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Comparison of Preloaded Bougie versus Standard Bougie Technique for Endotracheal Intubation in a Cadaveric Model

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Introduction: We compared intubating with a preloaded bougie (PB) against standard bougie technique in terms of success rates, time to successful intubation and provider preference on a cadaveric airway model.

Methods: In this prospective, crossover study, healthcare providers intubated a cadaver using the PB technique and the standard bougie technique. Participants were randomly assigned to start with either technique. Following standardized training and practice, procedural success and time for each technique was recorded for each participant. Subsequently, participants were asked to rate their perceived ease of intubation on a visual analogue scale of 1 to 10 (1=difficult and 10=easy) and to select which technique they preferred.

Results: 47 participants with variable experience intubating were enrolled at an emergency medicine intern airway course. The success rate of all groups for both techniques was equal (95.7%). The range of times to completion for the standard bougie technique was 16.0-70.2 seconds, with a mean time of 29.7 seconds. The range of times to completion for the PB technique was 15.7-110.9 seconds, with a mean time of 29.4 seconds. There was a non-significant difference of 0.3 seconds (95% confidence interval -2.8 to 3.4 seconds) between the two techniques. Participants rated the relative ease of intubation as 7.3/10 for the standard technique and 7.6/10 for the preloaded technique (p=0.53, 95% confidence interval of the difference -0.97 to 0.50). Thirty of 47 participants subjectively preferred the PB technique (p=0.039).

Conclusion: There was no significant difference in success or time to intubation between standard bougie and PB techniques. The majority of participants in this study preferred the PB technique. Until a clear and clinically significant difference is found between these techniques, emergency airway operators should feel confident in using the technique with which they are most comfortable. [West J Emerg Med. 2015;16(4):588–593.]

INTRODUCTION

Background

Airway management is an essential skill in emergency medicine (EM), and the emergency practitioner must manage all airway emergencies in the critically ill patient. Endotracheal intubation is a key component of emergency airway management. When a difficult airway is encountered, the emergency practitioner must be familiar with multiple intubation techniques, including the use of airway adjuncts.

Endotracheal tube (ETT) introducer is a general term

used to describe several similar devices, made from resin-coated, braided polyester, that are used as adjuncts to emergency intubation. These devices are also referred to as "gum elastic bougies" or "bougies." This article will use "bougie" to refer to ETT introducers generally. In the adult configuration, bougies are typically 60cm in length and 5mm in diameter with an angled tip.[1] Smaller versions are available for pediatric populations. Bougies are used to assist in the placement of an ETT when glottic visualization is suboptimal, or when other patient factors make orotracheal intubation difficult. Bougies have been shown to be particularly effective when a Cormack-Lehane Grade III view is encountered (epiglottis-only view), or when factors such as obesity, limited cervical mobility or upper airway distortion are present.[2-5] Success rates with bougies for difficult orotracheal intubation have been reported in the range of 74-99%.[3,5-7]

The procedure for bougie-assisted orotracheal intubation begins with the operator obtaining the best-possible view of the glottic structures with a laryngoscope. This may be accomplished with direct or video laryngoscopy.[8] The successful use of a bougie has been described with blind digital intubation as well.[9] The bougie is then passed below the epiglottis, with the angled tip oriented anteriorly, into the glottic opening and confirmed visually as the bougie passes through the vocal cords. Confirmation of blind tracheal placement of the bougie is accomplished by feeling vibrations as the angled tip passes over the tracheal rings and by resistance to further insertion at a depth of 24 to 40cm. Once tracheal placement of the bougie has been confirmed, the ETT is advanced over the bougie into the trachea while the operator seeks to maintain the best-possible laryngoscopic view.[1,10-11]

At our institution, we have observed several instances in which an ETT was "preloaded" onto a bougie by the operator prior to beginning rapid sequence intubation and before initiating laryngoscopy (Figure 1). This is contrary to the instructions of standard emergency airway texts, which describe placing the bougie into the trachea first, then cannulating the ETT over the distal end of the bougie.[1,10-11] Typically this step is accomplished by an assistant while the intubator maintains glottic visualization.

Importance

The preloaded bougie (PB) technique has been described in multiple online educational forums but has not been formally described in the peer-reviewed literature.[12-13] In the PB technique, the ETT is pre-positioned over the bougie prior to inserting it through the vocal cords. The tip of the ETT is secured in place by the operator's right hand as the tip of the bougie is placed into the glottis (Figure 2). Following bougie placement through the vocal cords, the already-cannulated ETT is advanced through the vocal cords into the trachea. Thus, a step is eliminated. An assistant is recommended to secure the bougie end after it passes through the vocal cords so that the intubator can maintain a laryngoscopic view with their left hand while sliding the ETT over the bougie with their right hand.

While the use of video laryngoscopy is rapidly growing in the United States, it is not always successful. The bougie will likely continue to be used as an adjunct for difficult airways, either with video laryngoscopy or direct laryngoscopy when video laryngoscopy is unsuccessful or unavailable for any number of reasons. Thus, it is important to identify optimal approaches to using the bougie successfully.

Goals of This Investigation

In this study, we used a human cadaveric airway model to compare success rates and times to successful intubation between the standard method of bougie-assisted intubation and the novel PB technique. Fresh-frozen cadavers have been

Figure 1. Endotracheal tube preloaded on a bougie.

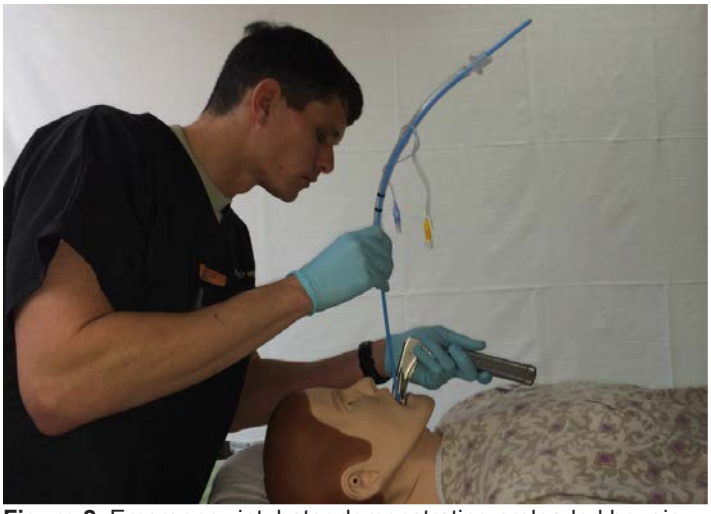

Figure 2. Emergency intubator demonstrating preloaded bougie technique on a mannequin.

shown to have greater airway fidelity when compared to a mannequin model.[14]

METHODS

Study Design

This study was a prospective cross-over design using a single study cohort of 47 EM residents (postgraduate years [PGY] 1-3), medical students, EM physician assistants (EMPA) and staff emergency physicians who volunteered to participate. All study participants attended a two-day emergency airway course for EM interns, either as students or instructors. Baseline demographic data was obtained and participants received standardized instruction in intubating with a bougie. Prior to initiation of the study, the local institutional review committee granted this project exemption from review.

Interventions

Two techniques were taught to each study participant, hereafter referred to as the "intubator." Standard bougie-assisted (SB) intubation was instructed as follows: a) The bougie was placed through the vocal cords by the intubator after visualizing them with a direct laryngoscope; b) Upon verbal command by the intubator, an assistant placed a 7.5 ETT over the bougie while the intubator continued to hold the bougie in place; c) The intubator then slid the ETT over the bougie, passing it through the vocal cords while maintaining the laryngoscope in place. The assistant secured the end of the bougie until the intubator re-took control and removed it, leaving the ETT in place.

The PB technique was instructed as follows: a) Prior to initiating the procedure, a 7.5 ETT was placed over the end of the bougie up to its 30cm mark with the intubator instructed to hold the bougie below this mark; b) The intubator visualized the vocal cords with direct laryngoscopy then placed the bougie tip through them, while securing the ETT and bougie simultaneously with their intubating hand. After passing the ETT through the vocal cords, the intubator directed the assistant to secure the bougie end; c) While maintaining the laryngoscope in place, the intubator then slid the ETT over the bougie through the vocal cords and then removed the bougie, leaving the ETT in place.

Methods and Measurements

Two human fresh frozen cadavers were used in order to maximize the number of study participants. Two researchers conducted standardized training with study participants, and an additional two researchers kept time. Both research teams followed the same standards for training and keeping time. Following standardized instruction, each participant was given one attempt to practice each technique before being evaluated. Participants were randomly assigned to start with either technique and consented for participation.

For both techniques, we sought to replicate actual intubating conditions, beginning at the point that the intubator judged the patient to be optimally sedated and paralyzed. The PB technique began with the ETT already in place over the bougie, as we determined that a reasonable intubator wouldn't paralyze the patient until this was ready, as part of their pre-intubation preparation. The SB technique, on the other hand, began without the ETT in place, just as in real life.

The intubator called "ready" to begin the timer and a bag-valve mask (BVM) was removed from the cadaver's face. The procedure was judged complete only after the bougie was removed from the ETT and the air cuff was inflated, at which point the timer was stopped. An intubation attempt lasting more than 300 seconds or a non-tracheal intubation was predetermined to be noted as a failed intubation. After intubation, a study investigator used direct laryngoscopy to verify placement of the ETT. After completion of both attempts, participants were asked to report their training level, prior intubation experience including prior experience with a bougie, their perceived ease of intubation on a visual analogue scale of 1 to 10 (1=difficult and 10=easy), and to select which technique they preferred (SB or PB). They were also asked to make a brief comment on the reason for selecting SB vs. PB.

Outcomes

The primary endpoint of our investigation was time to intubation. Based on previous studies of intubation we anticipated an average time of intubation of approximately 30 seconds.[16] Using a two-group t-test, we determined that a sample size of 24 subjects would allow us to detect a difference of 5s between groups, assuming α=0.05 and a power of 0.80. Secondary endpoints were success rate of intubation, subjective rating by intubators of perceived ease for each intubation technique, and preference for intubation technique. Additionally, each participant was asked to record comments regarding their preference.

Analysis

We collated, organized, and analyzed data using a Microsoft Excel spreadsheet. A paired t-test was used to determine if there was a difference in time to intubation between the standard bougie technique versus using the PB technique. We used an unpaired t-test to determine the difference for rating ease of use. The sign test was used to determine significance of the stated provider preference.

RESULTS

Characteristics of Study Subjects

Forty-seven participants performed intubation using both techniques. The study enrolled 10 medical students, four EMPAs, 19 EM PGY-1 residents, four EM PGY-2 residents, seven EM PGY-3 residents, and three emergency physicians. There was a broad range of reported experience levels (Table). Eighteen participants reported prior experience using the SB technique, whereas only four reported prior experience with

the PB technique.

Main Results

Forty-seven intubations were attempted for each technique. There were two failures for each technique with success rates of 95.7% for both. The failures were by two PGY-1s and one EMPA. One PGY-1 failed both techniques.

The range of times to completion for the standard bougie technique was 16.0-70.2 seconds, with a mean time of 29.4 seconds. The range of times to completion for the PB technique was 15.7-110.9 seconds, with a mean time of 29.7 seconds. There was no statistical difference in time to intubation between the two different methods of intubation in the overall group or any sub-groups (Table).

Participants rated the relative ease of intubation as 7.3/10 for the standard technique and 7.6/10 for the preloaded technique (p=0.53, 95% confidence interval of the difference -0.97 to 0.50). Thirty of 47 participants preferred the PB technique over the SB technique (p=0.039). Figure 3 demonstrates selected preferences by experience levels. The majority of participants who preferred the PB technique noted that there were less steps intubating with a PB once the procedure was started. Nearly all the participants who preferred the SB technique cited a decreased sense of control of the bougie using the preloaded method. See Figure 4 for representative comments from each preference group.

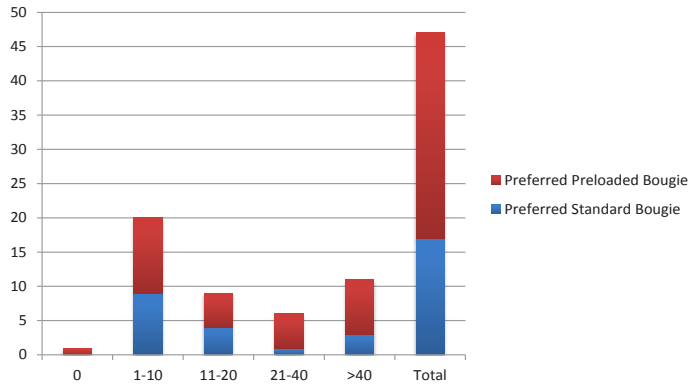

Figure 3. Reported preference for standard vs. preloaded bougie by experience level of intubators, post-study.

DISCUSSION

In this study, we used a human cadaveric model to compare the previously described standard bougie technique against an unstudied preloaded technique. The preloaded technique may appear to have an advantage, as it begins with the ETT already in place. The standard technique, however, is what is traditionally trained in EM residencies. We aimed to discover if there was any advantage in success or time with either technique.

Our prospective, randomized crossover study found that there was no significant difference in time to successful intubation. These results bore out across all experience levels, with the 95% confidence interval crossing zero in all subgroups (Table).

While the bougie has been in use for decades, we found minimal prior research on alternative techniques. Our results correlate well with other studies on use of the bougie in intubation, with typical times to intubate of approximately 30 seconds.[16] It seems unlikely that the non-significant differences found here would have any clinical significance in a real-world situation. Our secondary outcome of intubators' preferences might have a more significant clinical impact by impacting providers' approaches to intubation with a bougie. The majority of participants in this study group preferred the PB over the standard technique.

Emergent airways are a high stress situation even for experienced providers. Factors such as provider comfort with technique may provide a vital confidence boost. Further, reduction of distractions from concerns rather than positioning the airway device may improve real-world success rates. The most common explanation for preferences by study participants regarding why they preferred one technique or another was related to mechanics. For example, some participants preferred the PB technique for having one less step after paralyzing the patient. Others criticized it for being clumsy, as the added weight of the ETT at the distal end of the bougie interfered with deftly manipulating the bougie tip into

Table. Mean times for intubation using standard bougie versus preloaded bougie techniques.

Experience level of study participants, by number of intubations	Number of participants	Standard bougie technique, mean (SD)*	Preloaded bougie technique, mean (SD)*	Mean difference (95% CI)
Total	47	29.4 (10.8)	29.7 (16.8)	-0.3 (-6.1,5.5)
>40	11	22.8 (4.94)	19.9 (4.64)	2.8 (-1.4,7.1)
21-40	6	32.7 (16.8)	32.3 (22.97)	0.4 (-25.5,26.3)
11-20	9	33.5 (15.1)	37.1 (28.7)	-3.6 (-26.5,19.3)
1-10	20	29.6 (7.6)	31.1 (10.2)	-1.4 (-7.2,4.3)
0	1	39.2	26.4	N/A

*Mean time to intubation in seconds.

Standard bougie technique	Preloaded bougie technique
• Preloaded bougie required me to hold higher, increasing play • Easier to hold on to bougie and manipulate angles without a tube on it • Harder to manipulate bougie with weight of preloaded tube • Felt overly confident with preloaded and lost visualization	• Quicker, more efficient, less chance to mess up • Seemed to reduce steps, minimized loss of vision of airway • Fewer steps • Less to coordinate. Fewer things to drop. Felt faster. • Easier to manage endotracheal tube and bougie together • Don't have to worry about where the endotracheal tube is

Figure 4. Representative comments regarding preferred technique.

the airway. During the course of the study, several participants discovered variations that enabled increased individual comfort. For example, several participants held the ETT closer to their hand earlier in the procedure to increase dexterity. Further study and experiences with alternate techniques may produce additional improvements in technique.

LIMITATIONS

This research was conducted in conjunction with an airway training course, potentially leading to a bias in perceived ease and success as later participants gained additional practice through the course. The study design essentially controls each participant against him or herself. Further, prior research has demonstrated that the bougie can be effectively taught in a brief time frame.[15] There remains a potential for bias from participants having recently learned or practiced one method or the other during the concurrent airway course. In addition, these participants were self-selected by virtue of their course attendance to be highly motivated to manage advanced airways. This may limit generalizability to typical airway managers.

Due to limited availability and expense, the same two cadavers were used throughout this study. As a result, each cadaver experienced approximately 100 separate intubation attempts between set up, training, and evaluation attempts, with at least as many additional laryngoscopy attempts to verify ETT placement. Combined with the cadavers' decreased tissue elasticity, the repeated attempts led to an increasingly well-worn tract along the airway, potentially allowing for increased speed and ease for later participants.

While many experience levels were represented in the study group, the distribution of study participants was skewed toward inexperienced intubators. This was unavoidable due to the setting in which the study was conducted, i.e., an emergency airway course for PGY-1 EM residents. The predominance of inexperienced intubators may have affected the results, as the less experienced groups demonstrated slightly higher times with the preloaded technique. A significant difference might have been found with a larger group of experienced intubators. Additionally, it is possible that the limited diversity of training impacted success rates or introduced bias in terms of participants' preferences.

It is not clear how the use of video laryngoscopy would have affected the results as only direct laryngoscopy was studied. However, we posit that the differences in success and time between the two techniques would have been minimal with video laryngoscopy as well. Last, the bougie is typically discussed and used as an adjunct for difficult airways. The additional mechanical challenges presented by difficult airway anatomy might make differences in time to intubate more apparent. Preferences might change with the additional stress of a real-world, difficult airway.

CONCLUSION

There was no significant difference in success or time to intubation between standard bougie and PB techniques. The majority of participants in this study preferred the PB technique. Until a clear and clinically significant difference is found between these techniques, emergency airway operators should feel confident in using the technique with which they are most comfortable, whether it is the standard bougie or PB technique.

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Rural Ambulatory Access for Semi-Urgent Care and the Relationship of Distance to an Emergency Department

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Introduction: Availability of timely access to ambulatory care for semi-urgent medical concerns in rural and suburban locales is unknown. Further distance to an emergency department (ED) may require rural clinics to serve as surrogate EDs in their region, and make it more likely for these clinics to offer timely appointments. We determined the availability of urgent (within 48 hours) access to ambulatory care for non-established visiting patients, and assessed the effect of insurance and ability to pay cash on a patient's success in scheduling an appointment in rural and suburban Eastern United States. We also assessed how proximity to EDs and urgent care (UC) facilities influenced access to semi-urgent ambulatory appointments at primary care facilities.

Methods: The Appalachian Trail, which runs from Georgia to Maine, was used as a transect to select 190 rural and suburban primary care clinics located along its entire length. We calculated their location and distance to the nearest hospital-based ED or UC via Google Earth. A sham patient representing a non-established visiting patient called each clinic over a four-month period (2013), requesting an appointment in the next 48 hours for one of three scripted clinical vignettes representing common semi-urgent ambulatory concerns. We randomized the scenarios and insurance statuses (insured vs. uninsured). Each clinic was contacted twice, once with the caller representing an insured patient, once with the caller representing an uninsured patient. When the caller was representing an uninsured patient, any required upfront payment was requested from each clinic. One hundred dollars was used as a cutoff between the uninsured as a distinction between those able to afford substantial upfront sums and those who could not. To determine if proximity to other sources of care impacted a clinic's ability to grant an appointment, distance to the nearest ED or UC was modeled as a dichotomous variable using 30 miles as the divider.

Results: Of 380 requests, 96 (25.3%) resulted in appointments within 48 hours. Insured patients and uninsured patients able to pay a substantial amount upfront (>$100) were more likely to book an appointment (p-value <0.001, OR 18, CI [5-154]). Of the 47 clinics that granted uninsured patients appointments 89.3% required some form of payment up front. Farther distances from an ED did not result in greater likelihood of an appointment (OR 1.7, CI [0.4-11.3]). Clinics located within 30 miles of an UC were more likely to grant an appointment (OR 2.45, CI [1.19-5.80]).

Conclusion: Almost 75% of rural clinics were unable to grant a new appointment for a semi-urgent health complaint. Lack of insurance and large upfront charges appear to be significant barriers to rural ambulatory care appointments. Greater distance from an ED does not improve a clinic's ability to see semi-urgent appointments. Clinics located near an UC were more likely to grant an appointment than clinics without close alternative outpatient healthcare options. [West J Emerg Med. 2015;16(4):594-599.]

INTRODUCTION

Emergency departments (ED) are a routine site of care for patients with conditions that might otherwise be cared for in an ambulatory setting.[1-6] Increased ED visits have resulted in crowding, increased time to treatment, and worse patient outcomes.[7-13] Unreliable access to timely appointments and lack of a primary care physician (PCP) are major causes of patients using the ED rather than alternative sites of care.[4,14-20] The increased use of EDs for nonemergency conditions has led to increased healthcare costs for both the patients and hospitals.[21-22]

While it is known that scheduling non-emergent visits in an urban setting can be quite challenging, little data has been collected regarding the role of semi-urgent ambulatory care in a non-urban setting.[4,14-20] Data regarding barriers to care specifically in rural and suburban areas are lacking.[4,14-20,22] Trends in barriers to ambulatory care seen in larger cities may not be representative of trends present in other settings.

Up to 80% of established primary care patients are directed to the ED by their PCP upon calling with an exacerbation of symptoms.[14] The ready availability of the ED to resuscitate and manage patients with multiple complex morbidities has resulted in a shift of the burden of care to settings with easy ED access. It is reasonable to assume that in areas lacking readily available access to EDs or urgent care (UC) clinics, primary care centers would serve as a surrogate for acute care centers and be less likely to refer patients to locations that were significant distances from the original clinic. However, no study to date has examined whether this phenomenon exists.

This study aims to determine the availability of timely access to semi-urgent medical care using sham callers portraying patients traveling outside their usual source of primary care, specifically representing long-distance hikers traveling along the Appalachian Trail (AT). The AT was chosen as a model as it transects rural portions of 14 Eastern states and provides a rational explanation for the transient nature of the sham telephone caller without a local address in a rural setting. We determined the availability of timely access to ambulatory care at primary care facilities and a sham caller's ability to schedule a semi-urgent appointment in rural areas of the Eastern United States. We evaluated whether calls representing insured patients and uninsured patients able to pay substantial upfront cash fees were more likely to result in a timely appointment than calls representing uninsured patients unable to pay greater than $100. Our second goal was to assess whether a caller representing patients was more or less likely to book a timely appointment at primary care facilities with varying distances from UCs or EDs. We hypothesized that primary care clinics located greater distances from other sources of care would be more amenable to granting an appointment for a non-emergent complaint rather than referring them long distances to UCs or EDs.

METHODS

Study Design

We conducted this institutional review board-approved prospective telephone survey of primary healthcare facilities and clinics using a sham telephone caller representing patients attempting to schedule an appointment. The caller was trained to portray clinical vignettes representative of common semi-urgent complaints. For simplicity, any site where outpatient primary care is available was referred to as a clinic. The locations used to draw samples from were private physician offices, hospital and health system clinics, and community clinics.

Clinics were located and mapped using Google Maps (Google, Mountain View, CA) and Google Earth (Google, Mountain View, CA). Of 415 clinics initially selected, 190 were contacted. Those not contacted were unable to be reached due to incorrect or disconnected telephone numbers. Each clinic was contacted by a sham telephone caller trained to portray one of three clinical vignettes designed to represent semi-urgent complaints: an acute musculoskeletal injury, gastrointestinal distress, and a chronic medical condition needing maintenance. Two calls were made to each clinic to assess the effect of insurance and ability to pay cash on a patient's ability to schedule an appointment representing either an insured or uninsured patient. The sham telephone caller who represented an insured and uninsured patient during these calls was referred to as an insured patient and uninsured patient respectively for brevity.

Study Setting and Population

We used the AT as a guide for selection of rural and suburban primary care clinics along the Eastern United States. The proximity to the AT provided the sham caller with an explanation for being in the area and needing timely appointments. The clinical scenarios mentioned above were selected because they represent semi-urgent concerns that could have reasonably been experienced by someone traveling the AT and could be evaluated at an ambulatory care facility. We selected care facilities among towns and rural communities within 50 miles of the AT. The clinic location was then mapped to the nearest hospitals with a 24-hour ED and the nearest UC if available. Selected clinics ranged from 0-71 miles from the nearest UC, and 0-42 miles from the nearest ED.

Study Protocol

A prospective sham patient acting as an AT hiker away from their usual source of primary care called requesting an appointment for same day or next day availability for one of the three following conditions: an acute traumatic event represented by ankle pain and swelling following a stumble, a medical condition of diarrhea persistent for three days, and maintenance of the progression of intermittent asthma requiring increased use of a short acting beta agonist inhaler.

The scenario used was randomized for the first call to each clinic; the second call was randomized using the remaining two scenarios not used during the first call.

To eliminate any unforeseen events with the design of the sham calls, a short pilot study was performed to ensure that all necessary data could be reliably and accurately collected using the current scripted vignettes. Three clinics were selected that were within the clinic selection range, but were not included in the selection process for the main study. A trained sham caller portrayed hikers calling with complaints from the AT. No changes to the vignettes or study protocol resulted from the pilot. To minimize variation, one researcher was trained to request the next available appointment slot using one of the three randomized scripted vignettes. Two calls in randomized order, representing either an insured or uninsured patient, were made to each clinic to assess payment ability. If a patient was uninsured and granted an appointment the caller would request the necessary upfront payment required to be seen at each office.

To prevent clinics from becoming suspicious, a minimum of two weeks between each call was allotted, and identifying information of the sham patient was changed. The sham caller gave different identifying information for calls to the same clinic, and scenarios were not repeated at any individual clinic to minimize recognition by clinics' schedulers. Any available appointments were canceled before the end of each phone call to ensure appointment times were not taken from other potential patients.

Calls were made during standard office hours 8:00am-5:00pm, Monday through Friday. If a clinic's office hours were different from the standard office hours defined by this study, an additional call was made during the clinic's regular hours. The time interval from the first call to the repeat call was not included in the calculation of time till next available appointment – the time to next available appointment was started following the second call.

Measurements

The following data was collected during each call: appointment availability, time between call and scheduled appointment, and required payment method. We assessed timely care as a dichotomous variable - either the patient could successfully schedule an appointment within 48 hours or not. Insurance status of the sham caller was recorded for each call. If the caller was representing an uninsured patient, the required minimum upfront cash payment for the office visit was documented. If the amount of a specific upfront payment was not volunteered, the sham patient inquired about any fees that needed to be paid upfront before or immediately after the office visit. If an amount did need to be paid, the caller would ask if the clinic was supportive of setting up a payment plan, as well as the minimum upfront cost given this option. Almost all sampled clinics had upfront cash fees for uninsured patients, and most commonly a minimum of $100. This dollar amount was used to create two subcategories of uninsured patients: those who hypothetically could pay greater than or equal to $100 upfront, and those unable to pay this upfront fee. The purpose of creating these subgroups was to distinguish between uninsured patients who may or may not be able to afford these large upfront cash payments that are common in rural clinics.

If the facility could not make an appointment, the reason for inability to book an appointment and the location and facility type of other suggested healthcare options was recorded. It was suspected that some facilities might not be able to book appointments for reasons including but not limited to the following: the clinic was no longer accepting new patients, the clinic was not accepting new patients who were not insured, and/or there were no available appointments within a reasonable time period.

We calculated distance to the nearest ED or UC for each clinic using a program written in JAVAscript (Oracle, Redwood City, CA) and using Google Maps Application Programming Interface (Google, Inc. Mountain View, CA). Distances were manually checked to ensure accuracy of the program.

Data Analysis

We conducted analyses and sample size calculations in R (R Foundation for Statistical Computing, Vienna, Austria).[25] Each clinic was contacted twice – once representing an insured patient and once representing an uninsured patient. We applied McNemar's test to discern differences between the insured and uninsured callers. Logistic regression was used to control for distance from clinic to nearest healthcare facility, in order to determine if the scenario used affected a caller's ability to book an appointment.

To insure an adequate number of clinics were surveyed, sample size calculations were performed. Several assumptions were necessary for sample size calculations with McNemar's test. An appointment rate of 60% for insured patients was assumed based on previous studies,[15] with the goal to detect a 20% difference in appointment rate at a significance level of 0.05 with power equal to 0.90. The phi coefficient (φ), which quantifies the correlation between the outcome for the insured and uninsured status, was set at φ=-0.25, requiring a total of 164 clinics.

RESULTS

Of 380 requests for appointment made to 190 clinics, only 96 (25.3%) resulted in an appointment booked within the acceptable 48–hour window (Table 1). The chief complaint of the scenario did not influence the ability to schedule an appointment. The odds ratios calculated for a callers with intermittent asthma with mild worsening of symptoms and callers with gastrointestinal distress relative to those with a musculoskeletal complaint are as follows: (OR 0.2, CI [0.03-1.08]) and (OR 0.23, CI [0.05-1.04]). Payer type did appear to affect ability to book an appointment as insured patients

Table 1. Comparison of appointment availability between insured and uninsured patients.

Scenario	Private insurance	Cash payment <$100	Unlimited cash payment
Overall	49/190 (25.8)	15/190 (7.8)	47/190 (24.7)
Gastrointestinal	13/51 (25.5)	7/68 (10.3)	20/68 (29.4)
Musculoskeletal	22/72 (30.6)	4/60 (6.7)	13/60 (21.7)
Chronic disease	14/67 (20.9)	4/62 (6.5)	14/62 (22.6)

and uninsured patients willing to put $100 or greater down as payment were significantly more likely to be accepted (McNemar's chi-squared=28.6 and p-value <0.001, OR 18 CI 154). Only 47 of the 190 clinics contacted were willing to accept an uninsured patient. Of those 47 clinics, 42 (89.3%) required some form of upfront payment.

Clinics ranged in distance from zero to 35 miles to the nearest UC or ED. Increased distance from the nearest ED had no impact on the likelihood of booking an appointment (OR 1.7 CI [0.4, 11.3]). However, clinics located near an UC were more likely to grant an appointment than clinics without close alternative outpatient healthcare options (OR 2.45, 95% CI [1.19-5.80]).

Table 2 illustrates the results of securing an appointment given the population within a zip code and payer status. Zip code size differs from a town's population, as some areas have a single zip and others have multiple zip codes within a single town or suburban area. Previous studies have addressed barriers to outpatient care in large urban areas.[15,20] The actual town and city population of this study ranged from 746 to 97,856 based on data from the 2010 census, compared to previous studies whose populations ranged from 420,003 (Atlanta) to 8,175,133 (New York).[15,20]

DISCUSSION

The increased role of the ED in providing non-emergent care has been hypothesized to result from a lack of primary care access, availability of ambulatory care appointments, and general dissatisfaction with non-ED care.[1-6] Given the current rationale for accessing EDs for non-emergent conditions, it would seem reasonable that ambulatory facilities in rural areas, not easily accessible to EDs would fill the role of providing timely care for non-emergent conditions experienced by non-established visiting patients. However, we determined that increased distance from the nearest ED had no impact on the likelihood of booking an appointment. In actuality, clinics located a UC were more likely to grant an appointment than clinics without close alternative outpatient healthcare options (OR 2.45, 95% CI [1.19-5.80]). We believe this paradox may suggest proximity to UCs creates more competition for patients, increasing PCP offices' willingness to accommodate non-established visiting patients. Alternatively these facilities may be appropriately decreasing the volume burden experienced by PCPs allowing them time to see patients with urgent concerns in a timely manner.

We found only 25% of clinics surveyed were willing to treat a non-established visiting patient within a 48-hour window. Unsurprisingly, insurance status and ability to pay for the office visit upfront was a key predictor of ability to schedule an appointment, with insured patients and patients able to pay an upfront amount greater than $100 significantly more likely to be seen in the designated time frame of 48 hours. Seventy-five percent of rural ambulatory clinics were unwilling to see an uninsured patient not able to pay at least $100 upfront.

The results of this study support a previous study's findings that insurance status did not seem to make a difference as long as the uninsured patient was willing to pay a significant sum upfront.[15] Patients unable to pay a substantial amount upfront were also less likely to be able to book an appointment in a timely manner. Both studies found that difficulties booking an appointment were not limited to only the uninsured; one quarter of privately insured patients in this study were unable to book an appointment; one third were unable in large urban areas. One hundred percent of clinics in this study screened callers to determine insurance status, versus 98% found by Asplin et al.[15]

A multitude of reasons may exist for these findings including a clinic not currently accepting new patients, thin operating margins that would not cover the time necessary for establishing a new patient, lack of interest in seeing a patient who would not be establishing care, or inability to accept a certain brand of insurance. These findings may portend future challenges for patients and referring physicians searching for timely access to ambulatory care in rural settings as the insured patient pool is expanded through implementation of the Affordable Care and Patient Protection Act (ACA).

Despite financial disincentives enacted by insurance companies to discourage ED use for non-emergent conditions, it appears that in many cases the ED remains the best option for timely treatment, for both insured and uninsured individuals. This would seem to support literature regarding insured patients' increased use of the ED.[15]

If the likelihood of insured patients gaining appointments is slim, the likelihood for uninsured patients is much worse. Only 47 of the 190 clinics would accept patients without insurance, and almost 90% of those required upfront payment for services rendered. We believe the ED might remain the safety net for these patients who are outside of their normal healthcare provider range. It is not difficult to draw conclusions regarding future challenges for rural EDs.

Table 2. Comparison of appointment availability by clinic zip code population.

Population	Private insurance	Cash payment <$100	Unlimited cash payment
Overall	49/190 (25.8)	15/190 (7.8)	47/190 (24.7)
<10,000	20/84 (23.8)	9/84 (10.7)	19/84 (22.6)
10,000-20,000	15/56 (26.8)	3/56 (5.4)	12/56 (21.4)
20,000-30,000	7/23 (30.4)	1/23 (4.3)	8/23 (34.7)
30,000-40,000	7/26 (26.9)	2/26 (7.7)	8/26 (30.7)
40,000-50,000	0/1 (0.0)	0/1 (0.0)	0/1 (0.0)

Even in those states expanding Medicaid through the ACA, receiving care in a non-ED setting can be difficult for patients. It is likely that even rural EDs will suffer from crowding and the associated negative consequences there of.[7-13] It may be safe to assume that decreased Disproportionate Share Reimbursements will further increase the already significant financial strain on rural EDs.[24]

LIMITATIONS

One limitation of this study is the use of Google search engine for identifying primary care clinics. Of 415 clinics initially identified, only 190 were accessible by telephone number listed in the Google search. This study is also limited by the assumption that the AT is a sufficient surrogate marker for rural settings as well as limiting town/city size. Utilization of Geographical Information Systems to assess urban, suburban, and rural settings could potentially more accurately identify rural settings to target.

The inability for sham callers to provide local addresses could have made clinics less likely to grant appointments due to the decreased likelihood of the patient establishing continued future care. The nature of this study design only allows for conclusions to be drawn for acute new patient appointments for out-of-town patients not planning on establishing care and cannot represent appointment availability for established patients within a primary care practice. Furthermore, focusing on a transient population allowed the sham caller to minimize the amount of deception during the telephone call, eliminating the need to give intent to establish care at the clinic and give a local home address to a clinic scheduler who might be very familiar with the local neighborhoods and their inhabitants.

As our callers were not real patients, social security numbers and specific insurance policy information could not be given out, but this did not inhibit a clinic's ability to finish with the caller protocol. Clinics were instructed that the patient would call back immediately with this information; however, each appointment was canceled before the end of the phone call, so that this step was no longer necessary.

Cash payments appear to play a significant role in rural primary care visits, as it was commonly requested upfront during identification of uninsured status. We did not explicitly examine this effect other than sham caller's hypothetical ability to pay the minimum upfront fee. This is of course in stark contrast to ED visits that require no upfront payment. The $100 sum we used as a cutoff for a substantial upfront fee most likely overestimates the amount many uninsured are able to pay for such an office visit. This would suggest our findings might overestimate access to ambulatory care, and these patients may be even less likely to successfully schedule an appointment than our study predicts.

CONCLUSION

Significant barriers to rural ambulatory care for non-emergent medical conditions exist, resulting in use of EDs for non-emergent care by non-established visiting patients. Not surprisingly, there appears to be a disparity for financially vulnerable populations, leaving those uninsured and unable to pay large upfront fees less likely to be able to acquire timely access to outpatient care for semi-urgent ambulatory concerns. However, barriers to care do not seem to be limited to financially vulnerable populations; it was found that insured patients were also unable to schedule ambulatory care appointments. Primary care centers located greater distances from continuously staffed EDs are not surrogates for ED care. Timely access to outpatient care for urgent ambulatory concerns is necessary to prevent unnecessary ED visits. Barriers to this form of care have the potential to create challenges for both EDs and patients seeking care in facilities other than their established PCP office. Patients with concerns that could not be treated in the outpatient setting will experience increased wait times due to ED crowding. Patients with concerns that could be treated in the outpatient setting will accrue considerable costs that could otherwise be avoided if barriers to this care did not exist. This study helps emphasize that these barriers do in fact exist, but also brings to light the impact UC facilities might have on timely ambulatory healthcare access in rural and suburban areas. Further research evaluating the impact of these sites of care would provide a better understanding if their specific impact on ED utilization in rural and suburban environments.

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Nighttime Encounter

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I felt the world narrow
as I looked at her, a frail woman
tonight thin and grey,
lent animus by memory and
desperation and loneliness.

She gestured weakly as I came to her
and said something, muffled,
under the thick, coiled tubing
which snaked to the mask
bound about her face.

I took the straps off,
and at this early morning hour
she straightened her hair feebly,
gazing in the darkness
as the machine sputtered and blew.

I rapidly ministered to it,
pleading for silence.

Freed now, she spoke;
Dimly, there arose an elegance,
rapidity and lucidity,
an English accent and gentle words
spilling out in her deprecating way.

She beckoned; I sat,
and held her hand.

She told me of her time -
she was a young woman,
on a boat, falling away,
journeying overseas, Australia,
to a new home far removed.

Of a man she had met there, and loved and buried.
Of her work -
she had thought it very important;
Of the children she had borne -
how she missed them.

For me, for herself,
she sketched the arc of her star.

Sitting on a precipice, she spoke:
What really mattered now, here
mostly alone, in the dark,
a small hospital room
and drawn curtains, fold-out fabric walls.

At times I held that blowing mask
against her face, to give her the breath,
at times I asked a question -
but mostly I listened
and held her hand.

The machine huffed, disconnected,
waiting, in the dark.

She smiled as she spoke,
sometimes mocking herself,
sometimes wry, sometimes happy,
on some things she couldn't speak -
we both understood.

She held a strength, I knew,
found in those who dare reject hubris.

My pager interrupted,
it was the world interrupting, really,
I silenced it -
and sat with her and listened
until I could no more.

Her last words,
said with a smile:
"I know you're busy.
Thank you for listening
to an old windbag like me."

I told her it was my pleasure -
I have always honored teachers.

I strapped the mask back on
and smiled at her, constrained,
buried now, under mask and tubing
with life and machine
connected again, far from equal.

She gazed up at me, still and silent.
I gave her hand a squeeze,
and left into the world of light,
and movement,
and things to be done.

My world had expanded,
but it was her last conversation.

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Emergency Medicine Simulation Fellowship

University of California, Irvine, Department of Emergency Medicine (EM) is seeking a HS Clinical Instructor- Medical Simulation Fellow for July, 2016. University of California, Irvine Medical Center is a Level I Trauma center with 3,800 runs/year, 50,000 ED census with a nationally recognized three-year residency program since 1989. The UC Irvine Medical Education Simulation Center is a new $40 million, 65,000-square-foot facility that provides telemedicine and simulation-based educational programs and CME courses for thousands of healthcare providers each year. The four-story medical education center includes a full-scale operating room, emergency room, trauma bay, obstetrics suite and critical care unit. The simulation fellow will have the opportunity to educate/train and form cooperative collaborative relationships with medical students, residents, nurses, allied health professionals, EMTs, paramedics, and physicians while developing and delivering innovative simulation curriculum. Our simulation-based content has been implemented in educational courses at the local, regional and international level.

The Medical Simulation Fellowship is a one year mentored fellowship that offers advanced training in simulation teaching, curriculum design, educational program implementation, study design, and research for a graduate of an accredited Emergency Medicine residency program. A two-year track is available for those applicants in pursuit of an advanced degree. Salary is commensurate with qualifications and proportion of clinical effort.

For more information, visit our website at:
http://www.emergencymed.uci.edu/Education/simulation.asp

Submit CV and statement of interest at: https://recruit.ap.uci.edu/apply/JPF03023

SCHOOL OF MEDICINE
UNIVERSITY of CALIFORNIA · IRVINE
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Point-of-Care Ultrasound Fellowship

University of California Irvine, Department of Emergency Medicine seeks a Health Sciences Clinical Instructor. This is an ongoing recruitment. University of California, Irvine is a Level I Trauma Center with 3,800 runs/year and a 50,000 ED census. Academic department with Division of Emergency Ultrasound since 2001. Director is fellowship trained, as well as two additional faculty. A fully integrated 4-year medical student ultrasound curriculum is established. Research, teaching and clinical environment.

Clinical schedule of eight 10-hour shifts per month. Salary commensurate with level of clinical work. 1000 scans/year anticipated along with video review of 6000 more. RDMS certification expected upon completion of the fellowship. Prior experience not required.

Submit CV, statement of interest and three letters of recommendation at:
https://recriut.ap.uci.edu/apply/JPF03018

SINAI
Sinai Health System

December 2-4

Flamingo
LAS VEGAS

ROSALIND FRANKLIN UNIVERSITY of MEDICINE AND SCIENCE

6th Annual National Update on Behavioral Emergencies

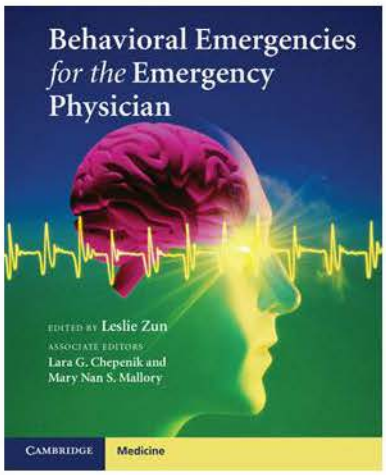
Topics (Tentative)
Thursday December 3 (Day 1)

- Introduction/AAEP
- Medical Clearance
- UDS
- Ketamine and EMS
- Disorders that Can Kill
- Treatment of Agitation
- Informed consent & Invol Meds
- Quality Improvement
- Applying BETA Guidelines
- Interviewing techniques
- Starting a PES/Psych Ed
- Research Forum

Topics (Tentative)
Friday December 4 (Day 2)

- Improving Efficiency
- Synthetic Cannabinoids
- High Utilizer Management
- HEADS ED
- Excited Delirium
- Violence in the ED/PES
- Neurobehavioral Manifestations of Non-Convulsive Status
- Fellowship
- AMA and other risk issues
- Psych collaborative
- Will I Get Sued
- Psych Boarders
- Working with law enforcement,

Every Registrant Receives a Copy



Pre-Conference Course Dec 2th
Full Day Seminar Improving Care and Flow and Reducing Bourding for People With Behavioral Health Problems
$400 In Advance $500 at the door.
See www.IBHI.Net for Details

Invited Speakers

Michael Wilson
Karen Murrell
Kingwai Lui
Jagoda Pasic
Clare Gray
Terry Kowalen-ko
Silvna Riggio
Stephen Har-garten
Laura Vearrier
Michael Geraldi
Jack Rozel
Kim Nordstrom
Nidal Moukad-dam
Aaron Doral-Laskey
Doug Rund
Michael Wilson
Laura Vearrier
Scott Zeller
Jon Berlin
David Hnatow
Kurt Isenburger
Margaret Belfour

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

For further information contact Les Zun, MD at zunl@sinai.org
773-257-6957

MEDICAL EDUCATION FELLOWSHIP
DEPARTMENT OF EMERGENCY MEDICINE
THOMAS JEFFERSON UNIVERSITY HOSPITAL
PHILADELPHIA, PA

The Department of Emergency Medicine at Thomas Jefferson University Hospital is proud to announce its one-year **Medical Education Fellowship** for graduating emergency medicine residents. Our intensive Fellowship is geared for residents seeking advanced training in pedagogy and learning theory; instructional design; and design thinking. The goal of the Fellowship is to prepare the Fellow for a highly successful career as an educational leader in academic emergency medicine.

Informed by the principles of Experiential Learning Theory, Transformative Learning Theory, and Self-Directed Learning Theory, the Medical Education Fellowships offers the prospective Fellow(s) the skillset to adapt to an ever-changing learning environment and educational landscape. The Fellowship will provide formalized training in adult learning in clinical and academic medicine, and will use simulation, telehealth, and patient safety (PS) and clinical quality (CQ) tools as vehicles to inform educational initiatives in undergraduate and graduate curricula, as well as faculty development programming and continuing medical education. In addition, the Fellow will identify a specific area of academic interest in the realm of education, and will be given the resources and time to develop his/her productivity within this specified domain. The Education Fellow will work clinically as an attending physician in the Emergency Departments (ED) of Thomas Jefferson University Hospitals.

Interested applicants should be graduates of an ACGME-accredited Emergency Medicine residency program. An application will consist of a letter of interest, curriculum vitae (CV), and 2-3 letters of recommendation. Please direct any questions to Dr. Dimitrios Papanagnou or Christina Melton. The deadline for application is October 1st, 2015. For additional information on the fellowship program, please visit:

http://www.jefferson.edu/university/jmc/departments/emergency_medicine/education/fellowships/medical_education.html

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CAL/AAEM

California Chapter Division of the American Academy of Emergency Medicine

Ohio ACEP
American College of Emergency Physicians
Advocacy | Education | Leadership

OHIO ACEP IS EXCITED TO ANNOUNCE A NEW DATE & LOCATION IN PARTNERSHIP WITH CALIFORNIA ACEP!

CALIFORNIA ACEP
AMERICAN COLLEGE OF EMERGENCY PHYSICIANS

February 8 - 12, 2016
Newport Beach, CA

Ohio ACEP Emergency Medicine Board Review Courses

FOUR DATE OPTIONS!

The Ohio ACEP Emergency Medicine Board Review

August 21 - 25, 2015 *(Columbus, Ohio)*
October 11 - 15, 2015 *(Columbus, Ohio)*
February 8 - 12, 2016 *(Newport Beach, California)*

Fast Facts Emergency Medicine Board Review

August 26 - 28, 2015 *(Columbus, Ohio)*

Approved for *AMA PRA Category 1 Credits ™*.

www.ohacep.org **(614) 792-6506**

COMPREHENSIVE. RELEVANT. ESSENTIAL.