Dear Colleague:

The emergency medicine research symposium aims to (1) highlight the research conducted by our department members; (2) provide an opportunity for presenting research findings, especially for trainees and new researchers; (3) offer a forum for presenters to receive peer review, feedback and suggestions; (4) enable collaborations among our researchers and our research colleagues; (5) encourage high-quality research and progression to publication of research findings; (6) facilitate a process for assessment of departmental investments in research; and (7) provide an opportunity to learn from experienced researchers, particularly pertaining to research methodology in emergency medicine.

This year, the research symposium will focus on the research of our trainees (residents, fellows, and EMPEDS). We invite you to be a part of this novel way of showcasing the interesting work done by our group, stimulating conversations, and forging collaborations.

2015 Planning Committee
Roland C. Merchant, MD, MPH, ScD
Elizabeth Goldberg, MD
Amy Michaluk
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Agenda

8:00 AM Introductions

8:05 AM Keynote Lecture
Problems and Progress in
Emergency Medicine Research
Edward Boyer, MD, PhD
UMass Medical School

9:00 AM Coffee Break

9:15 AM Oral Presentations – Session 1

9:15 AM Interim Results of Provider
Workload Assessment During
Simulated Prehospital Cardiac
Arrest Resuscitation Using an
Experimental Device-Assisted
Protocol
Nicholas Asselin, DO
PGY4

9:25 AM Q&A

9:40 AM Derivation of the Ebola Prediction
Score for Risk Stratification of
Patients with Suspected Ebola
Virus Disease
Tess Wiskel, MD
PGY1

9:50 AM Q&A

10:05 AM Objective Assessment and
Thematic Categorization of
Patient-Audible Information in an
Emergency Department
Xiao Chi (Tony) Zhang, MD, MS
PGY2

10:15 AM Q&A

10:30 AM Coffee Break

10:45 AM Oral Presentations – Session 2

10:45 AM The Lifespan Opioid Overdose
Prevention Program: Pre-
Implementation Population
Assessment and Provider Practice
Patterns
Elizabeth Samuels, MD, MPH
PGY3

10:55 AM Q&A

11:10 AM A Systematic Review of Clinician
Attitudes, Screening Practices and
Interventions to Reduce Firearm-
Related Injury
Jonathan Ameli, MD
PGY2

11:20 AM Q&A

11:35 AM Climatological Influence on
Patients Presenting to the
Emergency Department Diagnosed
with Nephrolithiasis
Seth Gemme, MD
PGY3

11:45 AM Q&A

12:00 PM Final Remarks

12:15 PM Lunch
Claverick 1 Conference Room
Keynote Speaker

**Edward Boyer, MD, PhD**
Professor of Emergency Medicine  
Chief of the Division of Medical Toxicology  
University of Massachusetts Medical School  
Lecturer in Pediatrics  
Harvard Medical School

A native of Mississippi, Ed went to Vanderbilt before entering graduate school at Columbia University. After receiving his doctorate in synthetic organic chemistry, he was a NIH postdoctoral fellow in protein design at The Rockefeller University. After a brief stint in an intellectual law firm, he entered Columbia University College of Physicians and Surgeons before pursuing resident education at the University of Pennsylvania. In 2001, following fellowship training at the Harvard Medical Toxicology program, he joined the faculty of the department of emergency medicine at the University of Massachusetts Medical School. He has been continuously funded by NIH since 2001 to pursue investigations related to substance abuse, HIV adherence, technology, and advanced behavioral interventions.

Keynote Lecture

**Title:** “Problems and Progress in Emergency Medicine Research”

**Learning Objectives:**
1. To identify research problems in emergency medicine
2. To describe progress in emergency medicine research
3. To identify future directions for emergency medicine research

CME Accreditation

**Accreditation:** The Warren Alpert Medical School of Brown University designates this live activity for a maximum of 1 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in this activity.

Disclosures

**Faculty Disclosure:** N/A
**Appropriate Commercial Support acknowledgement if applicable:** N/A
RESIDENT: JONATHAN AMELI, MD (PGY2)

A Systematic Review of Clinician Attitudes, Screening Practices and Interventions to Reduce Firearm-Related Injury
Jonathan Ameli¹, Paul J.D. Roszko², Patrick M. Carter³, Curtis T. Haynes¹, Rebecca M. Cunningham³, Megan L. Ranney¹. ¹Alpert Medical School of Brown University, Providence, RI; ²Beth Israel Deaconess Medical Center/Harvard Affiliated, Boston, MA; ³University of Michigan School of Medicine, Ann Arbor, MI

Background: Firearm injury is a leading cause of injury morbidity and mortality in the United States. Despite AMA/ACEP policies highlighting the need for firearm injury prevention, evidence-based clinical screening and intervention practices are lacking.

Objectives: To systematically identify and summarize the existing literature on clinical firearm screening and interventions for patients of all ages.

Methods: A systematic search of 4 databases (PubMed, WebOfScience, CINAHL, Psycinfo) and Clinicaltrials.gov was completed in October 2014. English-language original research on any clinician firearm screening or interventions, or patient/provider attitudes on the same, was included. 2 authors independently completed the title and abstract review to exclude unrelated studies. Remaining studies underwent full-text review, data abstraction, and quality scoring using the Newcastle-Ottawa Scale (NOS), modified NOS, or JADAD Scale by 4 study authors. Discrepancies were resolved by group consensus.

Results: 3260 unique titles were identified and 54 were included (1698 excluded at title review, 1488 at abstract review, 20 at full-text review). 33 studies examined clinician attitudes/practice patterns; study quality was poor (30/33=cross-sectional). Prior training, experience, and expectations correlated with clinicians’ regularity of firearm screening and likelihood of giving anticipatory guidance. Screening rates were low across studies and specialties (Emergency Medicine, Pediatrics, Psychiatry). 6 articles described patient attitudes; methodological quality was poor (5/6=cross-sectional), with mixed results on patient willingness to discuss firearm safety. 15 articles assessed patient interventions; 6 were RCTs, with 1 finding increased rates of 6-month safe firearm storage in families with children and 1 finding reduced 12-month weapon carriage by assault-injured youth.

Conclusions: Existing firearm injury prevention research largely focuses on clinician attitudes and practice patterns, with limited evidence regarding effective practices to decrease firearm injury. Methodological quality is poor, with low follow-up rates and lack of standardized outcome measures. The few high-quality studies indicate firearm screening and interventions may be acceptable to patients/providers and may reduce youth risky behaviors. Further research is needed to establish best screening and intervention practices.
Interim Results of Provider Workload Assessment During Simulated Prehospital Cardiac Arrest Resuscitation Using an Experimental Device-Assisted Protocol

Nicholas Asselin\(^1\), Bryan Choi\(^1\), Catherine C. Pettit\(^1,2\), Max Dannecker\(^2\), Mark S. Jones\(^2\), Lisa Merck\(^1\), Selim Suner\(^1\), Kenneth Williams\(^1\), Gregory D. Jay\(^1\), Leo Kobayashi\(^1,2\). \(^1\)Alpert Medical School of Brown University, Providence, RI; \(^2\)Lifespan Medical Simulation Center, Providence, RI

**Background:** Management of prehospital sudden cardiac arrest (PHSCA) is physically and mentally demanding. Mechanical resuscitation adjuncts may mitigate this workload.

**Objectives:** To assess 1) EMS teams’ physical and cognitive workload during simulated PHSCA resuscitation when using traditional protocols and 2) the workload impact of a device-assisted cardiac arrest resuscitation protocol.

**Methods:** Each 2-member EMS team (Basic with Intermediate/Cardiac/Paramedic) was randomized to control or experimental group and fitted with wireless heart rate (HR) monitors. Each team completed 3 PHSCA scenarios: 1) baseline, standard BLS/ALS roles; 2) standard roles, with or without experimental intervention; 3) reversed roles, with or without experimental intervention (to assess for the feasibility of experimental “ALS”-level protocol application by BLS providers). Experimental teams utilized a goal-directed, device-assisted resuscitation protocol with autocompressor, supraglottic airway/mechanical ventilator and intraosseous drill in scenarios 2 and 3. Subjective scales of reported exertion (BORG), multidimensional workload metrics (NASA TLX) and HR data were recorded for each scenario. The Tanaka method was used to determine estimated maximal HR (%EMHR).

**Results:** 10 teams (5 control and 5 experimental) were included in interim analysis. Baseline characteristics including age, number of prior SCAs managed, estimated patients/week and duty hours/week were similar between study groups. There were no significant differences between control and experimental groups during scenario 1. With the introduction of the device assisted protocol, there was a significant reduction in BORG score for the BLS providers in the experimental group. There was also a nonsignificant trend towards reduced %EMHR and NASA-TLX in both BLS and ALS providers with the intervention. Scenario 3 role reversal in experimental teams resulted in reduced %EMHR and BORG scores in the BLS subjects and reduced %EMHR and NASA-TLX scores in ALS subjects, relative to baseline metrics.

**Conclusions:** Objective and subjective metrics confirmed significant physiologic activation, mental exertion and task-associated workload during simulated PHSCA management. An experimental device-assisted protocol significantly reduced BLS and ALS provider PHSCA resuscitation workload.

Table 1. Comparison of objective and subjective workload metrics in control and experimental groups by resuscitation scenario. Values are reported as mean ± SD.

<table>
<thead>
<tr>
<th></th>
<th>Control Group. BLS Provider</th>
<th>Experimental Group. BLS Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scenario 1</td>
<td>Scenario 2</td>
</tr>
<tr>
<td>%EMHR</td>
<td>93% ± 5</td>
<td>82% ± 9</td>
</tr>
<tr>
<td>BORG</td>
<td>14.4 ± 1.9</td>
<td>14.4 ± 3.8</td>
</tr>
<tr>
<td>NASA-TLX</td>
<td>69 ± 10</td>
<td>69 ± 10</td>
</tr>
<tr>
<td></td>
<td>Scenario 1</td>
<td>Scenario 2</td>
</tr>
<tr>
<td>%EMHR</td>
<td>87% ± 15</td>
<td>86% ± 12</td>
</tr>
<tr>
<td>BORG</td>
<td>13.8 ± 3.4</td>
<td>13.8 ± 3.4</td>
</tr>
<tr>
<td>NASA-TLX</td>
<td>70 ± 22</td>
<td>55 ± 25</td>
</tr>
</tbody>
</table>

\(^2\) tailed t test. *p < 0.05, **p < 0.01
Resident: Seth Gemme, MD (PGY3)

Climatological Influence on Patients Presenting to the Emergency Department Diagnosed with Nephrolithiasis
Seth Gemme¹, Dorothy Skierkowski², Gregory Jay¹. ¹Alpert Medical School of Brown University, Providence, RI; ²Brown University School of Public Health, Providence, RI

Background: Patients commonly present to emergency departments (ED) with symptoms of renal colic. Previous studies have shown a relationship between climate and lithogenesis, but most studies were not done in the United States (U.S.) and were limited to one geographical site or did not use confirmed diagnosis. The STONE Study (Smith-Bindman NEJM 2014) is the largest database of diagnosed renal stones across fifteen disparate U.S. geographically locations. We hypothesized that warmer locations with more variation in climate have a higher incidence of nephrolithiasis.

Objective: To determine the relationship between climate and nephrolithiasis.

Methods: This is a secondary analysis of data from the multicenter randomized comparative effectiveness STONE study of ED patients 18-76 yo with suspected nephrolithiasis from October 2011 to February 2013. Temperature and humidity data was collected from National Oceanic and Atmospheric Administration’s National Climate Data Center for each of the 15 site locations. Subjects diagnosed with nephrolithiasis via urological follow-up were aggregated at a monthly level and minimum monthly temperature and humidity for each site were used as predictors for diagnosis of nephrolithiasis. Generalized estimating equations were used for data analysis.

Results: 817 of the 2759 patient enrolled were diagnosed with nephrolithiasis across all sites. The way in which nephrolithiasis related to temperature varied based on the degree of temperature fluctuation at each site (interaction p=0.0046). Specifically, there was no statistically significant relationship between monthly minimum temperatures and nephrolithiasis at sites which never dipped below freezing [p=0.1001; -6% per 10 °F (95%CI-13%-+1%)], but in sites which did dip below freezing, diagnosed nephrolithiasis increased on average by approximately 6% per every 10 °F (95%CI 2%-10%; p=0.0029). Humidity did not significantly predict nephrolithiasis diagnosis.

Conclusion: Over the 17 month enrollment period in the STONE study, those sites with drastic temperature variation were associated with an increased number of diagnosed renal stones as temperature increased. This could be explained in part due to the inability of the human body to acclimate to temperature in locations with a more dynamic climate.
The Lifespan Opioid Overdose Prevention Program: Pre-Implementation Population Assessment and Provider Practice Patterns
Elizabeth Samuels, Michael J Mello, Janette Baird, Eunice Yang. Alpert Medical School of Brown University, Providence, RI

Background: The Lifespan Opioid Overdose Prevention (LOOP) Program was established in September 2014 to prevent opioid overdose and overdose deaths and improve addiction treatment referral. LOOP is a hospital-community partnership that offers patients at risk of opioid overdose a take home intranasal naloxone rescue kit, overdose prevention and response education, and consultation with a peer recovery coach for recovery support and referral to treatment.

Objectives: This analysis aims to examine the extent of overdose risk among Lifespan ED patients prior to the inception of the LOOP program. Pre-implementation period assessment describes baseline population characteristics and provider practice patterns prior to LOOP program implementation.

Methods: This study is a retrospective chart review of ED patients who have had or who are at risk for opioid overdose and were seen at a Lifespan Hospital ED (Rhode Island (RIH), Miriam (TMH), and Newport Hospitals (NH) between 2014-2015. The study is conducted in accordance with STROBE guidelines. After initial chart screening and extraction, each chart is reviewed and included if the patient had any of the following: an opioid overdose; known nonmedical opioid use; prescription for a new or higher dose opioid with concurrent chronic opioid use, dialysis dependence, end stage liver disease or poorly controlled depression or pulmonary disease. The current analysis is focused on charts extracted from the preimplementation period, January-February 2014. Validation checks of extracted data are being conducted at regular intervals. All data is analyzed using SPSS software.

Results: 322 of 899 extracted pre-implementation charts were included in the analysis; 223 at RIH, 71 at TMH, and 28 at NH. Patients at risk for overdose were 60.6% male and 86% Caucasian. Most patients were between 30-50 years of age, but younger patients (p<0.008) and males were more likely to present after an overdose compared to females (45% vs 24%, p<0.000). Overdose visits did not vary significantly by race, visit recurrence, concurrent alcohol use, co-morbidities, or day or time seen. All visits were evenly distributed throughout the week, but most occurred between 3pm-11pm. Patients stayed for an average of 7.3 hours (SD ±10.3h). Twenty percent were repeat visits and 37.0% were after an opioid overdose. Naloxone was administered prehospital in 27.5% of cases, primarily by EMS (98.8%). Most patients (76.6%) were discharged, but a minority (12.3%) were linked to treatment. A greater proportion TMH and NH patients were linked to treatment compared to RIH (TMH 22.4% vs. NH 16.7% vs RIH 8.4%, p<0.026), and linkage was not affected by age, race, gender, visit recurrence, concurrent alcohol use, provider identification of substance abuse problem, or day or time seen. Of those admitted, 38.2% had an opioid overdose, 55.1% went to a medical floor, 25.6% went to an ICU, and 9% were admitted to psychiatry.

Conclusions: There is significant need among Lifespan ED patients for overdose prevention and addiction treatment services. Most of these patients were identified by ED providers and discharged to home but prior to initiation of the LOOP program, few leave with connection to treatment or overdose prevention services.
Assessment of the Impact of Chest Compressor Team Size and Rotation on Objective Performance and Workload During Simulated Cardiopulmonary Resuscitation
J. Schoen¹, L. Kobayashi¹, J. Machan², M. Dannecker³. ¹Alpert Medical School of Brown University, Providence, RI; ²Rhode Island Hospital, Providence, RI; ³Lifespan Medical Simulation Center, Providence, RI

Background: Effective chest compressions are paramount for successful resuscitation in cardiac arrest. However, the quality of compressions performed during cardiac arrest resuscitations and simulated scenarios is generally poor.¹² Prior studies have demonstrated that provider gender, age, weight, and fatigue influence the quality of compressions.³-⁷

Objectives: 1.) To evaluate whether the size of provider teams performing chest compressions has an effect on the quality of chest compressions, individual provider workload and fatigue, and the compressor team’s ability to maintain quality compressions throughout a resuscitation. (Sessions ongoing.) 2.) To evaluate the impact of targeted rest and recovery on individual provider workload and fatigue in two-provider compression teams. (Sessions scheduled.)

Methods: This randomized, prospective simulation study is being conducted in two phases. Phase I: Fifty first- and second-year medical students are being enrolled to perform continuous chest compressions on a Resusci-Anne SkillReporter manikin for four minutes while real-time, objective performance data are obtained (compression rate, depth and chest recoil). Thirty participants with the best performances will be enrolled in Phase II; participants unable to complete Phase I will be excluded. Phase II: Participants will perform manikin chest compressions during a simulated 20-minute resuscitation as part of a two-, three- or four-provider team. Each participant will perform continuous compressions for two minutes and then rotate with the next participant on their team. Baseline resting heart rate, real-time working heart rate (during active compressions), and real-time chest compression performance data will be collected for each participant. Individual participant demographic data will be collected to determine predicted maximal heart rate and calculate caloric expenditure for estimations of participant workload. During the two-participant team sessions, 7 teams (intervention) will perform deep breathing exercises and stretches during the rest interval, while 8 teams (control) will simply stand.

Results: Seventeen Phase I participants have been enrolled. Participant ages range from 21-30 years (median 24 years); 70% are male and all have prior CPR training (23.5% ACLS, 76.5% BLS). Participants performed an average of 430.8 (+/- 49.1) chest compressions over 4 minutes with an average rate of 108.2 (+/- 17) compressions/min and average depth of 41.2 (+/- 14) mm. The proportion of compressions with complete recoil ranges from 39.0-100.0% (median 90.2%); compressions adherent to 2010 AHA CPR guidelines⁸ range from 0.0-99.8% (median 10.9%). The most common errors were inadequate compression depth and inadequate chest recoil between compressions. Participant fatigue became evident at approximately 1-2 minutes as the depth and rate of compressions tended to deteriorate and the number of compressions with insufficient recoil increased, likely secondary to participant leaning on the manikin.

Conclusions: Investigators hypothesize that 1.) larger teams will perform higher quality compressions with less individual provider workload and fatigue compared to smaller teams, 2.) regular rest periods for providers performing chest compressions will decrease individual provider fatigue and assist with the maintenance of high quality chest compressions throughout the resuscitation, and 3.) performing targeted rest and recovery exercises (deep breathing and stretching) during the rest period will increase these effects compared to passive rest.
**Pediatric EM Fellow: Robyn Wing, MD**

**Heads Up: Communication is Key in School Nurses’ Preparedness for Facilitating “Return To Learn” Following Concussion**

Robyn Wing, Siraj Amanullah, Elizabeth Jacobs, Melissa A. Clark, Chris Merritt. Alpert Medical School of Brown University, Providence, RI; Brown University School of Public Health, Providence, RI

**Background:** While there are well-documented “return to play” guidelines for directing a student’s return to physical activities after concussion, there has been far less published to direct and assist with returning students to the classroom. Although school nurses are called upon to be leaders or members of the school academic team for concussion rehabilitation, they are often overlooked in concussion legislature and by diagnosing physicians.

**Objectives:** This study aimed to assess the current understanding and practices of a sample of school nurses regarding the concept of "return-to-learn" in concussed students.

**Methods:** School nurses from New England schools were surveyed about their knowledge, behaviors, and attitudes related to pediatric concussion management.

**Results:** Of the 151 school nurses surveyed, 19% felt that they did not have the training necessary to be a part of an academic rehabilitation team for a student with a concussion. The largest barriers to the school nurse’s role as a member of the school academic team for students with concussion were “inadequate communication with the provider that diagnosed the concussion” (73%), followed by “inadequate concussion training” (38%) and “inadequate time necessary to care for a student with concussion” (30%).

**Conclusions:** There has been little focus on educating school nurses for their role in academic concussion rehabilitation. By identifying specific gaps in knowledge and challenges at the school level, these results inform inter-disciplinary medical teams, state legislature, and state interscholastic leagues about the importance of educating and facilitating more effective “return-to-learn” academic teams and plans.
Derivation of the Ebola Prediction Score for Risk Stratification of Patients with Suspected Ebola Virus Disease
Tess Wiskel¹, Pranav Prathap Shetty², Ryan Burbach², Sambhavi Cheemalapati², Justin Glavis-Bloom¹, J. Kota T. Kesselly³, Adam C. Levine¹. ¹Alpert Medical School of Brown University, Providence, RI; ²International Medical Corps, Los Angeles, CA; ³College of Allied Health Sciences, Cuttington University, Suacoco, Liberia

Background: The current outbreak of Ebola Virus Disease (EVD) in West Africa is the largest on record and initially overwhelmed the capacity of both local health systems and the international community to provide sufficient isolation and treatment of all suspected cases of EVD. Better tools are needed to help clinicians risk stratify patients with suspected EVD in the context of such an epidemic, leading to more effective care and improved utilization of limited resources.

Objectives: To use clinical data from the current outbreak to empirically derive an Ebola Prediction Score to objectively risk stratify patients with suspected EVD prior to confirmatory laboratory testing.

Methods: We performed a retrospective analysis of de-identified patient data collected during routine clinical care at the Bong County Ebola Treatment Unit (ETU) in Suakoko, Liberia during its first 16 weeks of operation beginning September 5, 2014. The predictive power of 14 clinical and epidemiologic variables commonly used in the case definitions of EVD were measured against the primary outcome of laboratory-confirmed EVD, using logistic regression to develop a final Ebola Prediction Score.

Results: EVD testing results were available for 382 (97%) of 395 patients admitted to the Bong County ETU during the study period. A total of 160 patients (42%) tested positive for EVD. Positive EVD status was strongly associated with increased length of stay and overall mortality (p<0.001). The only baseline characteristics predictive of positive EVD status were female gender (p=0.03) and transport by International Medical Corps ambulance (p=0.07). Having a sick contact was the strongest independent predictor of positive EVD status with an odds ratio of 3.41 (95% CI: 2.41-5.42). Logistic regression analysis identified six variables independently predictive of laboratory confirmed EVD, including sick contact, diarrhea, loss of appetite, muscle pains, difficulty swallowing, and absence of abdominal pain. The Ebola Prediction Score, constructed using these six variables, had an area under the Receiver-Operator Characteristic curve of 0.75 (95% CI: 0.70-0.80) for the prediction of laboratory-confirmed EVD. The Ebola Prediction Score demonstrated similar test characteristics to the World Health Organization algorithm for a score of >1, however patients with higher Ebola Prediction Scores had consistently higher likelihoods of laboratory-confirmed EVD.

Conclusions: The Ebola Prediction Score can be used by clinicians as an evidence based tool to risk-stratify patients with suspected EVD in order to cohort or separate patients within an ETU to prevent nosocomial infections or as a triage tool when patient numbers overwhelm available isolation and treatment capacity.
Resident: Xiao Chi (Tony) Zhang, MD, MS (PGY2)

Objective Assessment and Thematic Categorization of Patient-Audible Information in an Emergency Department
Zhang XC¹, Kobayashi L¹, Reddy SPM¹, Berger M², Milson EI², Jay GD¹, Baruch JM¹. ¹Alpert Medical School of Brown University, Providence, RI; “Rhode Island School of Design, Providence, RI

Background: What patients hear in a medical facility can impact their perceptions of well-being, of the care they receive and of the providers they interact with. Observational research has noted that ambient noise levels in Emergency Department (ED) and Intensive Care Unit (ICU) settings generally exceed established safety and comfort thresholds. Surveys have found that up to 45% of patients overhear provider conversations; 10% do not have their expectations of privacy met. Yet numerous unanswered questions remain regarding precisely what the patient hears and perceives in these settings—there is a significant gap in the knowledgebase necessary for meaningful mitigatory efforts that are based on evidence-based healthcare facility design.

Objectives: 1.) To assess and categorize the audible and comprehensible components of recorded audio information (e.g., provider conversations) in ED patient areas (Phase 1). 2.) To complete a baseline assessment of the dynamic ED soundscape comprising voices, device sounds and ambient noise (Phase 2)- in progress, results pending.

Methods: In Phase 1, investigators accessed 21 de-identified transcripts (11 in patient rooms; 12 adjacent to nurses’ stations) recorded using in-ear binaural microphones during staff signouts as part of an approved quality management process in an academic ED. Transcript content was first categorized by speaker into 3 categories, "healthcare provider," "patient/family/friend," or "unknown." (For patient room recordings, transcribed materials from inside the room were excluded from further analysis.) Two investigators independently coded each transcript at the phrase, clause and sentence levels with qualitative analysis software into pre-defined thematic nodes as "general content," "patient information" and "HIPAA-defined patient identifiers," see Figure 1. The coding investigators conducted scheduled reviews to resolve data discrepancies.

Results: Patient room recordings featured a median of 11 (range 0–65) understandable words per minute (wpm) over 16.2 (12.5–20.3) minutes; nurses’ station recordings featured 74 (5–143) understandable wpm over 17.0 (15.2–25.9) minutes. Transcript content from patient room recordings was categorized as follows (medians; ranges): clinical: 44.8% (0.0–99.3%); non-clinical: 0.0% (0.0–33.7%); inappropriate (provider): 0.0% (0.0–0.3%); unknown 6.0% (0.0–100%). Transcript content from nurses’ stations was categorized as follows: clinical: 86.0% (66.5–96.0%); non-clinical: 1.2% (0.0–33.0%); inappropriate (provider): 0.1% (0.0–5.3%); unknown 1.3% (0.0–23.4%). Audible patient information was limited in patient room recordings, see Table 1. Audible patient information at nurses’ stations was coded as follows (median words, per signout):
general patient history: 116 (0–353); social history: 12 (0–149); physical exam: 39 (0–103); imaging results: 0 (0–36); laboratory results: 7 (0–81); other results: 0 (0–14); medical decision-making: 39 (0–108); management (general): 118 (0–264); pain management: 4 (0–90); disposition: 42 (0–181). Medians of 0 (0–3) and 3 (0–9) patient name identifiers were audible on in-room and nurses’ station recordings, respectively.

Conclusions: Sound recordings in an ED setting frequently captured audible and comprehensible provider discussions that included confidential, protected health information and discernible quantities of non-clinical content. In conjunction with an ED soundscape assessment, program findings may be useful in mitigating risks to patient confidentiality and improving the patient experience.

<table>
<thead>
<tr>
<th>Recording Description</th>
<th>ICC</th>
<th>Patient room recording (median and [inter-quartile range])</th>
<th>Nurses’ station recording (median and [inter-quartile range])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (min:sec)</td>
<td>n/a</td>
<td>16:09 [15.07 - 18:41]</td>
<td>17:00 [15:38 - 20:28]</td>
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<tr>
<td>Total recorded word count (audible, comprehensible; per sign-out recording)</td>
<td>n/a</td>
<td>574 [156 - 1,347]</td>
<td>1,467 [1,135 - 1,661]</td>
</tr>
<tr>
<td>Total analyzed word count (excluding in-room material; per sign-out recording)</td>
<td>n/a</td>
<td>171 [40 - 569]</td>
<td>1,467 [1,133 - 1,640]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transcript Coding by Thematic Categorical Nodes for Content Category (percentage of transcript)</th>
<th>ICC</th>
<th>Proposal room recording (median and [inter-quartile range])</th>
<th>Nurses’ station recording (median and [inter-quartile range])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inappropriate content (e.g., swearing, disparaging comments)</td>
<td>0.946</td>
<td>0.0% [0.0 - 0.0%]</td>
<td>0.1% [0.0 - 2.3%]</td>
</tr>
<tr>
<td>Clinical, appropriate content</td>
<td>0.997</td>
<td>44.8% [17.7 - 62.2%]</td>
<td>86.0% [68.7 - 94.7%]</td>
</tr>
<tr>
<td>Non-clinical content</td>
<td>0.982</td>
<td>0.0% [0.0 - 0.0%]</td>
<td>1.2% [0.0 - 19.5%]</td>
</tr>
<tr>
<td>Content from other patients and accompanying individuals</td>
<td>0.994</td>
<td>0.3% [0.0 - 3.0%]</td>
<td>1.5% [0.0 - 2.1%]</td>
</tr>
<tr>
<td>Unknown content (inadequate content and/or context for categorization)</td>
<td>0.997</td>
<td>6.0% [1.7 - 58.2%]</td>
<td>1.3% [0.0 - 7.1%]</td>
</tr>
</tbody>
</table>

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<tr>
<th>Transcript Coding by Thematic Categorical Nodes for Patient Information (words per sign-out)</th>
<th>Proposal room recording (median and [inter-quartile range])</th>
<th>Nurses’ station recording (median and [inter-quartile range])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient history (general)</td>
<td>0.956</td>
<td>0 [0 - 21]</td>
</tr>
<tr>
<td>Patient history (social, including substance abuse)</td>
<td>0.959</td>
<td>0 [0 - 0]</td>
</tr>
<tr>
<td>Physical exam</td>
<td>0.597</td>
<td>0 [0 - 2]</td>
</tr>
<tr>
<td>Imaging test results</td>
<td>0.870</td>
<td>0 [0 - 0]</td>
</tr>
<tr>
<td>Laboratory test results</td>
<td>0.926</td>
<td>0 [0 - 0]</td>
</tr>
<tr>
<td>Miscellaneous test results</td>
<td>0.665</td>
<td>0 [0 - 0]</td>
</tr>
<tr>
<td>Medical decision making</td>
<td>0.786</td>
<td>0 [0 - 4]</td>
</tr>
<tr>
<td>General patient care</td>
<td>0.871</td>
<td>2 [0 - 55]</td>
</tr>
<tr>
<td>Pain management</td>
<td>0.940</td>
<td>2 [0 - 5]</td>
</tr>
<tr>
<td>Disposition</td>
<td>0.917</td>
<td>0 [0 - 9]</td>
</tr>
</tbody>
</table>

| HIPAA-defined Patient Identifiers (identifiers per sign-out) \n
<table>
<thead>
<tr>
<th>Patient name</th>
<th>Proposal room recording (median and [inter-quartile range])</th>
<th>Nurses’ station recording (median and [inter-quartile range])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other patient identifier</td>
<td>n/a</td>
<td>0 [0 - 0]</td>
</tr>
</tbody>
</table>