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CME Information: Randomized trial of therapy dogs versus deliberative coloring (art therapy) to reduce stress in emergency medicine providers

CME Editor: Corey Heitz, MD

Authors: Jeffrey A. Kline, MD, Kimberly VanRyzin, MD, Jacob C. Davis, Jonathan A. Parra, Maxwell L. Todd, Liza L. Shaw, Benjamin R. Haggard, Michelle A. Fisher, Katherine L. Pettit, MS, and Alan M. Beck, PhD

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Educational Objectives
After reading the article, participants should be able to compare the effectiveness of a therapy dog session to therapeutic coloring to reduce provider stress in the ED.

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Randomized Trial of Therapy Dogs Versus Deliberative Coloring (Art Therapy) to Reduce Stress in Emergency Medicine Providers

Jeffrey A. Kline, MD\textsuperscript{1}, Kimberly VanRyzin, MD\textsuperscript{1}, Jacob C. Davis\textsuperscript{1}, Jonathan A. Parra\textsuperscript{1}, Maxwell L. Todd\textsuperscript{2}, Liza L. Shaw\textsuperscript{1}, Benjamin R. Haggard\textsuperscript{1}, Michelle A. Fisher\textsuperscript{3}, Katherine L. Pettit, MS\textsuperscript{1}, and Alan M. Beck, PhD\textsuperscript{4}

ABSTRACT

Objective: Cognitive stress during shift work contributes to burnout in emergency department (ED) workers. We hypothesize that if physicians and nurses interact with a therapy dog for 5 minutes while on ED shift, both their perceived and their manifested stress levels will decrease.

Methods: In this single-center, prospective, randomized controlled clinical trial (NCT03628820), we tested the effectiveness of therapy dogs versus coloring a mandala and versus no intervention (control) on provider stress. Consenting emergency medicine physicians and nurses provided three self-reported assessments of stress and saliva samples at the start (T1), at the middle (T2), and near the end (T3) of shift. Thirty minutes prior to T2, participants were randomized to either interacting with a therapy dog or coloring for 5 minutes; controls had neither. Stress was assessed on visual analog scale (VAS, 0–100 mm) and with salivary cortisol (Salimetrics) and the modified Perceived Stress Scale (mPSS-10). To assess potential change in participant behavior, patients of providers in either group were asked to complete an internally derived survey of empathic behaviors displayed by providers at T1 and T3.

Results: We enrolled 122 providers (n = 39 control, n = 40 coloring, n = 43 dog); 48% were residents, and 60% enrolled on an evening shift. At T1, mean (±SD) VAS score was not different between groups (18.2 ± 17.8 mm). At T3, VAS tended to increase with coloring (24.5 mm), remain unchanged in controls (20 mm), and decreased slightly with dogs (13.6 mm, p = 0.018 vs. coloring, Tukey’s post hoc). Salivary cortisol levels were consistently highest at the beginning of each providers’ shift and were significantly decreased versus control in both the dog and the coloring groups (p < 0.05, Tukey’s). We observed no difference between groups for the mPSS-10 nor in patient reported survey of empathic behaviors.

Conclusion: This randomized controlled clinical trial demonstrates preliminary evidence that a 5-minute therapy dog interaction while on shift can reduce provider stress in ED physicians and nurses.

Physician and nurse burnout is common in emergency medicine and appears to be more frequent than other specialties.\textsuperscript{1–3} Approximately 55% to 70% of emergency physicians, nurses, and residents in training are at risk of quitting their profession because of high levels of burnout, the rate of burnout among other specialties is 45% to 55%.\textsuperscript{3–5} Burnout has been associated with loss of empathy and compassion.

From the \textsuperscript{1}Indiana University School of Medicine, Indianapolis, IN; and \textsuperscript{2}Butler University, Indianapolis, IN; \textsuperscript{3}Lois and Sydney Eskenazi Hospital, Indianapolis, IN; and the \textsuperscript{4}Purdue University School of Veterinary Medicine, Lafayette, IN.

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toward patients, loss of coping ability, reduced career longevity, and lower physician satisfaction with career.\textsuperscript{6,7} Causative factors directly related to the work stated by providers are psychological demands on shift, poor job control, long shifts, night shifts, lack of autonomy, and criticisms on shift.\textsuperscript{3,4} Improving the well-being of providers may increase quality of patient care, inasmuch as happy providers generally evoke higher patient satisfaction\textsuperscript{8}. This work therefore seeks to reduce provider stress while on shift in the emergency department (ED).

In this clinical experiment, we test the effectiveness of therapy dogs versus a coloring exercise versus no intervention on provider stress. The rationale for therapy dogs is supported by prior literature that demonstrates that human perception of stress and pain can be reduced with exposure to animals in multiple settings, including health care workplaces.\textsuperscript{9–15} The rationale for coloring of mandalas centers on the potential for the exercise to cause a mental distraction from work concerns, potentially overriding cognitive stress responses (i.e., “mindfulness”).\textsuperscript{16,17}

The main study hypothesis is that emergency health care workers on shift who interact for 5 minutes with a therapy dog and handler will have lower perceived and manifested stress response compared with use of a time out that includes voluntary use of a coloring mandalas. The work will also address two exploratory hypotheses: The first is that salivary cortisol will correlate significantly with perceived stress and will increase from beginning to end of shift and that exposure to a therapy dog will blunt this increase.\textsuperscript{13,18–22} The second exploratory hypothesis states that participants who interact with a therapy dog will display more empathic behaviors.

METHODS

Overview
This was a single-center, prospective controlled trial that approved by the Indiana University School of Medicine Institutional Review Board. The trial was registered (NCT03628820). All study procedures were performed in the ED at the Lois and Sydney Eskenazi Hospital, a safety net hospital with an ED volume of 105,000 visits in 2018. This hospital has an existing animal therapy department, managed by a coauthor (MF). All human and animal participants were unpaid volunteers, and this study was not funded by an external source. All dogs and handlers were therapy certified as a team through one of the following organizations: Alliance of Therapy Dogs, Therapy Dogs International, Pet Partners, Paws and Think, or Love on a Leash. All dogs and handlers are registered and badge-identifiable volunteers at the hospital.

Theoretical Construct
The primary theoretical construct that informed the study design and motivated our use of dogs to reduce stress in emergency care arises from the biophilia hypothesis, which states that humans have an innate desire to focus on nature.\textsuperscript{23} Surgical patients who could view a garden had a shorter length of stay in the hospital and required fewer analgesics than those who had a view of a brick wall.\textsuperscript{24} People interacting with a dog have a larger drop in blood pressure in children compared to interacting with a person or even just resting.\textsuperscript{25} Conscious neurosurgical patients observed dozens of photographs of animals, famous people, or recognizable places while their amygdala was being monitored for activity. The amygdala’s primary role is in the processing of memory and emotional reactions. Photographs of animals triggered greater activation of the amygdala than views of famous people, landmarks, or common objects, indicating a category-specific recognition that animals are important to people.\textsuperscript{26} The use of dogs also harnesses cognitive distraction—a common psychological strategy to reduce focus on stress.\textsuperscript{27} Moreover, the dog is a special contact with nature that not only is an immediate contact with nature but fosters the health benefits associated with social support, including lower anxiety.\textsuperscript{28,29} Because the primary objective in the present work is the short-term alleviation of stress in persons without diagnosed anxiety trait, we submit that our use of dogs represented the interface of “dog-assisted support” (DAS) rather than “dog-assisted therapy,” as previously differentiated.\textsuperscript{14} Accordingly, from a study design standpoint, the biophilia hypothesis, and the social support theory both suggest the need to isolate the study subjects with the dog in a separate room, away from the work space.

Emergency Care Participants and Trial Design
Study subjects were emergency care providers, including nurses, residents, and physicians on duty in the ED of Eskenazi hospital. The only exclusion criteria were provider statement of dislike, allergy, fear or other reason to not interact with a therapy dog, and
prior enrollment. Enrollment occurred 7 days per week on shifts between 7 AM and 2 AM and was timed according to when therapy dogs were reliably available from May 28, 2018, until August 8, 2019. All participants provided verbal informed consent and were randomized by preprinted random sequence to receive either exposure to a therapy dog or to coloring a mandala. The control group that received no intervention was enrolled in a convenience sample that was performed after completion of randomization of 80 subjects between therapy dog and coloring groups. The reason for not triple randomizing was the desire to avoid the nocebo effect in the control group (disappointment in getting randomized to usual work process). To enroll unique providers, and reduce the chance of volunteer handlers showing up only to have a potential study participant decline, study associates gained access to schedules and precontacted potential participants to ensure their interest and willingness to participate.

Interventions

Providers in both the therapy dog and the coloring groups were asked to leave their shift approximately midway and were escorted by study personnel to a designated room with two doors. In the case of the therapy dog, study personnel coordinated to surreptitiously position the handler and dog in the room without interaction with any staff in the ED (hence the need for two doors in the room). Dogs remained on a 5-foot-long leash held by the handler during the entire encounter. Providers were freely able to touch or pet the dog if they wished. In the case of the coloring group, the study associate notified the provider that he or she was assigned to the coloring group and presented the provider with three mandalas to choose to color (Figure 1) and a complete palette of coloring pencils. The room was physically separate from the clinical care area and contained no electronic devices, telephone, window, or overhead speaker. Providers were asked to stay in the room with either the dog or the coloring exercise for 5 minutes. The study associate left the room during this time.

Measurements

The primary measurements obtained to assess provider cognitive stress were emergency physician reported stress on a 0- to 100-mm linear, visual analog scale (VAS) with vertical lines at the 0- and 100-mm ends, guidance that 0 mm = no anxiety, 20 mm = slight fear and worry, 40 mm = mild fear and worry, 60 mm = moderate worry with physical agitation, 80 mm = strong agitation with inability to sit still, and 100 mm = out of control behavior with self-harm. Providers also completed the 10-item Perceived Stress Scale (PSS-10; score range 0-40), with each question modified to reflect the “past several hours” rather than months. Hereafter, we refer to this scale as the “mPSS-10” (modified Perceived Stress Scale; see Data Supplement S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1111/acem.13939/full). Physiological effects of stress were measured with salivary free cortisol measured from 100 µL of saliva using a commercial kit (Salimetrics 1-3002 [5PK 1-3002-5]). Additionally, we measured provider-reported stress using the FACES scale (see Data Supplement S1). These four measurements were made at the beginning of the shift (T1), 30 to 40 minutes after intervention (T2), and near the end

Figure 1. Mandala options for coloring.
of shift (T3). In the therapy dog group, we measured the time of exposure and we asked handlers to evaluate physician interaction with the dog and handler by asking four questions: 1) Did the subject touch the dog? (Yes or No); 2) Did the subject talk to you? (Yes or No); 3) To what extent would you grade the interaction with the dog? (Likert 1-5); and 4) To what extent would you grade the interaction with you? (Likert 1-5). We maintained a log of the identity of each dog used for each interaction to compare their performance in the coprimary outcomes. Patient participants completed a survey, designed with patient input, comprising 11 questions (Likert scale, 0-5; maximum score 55; see Data Supplement S1 for questions) assessing specific behaviors associated with patient perception of emergency physician empathy.33

Sample Size Computation and Data Analysis
The coprimary outcomes were the patient reported stress from the VAS and mPSS-10 and the salivary cortisol concentration. The secondary outcome was the comparison of the patient reported score on 10 empathic behaviors. We assumed that therapy dogs would produce one-third of the effect in providers as they provided in anxious patients;34 therefore, the sample size of \( n = 39 \) per group was predicated on an effect size of a 10-mm difference between intervention groups for the VAS at T3, expecting a standard deviation of 20 mm with \( \alpha = 0.05 \) and \( \beta = 0.20 \). All data from patients, providers, and the medical record were recorded in the REDCap data archiving system.35 Data from the scales were analyzed for normality using multiple tests (Shapiro-Wilk or D’Agostino and Pearson) and the F-test on variances prior to application of parametric testing. Data were analyzed at each time point using one-way analysis of variance (ANOVA) with post hoc analysis using Tukey’s multiple-comparisons test. Within-group changes between times were compared with the paired t-test and chances from T1 to T3 were compared between groups with the time \( \times \) group p-value from the mixed-effects repeated measures (RM) ANOVA. Data were plotted using GraphPad Prism version 8.3 for Windows. Statistical analyses were performed using SPSS, version 26.0.

RESULTS
Study associates approached 127 providers and obtained consent on all 127, but while on shift, five voluntarily withdrew from participation with all five citing that they were too busy on shift to participate. No provider refused consent because of issues with dogs. Thus, we enrolled 122 providers with complete data, with characteristics described in Table 1 (39 controls, 43 in the dog group, and 40 coloring). The largest proportion (48%) enrolled were residents, and 60% of all participants were enrolled on an evening shift, starting between 3 and 5 PM. Days of week for enrollment were relatively evenly distributed with the fewest on Fridays (\( n = 12, 10\% \)), and the most on Tuesdays (\( n = 26, 21\% \)).

### Table 1
Work Roles, Demographic Data, and Shift Times of Participants

<table>
<thead>
<tr>
<th>Group</th>
<th>Role (n)</th>
<th>Gender</th>
<th>Race (n)</th>
<th>Age, Mean (±SD)</th>
<th>Shift Time (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n = 39)</td>
<td>Nurse 8 Male 19 Caucasian 33</td>
<td>33 (±7.2) Morning 21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resident 17 Female 18 Asian 2</td>
<td></td>
<td>Evening 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attending 14 Other 0 Other 1</td>
<td></td>
<td>Weekday 26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dog (n = 43)</td>
<td>Nurse 9 Male 20 Caucasian 35</td>
<td>31 (±7.1) Morning 11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resident 24 Female 20 Asian 3</td>
<td></td>
<td>Evening 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attending 9 Other 0 Other 2</td>
<td></td>
<td>Weekday 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coloring (n = 40)</td>
<td>Nurse 19 Male 14 Caucasian 37</td>
<td>32 (±7.3) Morning 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resident 16 Female 20 Asian 1</td>
<td></td>
<td>Evening 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attending 5 Other 0 Other 2</td>
<td></td>
<td>Weekday 25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Interaction Data**
In the coloring group, 15 subjects chose option 1, 10 chose option 2, and 14 chose option 3, and all 40 spent at least 5 minutes coloring, with the median being 5 minutes 26 seconds, (range = 5:00–6:20). In the dog group, two providers spent less than 5 minutes (median = 5 minutes 49 seconds [range = 2:30–6:11]) and handlers noted that the provider touched the dog and spoke with the handler in all cases (100%). Regarding the Likert scale question 3, handlers rated the degree of interaction with the dog as 5 (highly engaged) in n = 29, 4 (engaged) in n = 9, and 3 (moderate) in n = 2 (data missing for n = 2); for question 4, handlers rated their interaction as a 5 (highly engaged, talking the entire time) in n = 26, 4 (engaged, talking >3 minutes) in n = 12, and 3 (talking >1 minute) for n = 1 (data missing for n = 2).

**Provider-reported Stress**
At the beginning of shift, providers in all three treatment groups had an identical mean (±SD) VAS score of 18.2 (±17.8) mm. Figure 2 (top row) shows that VAS score in providers who performed the coloring exercise tended to increase (p = 0.12, paired t-test), whereas with exposure to therapy dogs, the reported VAS tended to decline such that T3 mean for the therapy dog group was significantly lower by the ANOVA (p = 0.015) with Tukey’s pairwise comparison of means showing p = 0.018 for coloring versus dog and p = 0.08 for dog versus control (p = 0.03 for time × group from RM ANOVA). However, the bottom row of plots in Figure 2 show that the mPSS-10 increased significantly in only one instance: from T1 to T3 in controls (p = 0.045, paired t-test). When stratified by provider status (resident, faculty, or nurse), we found that residents had slightly higher reported stress at T1 (Figure 3); when these means were compared with a one-way ANOVA, the only significant difference was resident mean VAS was higher than nursing VAS at T1 (Tukey’s p = 0.02).

Providers generally reported low numbers for the FACEx scale (all mean values from all groups at all

---

![Figure 2. Plots of mean (±standard error of mean) visual analog scale (VAS) scores of participant reported stress (top row) and the modified Perceived Stress Scale (mPSS) scores (bottom row; *p = 0.018 Tukey’s post hoc for T3, dog vs. coloring).](image-url)
times was <2) and as a result the data were not normally distributed. After examining the data post hoc, the authors believe that most revealing way to analyze the FACES results is by calculating the proportion of providers with a score >3 (Mild fear and worry). Figure 4 plots these proportions with associated 95% confidence intervals (CIs), indicating no significant difference between either controls versus coloring group or control versus dog group (p = 0.29 for both comparing, exact binomial formula).

**Provider Salivary Cortisol**

Figure 5 provides a dot plot of all salivary cortisol values. The means were not different between groups at T1 (p = 0.23, one-way ANOVA) and were also not different based on role (resident, faculty, or nurse). Unexpectedly, salivary cortisol was the highest at T1 in all groups and progressively decreased in all three groups (p < 0.001 for comparison of T1 to T2 by paired t-test in all three groups). The salivary cortisol concentrations indicate a greater decrease with either intervention compared with control (p = 0.02 by

![Figure 3](image-url)  
**Figure 3.** Comparison of self-reported stress by participant role at start of shift (T1). Error bars show standard error of the mean. p-Value from Tukey’s post hoc test after one-way analysis of variance.

![Figure 4](image-url)  
**Figure 4.** Proportion of providers with mild fear or worry, defined as a FACES score >3 (error bars represent 95% CI for proportions, p-value from exact binomial).

![Figure 5](image-url)  
**Figure 5.** Salivary cortisol concentrations. The bars show means and SDs (*p < 0.05 vs. control, Tukey’s post hoc).
time × group, RM ANOVA) such that the means were significantly different between groups at T3 (p < 0.001, one-way ANOVA), with Tukey’s pairwise comparison of ranks yielding p < 0.0001 for coloring versus control and p = 0.003 for dogs versus control and p > 0.9 for coloring versus dogs. Thus at T3, the coloring and dog groups were associated with significant lowering of salivary cortisol compared with control.

We also asked all participants explicitly if they used other methods of stress reduction on shift and, if so, to identify the method. Fifteen (12%) indicated yes; regarding the method, seven said they listened to music, three said interacting with colleagues, three said food/eating, one said getting away from the work area, and one said deep breathing. We also asked each participant to provide unstructured commentary. The most frequent theme in responses was disappointment of being assigned to the coloring group, exemplified by this comment: “I was excited about the dog and then got the coloring book instead and was pretty mad which made me anxious/irritable.” The authors perceived only one comment about the dog as negative “Mentioned dog was very creepy and not friendly.”

Patient-provided Data
We obtained surveys from 137 patients, which assessed patient perceptions of 10 behaviors thought to be associated with increased perception of empathy. We only obtained these surveys for patients cared for by providers in the coloring and therapy dog groups. Table 2 shows the demographic features and distribution of their chief complaints. We found no significant difference in any comparison of mean or median scores, either between or within groups (Table 3). We did not obtain these data for controls. The Cronbach’s alpha was 0.77 (95% lower confidence limit = 0.71), indicating only fair internal reliability.

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feature</strong></td>
</tr>
<tr>
<td>Total number</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Female sex</td>
</tr>
<tr>
<td>White race</td>
</tr>
<tr>
<td>Chief complaint</td>
</tr>
<tr>
<td>Chest pain</td>
</tr>
<tr>
<td>Dyspnea</td>
</tr>
<tr>
<td>Syncope</td>
</tr>
<tr>
<td>Trauma/wound</td>
</tr>
<tr>
<td>Dizziness</td>
</tr>
<tr>
<td>Abdominal pain</td>
</tr>
<tr>
<td>Abnormal laboratory values</td>
</tr>
<tr>
<td>Psychiatric</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

DISCUSSION

We found that 5-minute interaction with a therapy dog and handler was associated with provider-reported reduction in stress by the end of shift (T3), when measured on a VAS, but not when using an adaptation of the well-studied PSS-10. The adaptation was to reword questions to reflect perceptions over the past few hours, rather than months. When compared with controls, the salivary cortisol concentrations decreased significantly in both the coloring and the therapy dog participants. We studied both nurses and physicians and found minor differences in the reported stress levels between the providers at T1, but not for salivary cortisol concentrations. Handlers indicated that the majority of participants were highly engaged with the dog, and participants who were randomized to coloring expressed discontent. Findings from this controlled, randomized clinical trial demonstrate preliminary and novel evidence that DAS can reduce provider perception of stress and physiological stress response in the emergency care setting. The VAS data and the unstructured comments (and the implicit message in the participants’ frequent choice of the first mandala) support the biophilia hypothesis—that emergency care providers used the dogs as social support to reduce stress on shift and would rather have DAS than a mindfulness exercise to distract them from work-related stress.

The issue of work stress contributing to emergency provider burnout has received considerable attention.1,3,4,8,36 Approximately two-thirds of emergency residents satisfy criteria for burnout.3,37 Cognitive
contributors include emotional exhaustion, high depersonalization, and low personal accomplishment, present in 40% to 50% of emergency nurses and physicians.\textsuperscript{1,37} Burnout scores appear inversely correlated with emergency physician self-perception of empathy.\textsuperscript{38} It has widely been assumed that cognitive stress on shift is manifested as physiological stress, reflected by increased heart rate, blood pressure, and salivary cortisol concentrations.\textsuperscript{18–20} Within this context, of depersonalization and emotional and physical exhaustion, preliminary work in other nonemergent health care settings has suggested that exposure to a therapy dog will lower physiological stress manifestations on shift, including salivary cortisol.\textsuperscript{22} One group previously found that ED patients with moderate to severe anxiety had greater reductions in anxiety after exposure to a therapy dog compared with control conditions.\textsuperscript{34} In addition to the previous literature, unplanned observations during that study helped formulate the hypothesis that exposure to therapy dogs might reduce provider stress. These unplanned observations of research staff were the consistent and persistent request of providers who ostensibly asked “why do the patients get a dog and we don’t?” We believe that the present study supports the hypothesis that therapy dogs reduce provider stress, given that the mean T3 VAS and salivary cortisol concentrations were significantly lower in the therapy dog group. This work is preliminary and raises three points for discussion and future study.

First, it remains possible that the questions in the PSS-10 are insensitive to cognitive stress induced on shift in the ED. While the PSS-10 is well validated in general public, its questions may lack construct validity in emergency care. Second, we learned that providers disliked the experimental design that required them to leave their work area at a prescribed time. Based on provider comments, we believe that the ideal design to reduce provider stress would be better described as a “dog on demand.” In future work, we are planning a paradigm that allows providers to interact with a therapy dog in or near their workspace whenever they wish, at least during part of their shift, and for the same dog(s) to be available to patients experiencing stress. Third, and perhaps most unexpectedly, we learned that salivary cortisol values were consistently highest at the start of shift and decreased during the shift. This effect was remarkably consistent, regardless of the time of shift, between sexes and nurses and physicians. We do not believe that this represents a problem with sampling as we used rigorous methods of collection, including denying our subjects of food or water for 30 minutes prior to collection. We speculate that this is a result of activation of the hypothalamus–pituitary axis from uncontrolled anticipatory stress, as emergency care providers never know what type of shift they will encounter, ranging from easy to punishing, depending on variables that are completely out of provider control.\textsuperscript{39}

\section*{LIMITATIONS}

Limitations include the obligatory simultaneous interaction of research subjects with human handlers and dogs. Hospital policies prohibit therapy dogs without a leash and handler. The interaction data show that the majority of providers were highly engaged with the handlers, suggesting the possibility that a 5-minute break with another person could also be effective. The degree to which this work reflects human-facilitated dog support, versus dog-facilitated human therapy, or the mix in between remains uncertain. The real-world ED setting precluded multiple correlative measurements of physiological stress, such as blood pressure, heart rate, or skin resistance. Also, the authors are aware that many of our participants drink caffeinated beverages before each shift. Caffeine use clearly affects cortisol secretion, although chronic use appears to produce a tolerance effect.\textsuperscript{40} We did not systematically control, nor record, caffeine intake. We did ensure that providers did not drink anything for 30 minutes prior to sampling. We rationalized not performing triple randomization of the control group to avoid the nocebo effect.\textsuperscript{30} Instead we sought to understand stress patterns in the “wild-type” condition, when the subject was aware that he or she had no chance of seeing a dog or coloring mandala. Moreover, a true control would require placing a busy provider in an empty room with nothing to do might be viewed as punishment. Nonetheless, it could be argued that randomizing the controls would have been a better experimental design.

\section*{CONCLUSIONS}

In conclusion, in this three-arm trial, we found that emergency providers randomized to a 5-minute interaction with a therapy dog and handler had a significant reduction in self-reported anxiety using a visual analog scale compared with patients randomized to deliberate
coloring. Emergency providers had lower end-of-shift salivary cortisol with either coloring or therapy dog exposure compared with controls. These findings suggest that therapy dogs can reduce cognitive and physiological stress experienced by emergency care providers while on duty in the ED.

References


Supporting Information
The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1111/acem.13939/full
Data Supplement S1. Supplemental material.
Application of Different Commercial Tourniquets by Laypersons: Would Public-access Tourniquets Work Without Training?

Roberto C. Portela, MD, Stephen E. Taylor, MHS, Cameron S. Sherrill, MD, Whitman S. Dowlen, MD, Juan March, MD, Bryan Kitch, MD, and Kori Brewer, PhD

ABSTRACT

**Background:** The White House “Stop the Bleed” campaign has renewed interest in public-access bleeding kits and the use of tourniquets by the lay public. The objective of this study was to determine which type of tourniquet could be applied most effectively by the lay public using only manufacturer instructions included with each tourniquet.

**Methods:** This prospective study randomized participants to one of four different tourniquets (SOFTT-W, CAT, RMT, SWAT-T). Participants were all over 18 years of age. Individuals with prior military, EMS, or patient-care medical experience were excluded. Using only the manufacturer’s packaging instructions, participants were asked to apply a tourniquet on a simulated bleeding arm. A trained observer noted if tourniquet application by the participant was effective, partially effective, or ineffective based on reduction or cessation of simulated blood flow. Participant’s application of the tourniquet was also timed (in seconds) by the observer. The primary outcome of our study was the effectiveness of application for each of the four tourniquets. Secondary outcome was time to effective application.

**Results:** A total of 176 participants were enrolled. For untrained laypersons the RMT had the highest effective application rate of 64.4% and was also the most rapidly applied at 100.9 ± 8.8 seconds (95% confidence interval [CI] = 83.1 to 118.6). The SWAT-T had the highest ineffective application rate (55.5%) than any other tourniquet type (p = 0.002). There was no effect of age or education on time to application for any tourniquet type. Effective applications were performed significantly faster than partially effective or ineffective applications (93.4 ± 5.8 [95% CI = 81.7 to 104.9] vs. 136.7 ± 8.7 [95% CI = 118.8 to 154.7] vs. 151.9 ± 8.3 [95% CI = 135.2 to 168.6]; p ≤ 0.001). There was no difference in time between partial and ineffective applications (p = 0.261).

**Conclusions:** Our study suggests that laypersons could benefit from prior training to effectively apply tourniquets in emergency situations. Of the tourniquets studied, the RMT was the most effectively and most rapidly applied.

With the recent increase in mass casualty incidents across the United States, the need for tourniquet application by the public has increased. In 2016 and 2017 alone, there were 50 active shooter incidents in the United States, including the deadliest event to date resulting in 58 killed and 489 wounded.1 Events increased dramatically from only one incident in 2000 to 17 events in 2013. From 2000 to 2013 active shooter events resulted in 1,043 casualties, of which 486 died, stemming from an average of 11.4 incidents per year.2 In 2014 and 2015 alone there were 40 active shooter incidents across 26

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states, killing 92 and wounding 139. In 2013, in response to these incidents and to help prevent further deaths, the first Hartford Consensus was published. This landmark publication made clear that “life-threatening bleeding from extremity wounds is best controlled initially through use of tourniquets.” Subsequent publications of the Hartford Consensus called for integrating hemorrhage control as a core law enforcement skill and emphasizing bleeding control training for lay rescuers with prepositioning of tourniquets and hemostatic agents in appropriate public locations so “Everyone can save a life.” In 2015, the White House call to action launched a national awareness campaign entitled “Stop the Bleed.” The goal of this campaign was to encourage bystanders to become trained and equip them to help in a bleeding emergency before professional help arrives. In their press release, the White House stated: “Similar to the use of CPR or automatic defibrillators, improving public awareness about how to stop severe bleeding and expanding personal and public access to Bleeding Control Kits can be the difference between life and death for an injured person.”

Studies in the military have shown tourniquets to improve survival and have a low incidence of complications. Tourniquets have also been shown to be safe for use in the civilian prehospital setting. Studies involving laypeople have examined the impact training has on application effectiveness. The study by Ross et al. showed that no prior training or instruction results in high rate of failures, most commonly due to inadequate tightness. Meanwhile, the study by Goolsby et al. showed that laypeople without medical training can apply a tourniquet if handed a card with basic instructions twice as often as subjects without any instructions or training.

The objective of our study was to establish if laypersons without prior training on tourniquets could correctly apply tourniquets in a timely manner utilizing only the instructions included by the manufacturer in the tourniquet package. We chose four of the most commonly used tourniquets and sought to find out which could be placed most effectively in this population. Secondary outcomes included the effect of age, sex, and education on the effectiveness of application, as well as differences in time for application between tourniquets.

**Study Population**

Participants were recruited from a university campus or a local public taekwondo tournament and completed a short demographic and experience questionnaire prior to participating. Exclusion criteria included any participant under 18 years of age, reported prior experience of tourniquet use or employment history as a law enforcement officer, emergency medical services provider, physician, physician assistant, nursing, or any military involvement in the previous 10 years. Five participants had missing data elements and five reported prior tourniquet experience and were excluded after data collection.

**Study Protocol**

Participants were randomized utilizing a random sequence generator from www.randomizer.org that randomly assigned participants to one of the four tourniquets: ratcheting medical tourniquet (RMT), combat application tourniquet (CAT), special operations tactical tourniquet–wide (SOFTT-W), or the stretch wrap and tuck tourniquet (SWAT-T; see Figure 1).

Participants were handed one of the four tourniquets and the corresponding manufacturer’s instructions. Only the RMT instructions from the manufacturer were in color. They were then told to apply the tourniquet to a manikin arm with water dyed red to mimic blood (Figure 2). Participants were timed (in seconds) during placement of the tourniquet. All manufacturer instructions had both diagrams showing correct application and written instructions. Timing was stopped when the participants acknowledged that they had completed application of the tourniquet.

The primary outcome of our study was the effectiveness of application for each of the four different tourniquets reported by the evaluator observing the participants. Effective application was defined as placing the tourniquet and making the blood flow stop completely, which meant that there was “no visible dripping.” Partial effectiveness was scored when the blood flow was slowed significantly but did not stop completely, meaning that there was less dripping than before application of the tourniquet without complete cessation. Ineffective applications did not stop or significantly slow the flow of blood; there was no difference in dripping from the start. The time of tourniquet application and the relation of the participant demographics to effectiveness were also analyzed as a secondary outcome.

**METHODS**

**Study Design**

A prospective randomized study was approved by the institutional review board (#UMCIRB 16-000661) and was conducted utilizing consenting participants.
Data Analysis
Prior to conducting data collection a priori $\alpha = 0.05$ sample with a power analysis of 0.90 was computed, requiring 152 participants to power the study objective for a medium to large effect Cohen (1988). Statistics compiled are descriptive, Student’s $t$-tests, one-way ANOVA, and chi-square analysis, using IBM SPSS Statistics version 24. There were no substantial outliers in our data following assessment with boxplots and histograms.

RESULTS
A total of 176 participants were randomized into one of the four study groups as shown in Figure 3. Ten enrollees were excluded with the remaining 166 participants available for data analysis. The mean age of participants was 31.8 years with a range of 18 to 67 years. Participants were 51.2% female, with 28% having a graduate degree, 61% a college degree, 9% a high school diploma, and 2% having only a primary school–level education (see Table 1).

Normally distributed continuous variables were analyzed by Student’s $t$-test, one-way ANOVA and categorical variables with chi-square tests. Effective rates of tourniquet application was RMT 63.4%, SOFTT-W 61.4%, CAT 53.7%, and SWAT-T 22.5% producing a statistically significant difference in the association $\chi^2(1) = 20.351$, $p = 0.002$. The SWAT-T at 57.5% was the most frequently ineffectively applied tourniquet in our study compared to the RMT, SOFTT-W, and the CAT at 19.5, 22.7, and 34.1%, respectively. The mean times to application for the tourniquets were 148.5 seconds for the SWAT-T, 128.5 seconds for the CAT, 103.4 seconds for the SOFTT-W, and 100.9 seconds for the RMT. The average application time for all tourniquet types regardless of effectiveness was 119.8 seconds.

Analysis of variance between the means was performed for “effectiveness” and “time to completed” for each randomly assigned tourniquet. Effectiveness between the groups of tourniquets applied was statistically significant ($F(3,162) = 7.256$, $p = 0.001$, partial $\eta^2 = 0.12$). Levene’s test ($p = 0.221$) met the assumption of homogeneity of variance. Post hoc comparisons computed with Tukey’s HSD indicated that the mean effectiveness for the SWAT-T (mean ± SD = 0.65 ± 0.834) was significantly different than the means of the other tourniquets, CAT (mean ± SD = 1.2 ± 0.928, $p = 0.024$), SOFTT-W (mean ± SD = 1.39 ± 0.841, $p = 0.001$), and the RMT (mean ± SD = 1.2 ± 0.808, $p = 0.000$). No other between-group comparisons were significant. Time to
completed application between tourniquet groups was also significant (F(3,162) = 6.103, p = 0.001, partial $\eta^2 = 0.10$). Levene’s test (p = 0.62) again met the assumption of homogeneity of variances.

Tourniquet applications reported by the means with standard error and confidence intervals (CIs) with effective applications applied significantly faster than partially effective or ineffective applications (effective—93.4 ± 5.8 [95% CI = 81.7 to 104.9] vs. partially effective—136.7 ± 8.7 [95% CI = 118.8 to 154.7] vs. ineffective—151.9 ± 8.3 [95% CI = 135.2 to 168.6]; p < 0.001). There was no significant difference in time between partial and ineffective applications (p = 0.261). The mean ± standard error application time of the SWAT-T was the longest: 148.5 ± 8.5 seconds (95% CI = 131.4 to 165.6 seconds). The CAT took a mean ± standard error of 128.5 ± 11.2 seconds (95% CI = 105.9 to 151.1 seconds), SOFTT-W took 103.4 ± 7.7 seconds (95% CI = 87.9 to 118.8 seconds), and the RMT application took 100.9 ± 8.8 seconds (95% CI = 83.1 to 118.6 seconds).

Neither age nor education levels affected the time or effectiveness of application on any of the four different tourniquets studied. One time data element in the CAT tourniquet group was identified and was not excluded as the outcome failed to significantly impact the outcomes (see Figure 4).
This study shows that even nontrained laypeople can place a tourniquet in a timely manner, but that overall tourniquets were not placed effectively almost half of the time, and with one-third of all tourniquet applications being completely ineffective (see Figure 5). The results of our study support the results from previous studies suggesting that for public-access tourniquets to be efficacious, some formal education of the general public is necessary. Exact time to exsanguination in humans is unknown and depends on multiple factors like characteristics of the arterial hemorrhage, type of injury, and location of injury. Animal models suggest that the mean time to death by exsanguination is 23 minutes. Overall, tourniquet placement was on average only 50% effective regardless of which tourniquet was used, with the other 18% being partially effective and 32% ineffective. Our study shows that time to tourniquet application averaged 119.82 seconds for all applications. This study shows that even non-trained persons can place a tourniquet in a timely manner, but that overall tourniquets were not placed effectively almost half of the time, and with one-third of all tourniquet applications being ineffective (see Figure 5). A similar study by Ross et al. also showed high failure rates when using the RMT, CAT, and SWAT-T without any prior training or instructions. In that study Ross et al. the RMT tourniquet was also the most often applied successfully at a rate of 23.4%, although this is at a significant lower success rate than our study. In our study with only the addition of the manufacturer’s instructions, the number of effective RMT applications improved to 63.4%. With formal training effectiveness would likely improve even more. However, it is important to note that general education level did not affect the time of application in any of the tourniquet groups.

It is difficult to quantify how much of an impact did the manufacturer instructions had on time and effectiveness of application. Every participant was given the instructions in a laminated sheet at the same time they were given their assigned tourniquet. It was the option of the participants to either use them or not; although participants with prior tourniquet training were excluded, it is possible some had prior knowledge of tourniquet application through social media or TV. Still this scenario recreates a real-life encounter better, since instructions are included in each tourniquet package and the user might have not had any prior training when trying to apply it.

The SWAT-T resulted in the highest rate of ineffective tourniquet application by laypersons without
previous tourniquet training and would be the least favorable choice for public access bleeding kits. Based on our results, the RMT could be the best tourniquet to place in public-access bleeding kits for use by non-trained civilians, but our results strongly suggest that additional or supportive training should be used with deployment of any public-access tourniquet. Further studies are warranted to determine the most effective method of layperson tourniquet application. Potential areas of future studies should include “just-in-time training” having participants watching short training videos prior to applying the tourniquets or comparing different picture guides for tourniquet application. In addition, simple audio instructions could prompt the layperson to properly apply the tourniquet similar to verbal prompts used for an AED. Further research should examine long-term retention of skills after training. Until other educational methods are studied and proven effective, we suggest that formal hands-on tourniquet training be included with other public health initiatives like naloxone training and CPR/AED training.

LIMITATIONS

Participants who volunteered for this study between the two recruitment sites may have been subject to self-selection bias. Although participants were excluded if they had any formal tourniquet training, we did not exclude participants that could have had social media or TV exposure to tourniquet application. Some of the differences in application times and effectiveness could be the result of poor design of the manufacturer’s instructions. However, the instructions cannot be compared since all the instructions have different format and size. Simulated blood flow rate was not measured, and partial effective application was rated based on the subjective finding of decrease dripping from the manikin arm. This study did not address the willingness of the participants to apply a tourniquet in real life or willingness for self-application. This study also did not take into account the effects of a stressful environment as an obstacle to effective tourniquet application. This study was a simulated environment, without any distractors, consequences, or dangers. It would be extremely difficult to simulate an active shooter incident or mass casualty incident with all the potential distractors associated with a true event. Future studies should include larger samples and conduct multivariable regression modeling to determine independent contributors and confounders to tourniquet effectiveness.

CONCLUSIONS

For this untrained cohort of laypersons the ratcheting medical tourniquet was the most effectively and most rapidly applied tourniquet. The stretch wrap and tuck tourniquet had the highest ineffective application rate than any other tourniquet type. The stretch wrap and tuck tourniquet also took the longest to apply. People who applied the tourniquets effectively were able to apply them quicker than the people who applied them incorrectly. There was no effect of age, sex, or
education on application time or effectiveness of application for any tourniquet type. We suggest that further study is needed to assess the value of community education in improving success rates of applying commercially available tourniquets.

References

Sex Without Contraceptives in a Multicenter Study of Adolescent Emergency Department Patients

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ABSTRACT

Objectives: In the United States, rates of teenage pregnancy and sexually transmitted infections (STIs) remain exceptionally high, and racial and ethnic disparities persist. Emergency departments (EDs) care for over 19 million adolescents each year, the majority being minority and low socioeconomic status. Single-center studies demonstrate infrequent use of contraceptives among adolescent ED patients and an association between risky sex and behaviors such as alcohol and drug use; however, no multicenter ED data exist. The objectives of this study were to 1) determine the prevalence of sex without contraceptives in a large multicenter adolescent ED study and 2) assess patient demographic and risky behaviors associated with sex without contraceptives.

Methods: Participants aged 14 to 17 years (n = 3,247) in 16 pediatric EDs across the United States completed an electronic survey. Questions focused on validated measures of risky sex; use of alcohol, tobacco, marijuana, and other drugs; and depression and violence. In this secondary analysis, we constructed univariable and multivariable models to identify demographic and behavioral factors associated with sex without contraceptives (our primary outcome), separately for adolescent males and females.

Results: In the prior year, 17.4% (236/1,356) of males and 15.8% (299/1,891) of females had sex without contraceptives. In the multivariable model, sex without contraceptives for both genders was more likely among teens...
who were black, with conduct problems and participated in casual sex, binge drinking, or cannabis use. Sex without contraceptives was also more likely among Hispanic and cigarette-smoking males, as well as depressed females.

Conclusions: Adolescent ED patients across the United States are participating in risky sexual behaviors that increase their likelihood of pregnancy and STI acquisition. These adolescents report a number of problem behaviors, including substance use, which are strongly correlated with unprotected sex. The ED visit may be an opportunity to identify at-risk adolescent patients, address risky behaviors, and intervene to improve adolescent health.

In the United States, reducing disparities in unintended teenage pregnancy and sexually transmitted infections (STIs) is a public policy priority. Despite declines over decades, the rate of unintended teenage pregnancy in the United States remains one of the highest in the industrialized world. Young adults account for nearly half of the 20 million cases of STIs diagnosed annually. Access to contraceptives vary by geographic location, while teens living in poverty and of minority status disproportionately experience unplanned pregnancies and STIs. Novel interventions to eliminate these disparities are needed.

Emergency departments (EDs) care for over 19 million adolescents each year, the majority being ethnic and racial minorities. Single-center ED studies demonstrate high sexual activity rates and infrequent use of effective hormonal birth control among adolescents. STI rates among adolescent ED patients range from 4% to 26% depending on symptomology. Single-center adolescent ED studies reveal how infrequent use of condoms is associated with other high-risk behaviors, such as violence and substance abuse, yet referral to preventive care shows limited success. Efforts are needed to address concomitant comorbidities in this high-risk adolescent population.

Very little is known about how demographics and risky behaviors link to high-risk sex among adolescents who present for care in EDs across the United States. Understanding how contraceptive use is associated with other risky health behaviors is important to better identify these at-risk youths in the acute care setting and design clinical interventions that address a constellation of risky adolescent behaviors. Therefore, it was the objective of this secondary analysis to assess the demographics and risky behaviors associated with the variable use of contraceptives among adolescents presenting to the ED for medical care.

METHODS

Study Design and Setting
We performed a planned secondary analysis of data from an institutional review board–approved prospective observational cohort study designed to test the validity of a brief alcohol screen in 16 pediatric EDs within the Pediatric Emergency Care Applied Research Network (PECARN). Sites were located in the Northeast, Middle Atlantic, West, Midwest, and Southwest regions of the United States, primarily in urban areas. All sites received institutional review board approval and a certificate of confidentiality was obtained. This study was funded by the National Institute of Alcohol Abuse and Alcoholism and the Health Resources and Services Administration.

Study Participants
Eligibility criteria included the following: 1) age 12 to 17 years; 2) seen in the ED for a non–life-threatening health condition; and 3) medically, cognitively, and behaviorally stable. Additional criteria excluded youth who 1) were in severe acute emotional distress (i.e., suicidal), 2) were cognitively impaired, 3) were unaccompanied by an adult or guardian, 4) were unable to read and speak English or Spanish or whose parents were unable to read and speak English or Spanish, and 5) were previously enrolled in this study or had neither a telephone nor an address of residence. For the purpose of this analysis, given the low rates of sexual activity among 12- and 13-year-old adolescents in the United States, we limited our results to participants age 14 to 17 years and to those who had a non-missing response (n = 3,247).

Study Procedures
Each of the 16 sites received a screening schedule based on research staff availability that included five 4-hour screening shifts per site each week. The shifts were randomly chosen with greater weight given to times when the age group of interest most frequently visits the participating EDs. However, times spanned morning to night and all days of the week. Patients were screened consecutively in the order of ED arrival to minimize selection bias. Research coordinators approached parents or guardians and explained the study in detail. Parents provided written informed consent; adolescents provided written informed assent.
Adolescents then completed a criterion assessment battery self-administered on a tablet computer in English or Spanish in a private location to maintain confidentiality. This assessment battery included validated measures of substance use and risk behavior, including validated questions of alcohol use and misuse; tobacco, marijuana, and other drug use; violence; and other risky behaviors such as sex without contraceptives and/or with someone you did not know well. Participants had the option of using an audio computer-assisted self-interview. Participants received a $10 gift card for participation in the survey. Detailed procedural methodology is described elsewhere.17

Key Outcome Measures
Data for our primary outcome came from participants’ answer to the Reckless Behavioral Questionnaire (RBQ) item, “How many times in the past 12 months have you had sex without contraceptives (withdrawal and having sex at a ‘safe’ time on the menstrual cycle doesn’t count as a contraceptive)?”18 The RBQ is a validated 10-item scale used to evaluate past-year risky behaviors among high school and college samples, namely, substance abuse patterns.18 Sex without contraceptives was reported as categories (0, 1, 2–5, 6–10, or > 10 times within the past year) and was dichotomized for the primary analysis. Individual questions about substance abuse over the past year were administered. The Diagnostic Interview Schedule for Children (DISC), adapted for a Diagnostic and Statistical Manual of Mental Disorders (DSM-5) diagnosis, assessed substance use disorders.19 The Global Appraisal of Individual Needs (GAIN) screened for behavioral health disorders, including conduct disorder and peer aggression.20 The Mental Health Inventory (MHI-5) screened mood and is considered a general indicator of mental health status; a score of < 70 is considered the cutoff for significant depressive symptoms.21 The lower the score, the higher the risk of depressed mood. Casual sex was defined as sex with someone the participant did not know well in the past 12 months.

Data Analysis
We used both unadjusted and mutually adjusted logistic regression models to investigate the association between adolescent characteristics and sex without contraceptives. We analyzed females and males separately because of differential contraceptive decision making based on gender.22,23 We evaluated the univariable association of sex without contraceptives by gender with each variable. Candidate variables included age; race; ethnicity; casual sex (sex with someone the participant did not know well in the past 12 months); DSM-5 alcohol use disorder; frequency of binge drinking, marijuana use, smoking, or drug use; MHI-5 score; and number of GAIN-reported conduct problems. Those variables significant at the p < 0.2 level in the univariable analysis were considered in each of the two multivariable models. To arrive at parsimonious models, a stepwise variable selection method was utilized with a dropout p-value threshold of 0.05. The data were examined for potential outliers. Correlation between model variables was calculated and examined for collinearity. We looked for data points with excessive influence on the model results and inspected linearity of the logit. To examine model fit, we calculated c-statistics and performed the Hosmer and Lemeshow test. We also performed leave-one-out cross-validation. We used SAS, version 9.4, software for all analyses.

RESULTS
Of 7,545 adolescents who were screened, eligible, and approached for participation, baseline surveys were completed by 5,001 (66.3%). Of these, 4,855 answered the RBQ question on sex without contraceptives, with 3,247 between the ages of 14 to 17 years included in the analyses. Sex without contraceptives was reported one time by 5.3% (100/1,891) of females and 6.7% (91/1,356) of males, two to five times by 5.6% (105/1,891) of females and 6.4% (87/1,356) of males, six to 10 times by 2.0% (37/1,891) of females and 1.7% (23/1,356) of males, and > 10 times by 3.0% (57/1,891) of females and 2.6% (35/1,356) of males. Table 1 displays the proportion of participants having sex without contraceptives by sociodemographic and substance use characteristics. Overall, 16.5% (535/3,247) participants had sex without contraceptives in the prior year, with 44.1% (236/535) being males and 55.9% (299/535) being females. Table 1 also indicates that rates of sex without contraception increase steadily for both males and females from age 14 to 17.

Table 2 displays results from logistic regression analysis. In the univariable regression model, all variables were significantly associated with sex without contraceptives. In the multivariable logistic regression model, for both genders, sex without contraceptives
### Table 1

Demographics, Substance Use, Depressive Symptoms, and Conduct Problems Associated With Sex Without Contraceptives by Gender in the Prior 12 Months

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
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<tbody>
<tr>
<td>14</td>
<td>364 (32.5)</td>
<td>29 (12.3)</td>
<td>393 (29.0)</td>
<td>425 (26.7)</td>
<td>18 (6.0)</td>
<td>443 (23.4)</td>
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<tr>
<td>15</td>
<td>302 (27.0)</td>
<td>53 (22.5)</td>
<td>355 (26.2)</td>
<td>447 (28.1)</td>
<td>74 (24.7)</td>
<td>521 (27.6)</td>
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<td>16</td>
<td>271 (24.2)</td>
<td>74 (31.4)</td>
<td>345 (25.4)</td>
<td>405 (25.4)</td>
<td>101 (33.8)</td>
<td>506 (26.8)</td>
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<td>17</td>
<td>183 (16.3)</td>
<td>80 (33.9)</td>
<td>263 (19.4)</td>
<td>315 (19.8)</td>
<td>106 (35.5)</td>
<td>421 (22.3)</td>
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</table>

<table>
<thead>
<tr>
<th>Race Unknown or not reported</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>543 (48.5)</td>
<td>78 (33.1)</td>
<td>621 (45.8)</td>
<td>771 (48.4)</td>
<td>108 (36.1)</td>
<td>879 (46.5)</td>
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<td>Black</td>
<td>305 (27.2)</td>
<td>90 (38.1)</td>
<td>395 (29.1)</td>
<td>391 (24.6)</td>
<td>97 (32.4)</td>
<td>488 (25.8)</td>
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<td>American Indian/Alaska Native/Asian/Hawaiian</td>
<td>50 (4.5)</td>
<td>12 (5.1)</td>
<td>62 (4.6)</td>
<td>60 (3.8)</td>
<td>11 (3.7)</td>
<td>71 (3.8)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Ethnicity Unknown or not reported</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic or latino</td>
<td>251 (22.4)</td>
<td>74 (31.4)</td>
<td>325 (24.0)</td>
<td>411 (25.8)</td>
<td>89 (29.8)</td>
<td>500 (26.4)</td>
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<tr>
<td>Not hispanic or latino</td>
<td>837 (74.7)</td>
<td>150 (63.6)</td>
<td>987 (72.8)</td>
<td>1,035 (63.7)</td>
<td>208 (66.2)</td>
<td>1,243 (66.8)</td>
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</table>

<table>
<thead>
<tr>
<th>Casually sex*</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>I prefer not to answer</td>
<td>3 (0.3)</td>
<td>6 (0.4)</td>
<td>1 (0.1)</td>
<td>1 (0.3)</td>
<td>2 (0.1)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1,066 (95.2)</td>
<td>1,224 (90.3)</td>
<td>1,556 (97.7)</td>
<td>233 (77.9)</td>
<td>1,899 (94.6)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>51 (4.6)</td>
<td>126 (9.3)</td>
<td>35 (2.2)</td>
<td>65 (21.7)</td>
<td>100 (5.3)</td>
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</table>

<table>
<thead>
<tr>
<th>Alcohol use disorder†</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1,078 (96.3)</td>
<td>1,295 (95.5)</td>
<td>1,539 (96.7)</td>
<td>273 (91.3)</td>
<td>1,812 (95.8)</td>
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<tr>
<td>Yes</td>
<td>18 (1.6)</td>
<td>32 (2.4)</td>
<td>14 (0.9)</td>
<td>20 (6.7)</td>
<td>34 (1.8)</td>
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<tr>
<td>Unknown</td>
<td>24 (2.1)</td>
<td>29 (2.1)</td>
<td>39 (2.4)</td>
<td>6 (2.0)</td>
<td>45 (2.4)</td>
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</table>

<table>
<thead>
<tr>
<th>Binge drinking‡</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>I prefer not to answer</td>
<td>8 (0.7)</td>
<td>8 (0.6)</td>
<td>10 (0.6)</td>
<td>7 (2.3)</td>
<td>17 (0.9)</td>
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</tr>
<tr>
<td>Never</td>
<td>1,023 (91.3)</td>
<td>1,191 (87.8)</td>
<td>1,436 (90.2)</td>
<td>195 (65.2)</td>
<td>1,631 (86.3)</td>
<td></td>
</tr>
<tr>
<td>Less than monthly</td>
<td>59 (5.3)</td>
<td>97 (7.2)</td>
<td>113 (7.1)</td>
<td>60 (20.1)</td>
<td>173 (9.1)</td>
<td></td>
</tr>
<tr>
<td>Monthly or more</td>
<td>30 (2.7)</td>
<td>60 (4.4)</td>
<td>33 (2.1)</td>
<td>37 (12.4)</td>
<td>70 (3.7)</td>
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</table>

<table>
<thead>
<tr>
<th>Marijuana use§</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>I prefer not to answer</td>
<td>80 (7.1)</td>
<td>96 (7.1)</td>
<td>109 (6.8)</td>
<td>16 (5.4)</td>
<td>125 (6.6)</td>
<td></td>
</tr>
<tr>
<td>0 to 1 time</td>
<td>924 (82.5)</td>
<td>1,053 (77.7)</td>
<td>1,333 (83.7)</td>
<td>164 (54.8)</td>
<td>1,497 (79.2)</td>
<td></td>
</tr>
<tr>
<td>2 or more times</td>
<td>116 (10.4)</td>
<td>207 (15.3)</td>
<td>150 (9.4)</td>
<td>119 (39.8)</td>
<td>269 (14.2)</td>
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</table>

<table>
<thead>
<tr>
<th>Cigarette smoking</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown or Not Reported</td>
<td>10 (0.9)</td>
<td>19 (1.4)</td>
<td>16 (1.0)</td>
<td>6 (2.0)</td>
<td>22 (1.2)</td>
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</tr>
<tr>
<td>No</td>
<td>1,047 (93.5)</td>
<td>1,222 (90.1)</td>
<td>1,452 (91.2)</td>
<td>208 (69.6)</td>
<td>1,660 (87.8)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>63 (5.6)</td>
<td>115 (8.5)</td>
<td>124 (7.8)</td>
<td>85 (28.4)</td>
<td>209 (11.1)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug use*</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
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</thead>
<tbody>
<tr>
<td>No</td>
<td>1,031 (92.1)</td>
<td>1,207 (89.0)</td>
<td>1,442 (90.6)</td>
<td>231 (77.3)</td>
<td>1,673 (88.5)</td>
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</tr>
<tr>
<td>Yes</td>
<td>49 (4.4)</td>
<td>71 (4.5)</td>
<td>52 (17.4)</td>
<td>123 (6.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>40 (3.6)</td>
<td>58 (4.3)</td>
<td>79 (5.0)</td>
<td>16 (5.4)</td>
<td>95 (5.0)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Depressive symptoms**</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
<th>Males</th>
<th>Females</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1,078</td>
<td>224</td>
<td>1,302</td>
<td>1,532</td>
<td>290</td>
<td>1,822</td>
</tr>
</tbody>
</table>

(Continued)
was more likely among black (vs. white) teens (odds ratio [OR] [95% confidence interval (CI)] = 2.83 [1.75 to 4.60] for males and 2.39 [1.59 to 3.60] for females), those who had conduct problems (OR [95% CI] = 1.18 [1.06 to 1.32] for males and 1.16 [1.05 to 1.28] for females), and teens who participated in casual sex (OR [95% CI] = 4.76 [2.60 to 8.70] for males and 4.61 [2.41 to 8.82] for females), binge drinking (OR [95% CI] = 2.46 [1.22 to 4.97] for males and 2.78 [1.63 to 4.75] for females), or marijuana use (OR [95% CI] = 1.74 [1.01 to 2.99] for males and 3.39 [2.17 to 5.30] for females). Among males, sex without contraceptives was more likely among Hispanic (vs. non-Hispanic) teens (OR [95% CI] = 2.19 [1.23 to 3.92]) and cigarette smokers (OR [95% CI] = 2.13 [1.06 to 4.31]), while among females, it was more likely among those who reported depressive symptoms (OR [95% CI] = 0.84 [0.76 to 0.92]). Leave-one-out cross-validation resulted in a drop in AUC from 0.818 to 0.787 for males and from 0.92 [95% CI] = 0.801 for females.

**DISCUSSION**

This is largest study to date to examine high-risk sex patterns among an ED adolescent population. In this multicenter study, we found that almost one in five adolescent ED patients age 14 to 17 had sex without contraceptives in the past year. That number increased with age, with one in four teens aged 17 years having sex without contraceptives in the past year. This risk was similar for males and females. Although we cannot assume that the partners with which these adolescents are not using contraceptives are the casual partners, having sex without contraceptives in our study was significantly associated for both males and females with having had casual sex over the past year. Thus, a subset of adolescent ED patients are having sex without contraceptives and casual sex, escalating their risk of teenage pregnancy and STIs.

Sex without contraceptives was also associated with being black (vs. white) and Hispanic (for males). This finding strengthens single-center data. In one urban ED caring for predominantly African American teens, 21% of surveyed adolescents reported using no contraception at last intercourse. Similarly, in another urban ED caring for predominantly Hispanic teens, over half of the 250 sexually active teens surveyed used no condom at last intercourse, with one-quarter using no contraceptive at all at last intercourse. Although our analysis does not control for socioeconomic status nor take into account societal inequities facing minority populations, this finding does correlate with national data regarding the higher risk of unintended pregnancy and STIs for these ethnic and racial groups, further illuminating how disparities affect teens in the ED as well.

Certain risky behaviors were associated with sex without contraceptives such as binge drinking, marijuana use, and conduct problems. This is important because it suggests that adolescent ED patients who present with the latter problems should be evaluated for the former and vice versa. For example, ED visits for depression and suicidality are rising in the United States. We found that adolescents females who suffer from depression and poor mental health were

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**Table 1. (continued)**

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sex Without Contraceptives</td>
<td>Sex Without Contraceptives</td>
</tr>
<tr>
<td>No (n = 1,120)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
</tr>
<tr>
<td>Yes (n = 236)</td>
<td>74.8 (±16.09)</td>
<td>70.0 (±18.30)</td>
</tr>
<tr>
<td>Overall (n = 1,356)</td>
<td>74.0 (±16.59)</td>
<td>66.1 (±19.85)</td>
</tr>
<tr>
<td>Yes (n = 1,592)</td>
<td>66.1 (±19.85)</td>
<td>56.9 (±21.01)</td>
</tr>
<tr>
<td>Overall (n = 1,891)</td>
<td>64.7 (±20.15)</td>
<td>63.0 (±20.15)</td>
</tr>
<tr>
<td>Number of reported conduct problems,††</td>
<td>1.0 [0.0, 2.0]</td>
<td>2.0 [1.0, 4.0]</td>
</tr>
<tr>
<td></td>
<td>Median [Q1, Q3]</td>
<td>Median [Q1, Q3]</td>
</tr>
<tr>
<td></td>
<td>1.0 [0.0, 2.0]</td>
<td>2.0 [1.0, 4.0]</td>
</tr>
<tr>
<td></td>
<td>1.0 [0.0, 2.0]</td>
<td>2.0 [1.0, 4.0]</td>
</tr>
</tbody>
</table>

---

Data are reported as n (%).

*Casual sex is defined as sex with someone the participant did not know well in the past 12 months.

††Alcohol use disorder is defined by the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-5) diagnosis of mild, moderate, or severe alcohol use disorder.

†††Binge drinking is defined as five or more (males) and four or more (females) alcoholic drinks on one occasion.

††††Marijuana use refers to any use of cannabis (K2), heroin, inhalants, or prescription drugs over the past year.

¶†Illicit drugs refers to any use of cocaine, crystal methamphetamine, lysergic acid diethylamide (LSD), phencyclidine (PCP), synthetic cannabinoids (K2), heroin, inhalants, or prescription drugs over the past year.

**Depressed mood was defined by the Mental Health Inventory (MHI-5) score as less than 70. The lower the score, the higher the risk of depression.

††††Conduct problems as defined by the GAIN.
more often having sex without contraceptives. Given this finding, ED providers should consider, when evaluating adolescents presenting for such psychiatric complaints, further assessments for unprotected sex and the resulting need for STI and pregnancy testing as well as emergency contraception provision.

Our findings are consistent with prior national surveys that highlighted high-risk sex among adolescents. Although our findings are difficult to compare to national survey data, given differences in the phrasing of survey questions, the prevalence of sex without contraceptives in our cohort was high. The National Survey of Family Growth (NSFG) surveyed teens aged 15 to 19 and found that 14% of females and 7% of males reported having not used contraceptives at last intercourse.22 Similarly, the Youth Risk Behavior Surveillance System (YRBSS) reported that at last intercourse an estimated 14% of high school students did not use any contraceptive.23 Our data also highlight early initiation of high-risk sex. According to the NSFG, 18% of males and 13% of females in the United States have ever had sexual intercourse by age 15.24

In our cohort of 15-year-olds, 16.5% of our population had sex without contraceptives.25 Our data also highlight the resulting need for STI and pregnancy testing as well as emergency contraception provision.

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted OR (95% CI) p-value*</td>
<td>Adjusted OR (95% CI) p-value*</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black vs. white</td>
<td>2.05 (1.47–2.87)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>American Indian/Alaska Native/Asian/Hawaiian vs. white</td>
<td>1.67 (0.85–3.28)</td>
<td>1.33 (0.53–3.32)</td>
</tr>
<tr>
<td>More than one race vs. white</td>
<td>1.39 (0.77–2.50)</td>
<td>1.18 (0.53–2.60)</td>
</tr>
<tr>
<td>Hispanic or Latino vs. not Hispanic or Latino</td>
<td>1.65 (1.20–2.25)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Casual sex†</td>
<td>9.92 (6.70–14.70)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Alcohol use disorder‡</td>
<td>3.86 (1.89–7.89)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Binge drinking§</td>
<td></td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Less than monthly vs. never</td>
<td>3.92 (2.53–6.08)</td>
<td>2.46 (1.22–4.97)</td>
</tr>
<tr>
<td>Monthly or more vs. never</td>
<td>6.09 (3.58–10.36)</td>
<td>2.31 (0.93–5.71)</td>
</tr>
<tr>
<td>Marijuana use</td>
<td>5.62 (4.04–7.82)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Cigarette smoking‡</td>
<td>4.94 (3.31–7.37)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Drug use*</td>
<td>5.02 (3.23–7.81)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Depressive symptoms†‡</td>
<td>0.85 (0.78–0.92)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Conduct problems‡‡</td>
<td>1.37 (1.28–1.47)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Adjusted ORs are only shown for variables retained by model selection. The c-statistic for the multivariable male and female models are 0.818 and 0.813, respectively. The Hosmer and Lemeshow p-values are 0.1039 and 0.5777, respectively.

*p-values correspond to the omnibus test for variable significance.

†Casual sex is defined as sex with someone the participant did not know well in the past 12 months.

‡Alcohol use disorder is defined by the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-5) diagnosis of mild, moderate, or severe alcohol use disorder.

§Binge drinking is defined as five or more (males) and four or more (females) alcoholic drinks on one occasion.

¶Marijuana use refers to any use in the past year.

‖Cigarette smoking over the past year.

**Illicit drugs refers to any use of cocaine, crystal methamphetamine, lysergic acid diethylamide (LSD), phencyclidine (PCP), synthetic cannabinoid (K2), heroin, inhalants, or prescription drugs over the past year.

††Depressed mood was defined by the Mental Health Inventory (MHI-5) score as less than 70. The lower the score, the higher the risk of depression.

‡‡Conduct problems as defined by the GAIN.
LIMITATIONS

First, our primary outcome was sex without contraceptives over the past year. Other surveys ask about contraceptive use at last or first intercourse to minimize recall bias. Second, the RBQ question does not specifically identify condoms as a contraceptive, which might have resulted in inaccurate responding. Also, the way the RBQ asks about last contraceptive use only accounts for the one-sided perspective of the surveyed participant. Particularly males may not be aware of the hormonal contraceptives used by their sexual partners, especially if these sexual partners are casual; this may have falsely increased the prevalence of sex without contraceptives among male adolescents. In addition, we must assume that a proportion of sexual encounters involved hormonal contraceptives alone and no condoms. This increases our populations risk of STIs. Third, a proportion of participants chose “I prefer not to answer” or “unknown” for marijuana and drug use, respectively; if these participants were all drug users, then that would have affected the results of our regression models. Fourth, although we used validated measures, we must also appreciate the complex social contexts and decision making that influence adolescent sexual behaviors that may not have been captured by our question set. Fifth, certain issues such as partner violence, reproductive coercion, and sex trafficking, which are important to consider when considering adolescent risky sexual patterns, were not addressed in our data set. When considering future sexual health ED-based interventions, we should consider the complicated context within which risky sexual behaviors occur and address directly with the adolescent. Finally, our models were only internally cross-validated. While the results remain stable, the findings require further validation to become more definitive.

CONCLUSIONS

This multicenter study indicates that about one in five adolescent ED patients engage in sex without contraceptives. These adolescents also report a number of problem behaviors, including conduct problems and substance use, which are strongly correlated with sex without contraceptives. A study such as this one pushes us to think about the broad context of our role as ED providers. While we recognize the ED is busy with limited resources, our current standards of care often do not address these behaviors, putting our patients at risk for a multitude of unintended consequences, such as pregnancy and sexually transmitted infections. The ED visit may be an opportunity for medical providers to screen and identify adolescents who are at risk for unintended teenage pregnancy and sexually transmitted infections and intervene to improve their sexual health. The ED may provide a unique opportunity for adolescents to ask questions about sexual health because of the relative anonymity of the ED compared to primary care. The answers to such questions might trigger a brief educational or motivational intervention in the ED and/or a referral (e.g., back to their primary care provider or to a community agency). These interventions should also consider the high probability of other cooccurring risk factors in this population, such as substance use, and how they affect sexual risk behavior. The ED visit may be an opportunity to address other risky adolescent behaviors. The ED can play a significant role in the health outcomes of our adolescent patients, but more research is needed to understand the best practices to do so.

References

ABSTRACT

Background: In the era of frequent head-to-pelvis computed tomography (CT) for adult blunt trauma evaluation, we sought to update teachings regarding aortic injury by determining 1) the incidence of aortic injury; 2) the proportion of patients with isolated aortic injury (without other concomitant thoracic injury); 3) the clinical implications of aortic injury (hospital mortality, length of stay [LOS], and rate of surgical interventions); and 4) the screening value of traditional risk factors/markers (such as high-energy mechanism and widened mediastinum on chest x-ray [CXR]) for aortic injury, compared to newer criteria from the recently developed NEXUS Chest CT decision instrument (DI).

Methods: We conducted a preplanned analysis of patients prospectively enrolled in the NEXUS Chest studies at 10 Level I trauma centers with the following inclusion criteria: age > 14 years, blunt trauma within 6 hours of ED presentation, and receiving chest imaging during ED trauma evaluation.

Results: Of 24,010 enrolled subjects, 42 (0.17%, 95% confidence interval [CI] = 0.13% to 0.24%) had aortic injury. Most patients (79%, 95% CI = 64% to 88%) had an associated thoracic injury, with rib fractures, pneumothorax/hemothorax, and pulmonary contusion occurring most frequently. Compared to patients without aortic injury this cohort had similar mortality (9.5%, 95% CI = 3.8% to 22.1% vs. 5.8%, 95% CI = 5.4% to 6.3%), longer median hospital LOS (11 days vs. 3 days, p < 0.01), and higher median Injury Severity Score (29 vs. 5, p < 0.001). High-energy mechanism and widened mediastinum on CXR had low sensitivity for aortic injury (76% [95% CI = 62% to 87%] and 33% [95% CI = 21% to 49%], respectively), compared to the NEXUS Chest CT DI (sensitivity 100% [95% CI = 92% to 100%]).

Conclusions: Aortic injury is rare in adult ED blunt trauma patients who survive to receive imaging. Most ED aortic injury patients have associated thoracic injuries and survive to hospital discharge. Widened mediastinum on CXR and high-energy mechanism have relatively low screening sensitivity for aortic injury, but the NEXUS Chest DI detected all cases.
The desire to detect (or not miss) significant injury and the broad availability of rapid computed tomography (CT) have ushered in the era of frequent head-to-pelvis CT (pan-scan) in adult blunt trauma patient evaluation over the past two decades. Although major injury prevalence in the United States remained stable, the proportion of CT scans performed per injury-related visit more than doubled from 1998 to 2007, and currently, 245 CT scans are performed per 1,000 patients annually—more than any other high-income country by a wide margin. Aortic injury is one of the gravest thoracic complications of blunt trauma, and the need for its detection may be a major driving force for increased chest CT utilization.

The incorporation of frequent chest CT in the evaluation of blunt trauma patients mandates a need for reassessment of traditional teachings about injuries detected. Using data from our large, prospectively derived database of adult blunt thoracic injuries (the NEXUS Chest studies), we have previously updated and revised classic teachings regarding pulmonary contusion, sternal fracture, rib fracture, scapular fracture, and pneumothorax/hemothorax in the modern era. In this analysis, we seek to similarly update teachings about aortic injury. Specifically, we sought to determine 1) the incidence of aortic injury in adult blunt trauma patients who receive imaging; 2) how often aortic injury occurs in isolation (without other thoracic injury); 3) the clinical implications of aortic injury (mortality, hospital length of stay [LOS], and rate of surgical interventions); and 4) the screening value of a) high-energy mechanism (defined a priori as fall > 20 feet, motor vehicle collision > 40 miles/hour, or pedestrian hit by motorized vehicle), b) widened mediastinum on chest X-ray (CXR), and c) NEXUS Chest CT DI criteria for aortic injury (see Box 1).

**Methods**

**Study Design**

We conducted a planned secondary analysis of data from two prospective, observational studies of four cohorts of adult blunt trauma patients: derivation and validation cohorts in the NEXUS Chest study (conducted from January 2009 to December 2012) and in the NEXUS Chest CT study (conducted from August 2011 to May 2014). We obtained institutional review board approval at all study sites prior to enrollment.

**Study Setting and Participants**

The specifics of these parent studies have been previously described. Briefly, we conducted both studies at 10 urban U.S. Level I trauma centers, prospectively enrolling blunt trauma patients with the following inclusion criteria: 1) patient age > 14 years; 2) presenting to the emergency department (ED) within 6 hours of blunt trauma; and 3) receiving chest imaging (CXR and/or chest CT ordered at the discretion of providers) during their ED evaluation. All injuries in this analysis were identified from ED imaging with the index CXR preceding chest CT in all cases.

**Measures and Outcomes**

Our primary outcome measures were 1) the incidence of aortic injury in adult blunt trauma patients; 2) the proportion of patients whose aortic injury occurs in isolation (without other thoracic injury on chest imaging); 3) aortic injury associated hospital mortality, LOS, and rate of surgical interventions; and 4) the sensitivity of a) high-energy mechanism (defined a priori as fall > 20 feet, motor vehicle collision > 40 miles/hour, or pedestrian hit by motorized vehicle), b) widened mediastinum on CXR, and c) NEXUS Chest CT DI criteria for aortic injury (see Box 1).

**Data Management and Analysis**

We managed input data using Research Electronic Data Capture (RedCAP) hosted by the University of California at San Francisco and exported completed data to Microsoft Excel for sorting and STATA v14 for analyses. For age, Injury Severity Score (ISS), and LOS, we determined medians and interquartile ranges (IQRs). For the incidence of aortic injury, mortality, rate of isolated aortic injury, sensitivity, and other proportions, we calculated 95% confidence intervals (CIs). Because aortic injury is considered to be a

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**Box 1 NEXUS Chest CT Criteria to guide selective chest CT**

1. Rapid deceleration mechanism
2. Distracting injury
3. Chest wall tenderness
4. Sternal tenderness
5. Thoracic spine tenderness
6. Scapular tenderness
7. Abnormal CXR defined as any injury or widened mediastinum seen on CXR
grave, highly lethal injury and because the low prevalence of disease would artificially inflate negative predictive value (NPV), sensitivity was chosen as the screening parameter of choice (instead of specificity and NPV). To compare sensitivities we calculated difference in proportions with 95% CIs that did not cross zero indicating significant difference. In terms of reporting our work, we followed the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines.

RESULTS

Of 24,010 enrolled subjects, 42 (0.17%, 95% CI = 0.13% to 0.24%) had aortic injury (see Figure 1 for enrollment and classification and see Table 1 for characteristics of aortic injury versus nonaortic injury patients). Nine patients (21%, 95% CI = 12% to 36%) had isolated aortic injury. The most common associated thoracic injuries were rib fractures (57%), pneumothorax (45%), pulmonary contusion (31%), hemothorax (24%), and sternal fracture (12%).

Compared to patients without aortic injury, the aortic injury group had statistically similar mortality (9.5% vs. 5.8%, difference = 3.7%, 95% CI = −2.0% to 16.3%), longer median hospital LOS (11 days vs. 3 days), and higher median ISS (29 vs. 5). The four deaths in aortic injury patients were attributed to traumatic brain injury and not to the aortic injury itself. Most aortic injury patients (57%) had surgical interventions—exclusively endovascular repair.

The sensitivities of high-energy mechanism and widened mediastinum on CXR for aortic injury were 76.2% (95% CI = 61.5% to 86.5%) and 33.3% (95% CI = 21.0% to 48.5%), respectively—both significantly lower than the sensitivity of the Nexus Chest CT DI (100% [95% CI = 91.6% to 100%]; see Table 2).

DISCUSSION

The evolution of trauma imaging practice toward more CT utilization mandates reconsideration of traditional teachings about traumatic injuries. As such, we present a number of notable findings regarding aortic injury in the era of frequent chest CT for blunt trauma. First, the incidence of aortic injury in ED blunt trauma patients is low, especially considering that we only included trauma patients who had chest imaging—a more injured group of patients than all-comers who did not receive chest imaging. The incidence in an unselected group of ED blunt trauma patients would almost certainly be lower. Using ICD-9 codes from the 2000 to 2005 National Trauma Database, Arthurs et al.11 found that 0.3% of blunt

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**Figure 1** Enrollment and classification. CXR = chest X-ray.
trauma admissions had aortic injury; when removing the 23% of these patients who died on ED arrival or in triage (presumably prior to imaging), the resultant 0.22% incidence of aortic injury closely approximates ours.

Second, we found that isolated aortic injury is even rarer—nine of 24,010 (0.03%) of all patients in this study. Aortic injury more commonly occurs as part of a thoracic injury complex associated with other injuries. As such, management for these cases often involves a multimodal approach with stabilization of thoracic injuries beyond the aortic repair, as well as treatment of injuries outside of the thorax.

Third, mortality was low and death in the few patients who died was attributed to other injuries. Given that this was an observational study, we cannot determine whether this low mortality resulted from early detection and surgical intervention or other factors. Additionally, as noted, we did not evaluate patients who died in the field or before imaging, and therefore overall mortality from aortic injury is higher. Our research supports a body of evidence suggesting that inpatient mortality from aortic injury has steadily declined in the past few decades.12–15 Examining blunt aortic injury patient data from 1977 to 1985, Cowley et al. reported inpatient mortality of 33%, while later studies in 1997 and 2007 found aortic injury mortality of 22% to 13%,12–14 respectively. These reductions in mortality were associated with a transition in diagnostics from aortography to CT scan, higher rates of endovascular repair instead of open surgical techniques, and increased use of cardiovascular bypass.14,15

Finally, we have several findings regarding screening markers that may inform decisions for the ordering of chest CT to detect aortic injury. Counter to classic teachings,16–19 widened mediastinum and abnormal

Table 1  
Characteristics of Aortic Injury Patients Versus Nonaortic Injury Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Aortic Injury (n = 42)</th>
<th>No Aortic Injury (n = 23,968)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>32 (76)</td>
<td>14,853 (62)</td>
</tr>
<tr>
<td>Age (years), median (IQR)</td>
<td>49 (37–68)</td>
<td>45 (29–61)</td>
</tr>
<tr>
<td>GCS score, median (IQR)</td>
<td>15 (14–15)</td>
<td>15 (15)</td>
</tr>
<tr>
<td>ISS, median (IQR)</td>
<td>29 (17–44)</td>
<td>5 (1–10)</td>
</tr>
<tr>
<td>Hospital LOS, median (IQR)</td>
<td>11 (4–23)</td>
<td>3 (1–5)</td>
</tr>
<tr>
<td>Admitted, n (%)</td>
<td>42 (100)</td>
<td>12,629 (53)</td>
</tr>
<tr>
<td>Mechanism of injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor vehicle collision</td>
<td>23 (55)</td>
<td>8,453 (35)</td>
</tr>
<tr>
<td>Pedestrian struck by vehicle</td>
<td>8 (19)</td>
<td>2,508 (10)</td>
</tr>
<tr>
<td>Fall &gt; 20 feet</td>
<td>4 (10)</td>
<td>6,406 (27)</td>
</tr>
<tr>
<td>Bicycle crash</td>
<td>3 (7)</td>
<td>1,650 (7)</td>
</tr>
<tr>
<td>Fall from standing</td>
<td>0</td>
<td>3,591 (15)</td>
</tr>
<tr>
<td>Stuck by object or assault</td>
<td>0</td>
<td>1,475 (6)</td>
</tr>
<tr>
<td>Other or unknown</td>
<td>2 (5)</td>
<td>1,287 (5)</td>
</tr>
</tbody>
</table>

GCS = Glasgow Coma Score; ISS = Injury Severity Score; IQR = interquartile range; LOS = length of stay.

Table 2  
False Negatives and Sensitivity of Criteria for Aortic Injury

<table>
<thead>
<tr>
<th>Criteria</th>
<th>False Negatives (n = 42)</th>
<th>Sensitivity, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Widened mediastinum on CXR</td>
<td>28</td>
<td>33 (21–49)</td>
</tr>
<tr>
<td>High-energy mechanism</td>
<td>10</td>
<td>76 (61–87)</td>
</tr>
<tr>
<td>Chest, sternal, thoracic spine, or scapular tenderness to palpation</td>
<td>20</td>
<td>52 (38–67)</td>
</tr>
<tr>
<td>Distracting injury*</td>
<td>9</td>
<td>79 (64–88)</td>
</tr>
<tr>
<td>Abnormal CXR†</td>
<td>14</td>
<td>67 (52–79)</td>
</tr>
<tr>
<td>NEXUS Chest CT DI</td>
<td>0</td>
<td>100 (92–100)</td>
</tr>
</tbody>
</table>

CXR = chest x-ray; DI = decision instrument.
* Distracting injury was defined a priori as any condition thought by the clinician to produce pain sufficient to distract from a second injury, including, but not limited to, long-bone fracture, visceral injury requiring surgical consultation, large laceration, degloving injury, crush injury, large burns, or any injury causing acute functional impairment.
† Abnormal CXR was defined as any injury (including clavicle fracture) or widened mediastinum seen on CXR.
CXR had low sensitivity for aortic injury. The sensitivities of high-energy mechanism and distracting injury are higher, but still insufficient for use as rule-out criteria. Thus, none of the three components of blunt thoracic trauma evaluation (history [mechanism of injury], physical examination [thoracic tenderness and distracting injury], or imaging [CXR]) had high sufficiently high sensitivity for aortic injury as criteria by themselves. The gravity of aortic injury mandates that a screening tool should have perfect or near-perfect sensitivity, and we therefore recommend use of the NEXUS Chest CT DI, which incorporates all three trauma evaluation components, and detected all cases.

LIMITATIONS

Our greatest limitation in this study is that we only captured patients who survived in the ED long enough to have chest CT (not patients who died in the field or immediately in the ED), and we therefore cannot assess the true incidence of aortic injury and its true overall mortality. Although we conducted follow-up procedures to detect work-up bias, we could not completely rule out aortic injury in patients who did not receive chest CT (only received CXR). We also conducted this study at high-volume, urban Level I trauma centers, which may introduce spectrum bias limiting generalization of our findings to lower-acuity trauma centers. We did not fully account for confounding factors, such as injury to other organ systems that likely affected the outcomes of admission rates, LOS, and mortality. Finally, even though we had a large total sample size of over 24,000 patients, the low number of aortic cases led to wide CIs in many of our analyses that may have precluded finding significant differences where they truly exist—especially with regard to mortality.

CONCLUSIONS

Aortic injury is rarely diagnosed in the current era of frequent chest computed tomography for adult blunt trauma patient evaluation. Aortic injury is usually seen as part of a thoracic injury complex and inpatient mortality (for those who survive long enough to be imaged) is low. Classic risk stratification markers of widened mediastinum and high-energy mechanism are insensitive predictors of aortic injury, while the NEXUS Chest computed tomography decision instrument detected all cases.

References

Building RAFT: Trafficking Screening Tool Derivation and Validation Methods

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ABSTRACT

Background: Labor and sex trafficking have long impacted the patients who seek care in emergency departments (ED) across the United States. Increasing social and legislative pressures have led to multiple calls for screening for trafficking in the clinical care setting, but adoption of unvalidated screening tools for trafficking recognition is unwise for individual patient care and population-level data. Development of a valid screening tool for a social malady that is largely “invisible” to most clinicians requires significant investments. Valid screening tool development is largely a poorly understood process in the antitrafficking field and among clinicians who would use the tools.

Methods: The authors describe the study design and procedures for reliable data collection and analysis in the development of RAFT (Rapid Appraisal for Trafficking). In a five-ED, randomized, prospective study, RAFT will be derived and validated as a labor and sex trafficking screening tool for use among adult ED patients. Using a novel method of ED patient-participant randomization, intensively trained data collectors use qualitative data to assess subjects for a lifetime experience of human trafficking.

Conclusion: Study methodology transparency encourages investigative rigor and integrity and will allow other sites to reproduce and externally validate this study’s findings.

In 2000, the U.S. federal government defined human trafficking as the recruitment, harboring, transportation, provision, and/or obtaining of a person by the use of force, fraud, and/or coercion, for the purposes of labor and/or sexual exploitation.1 Defined as a crime, human trafficking fell under the purview of the

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[Corrections added on January 3, 2020 after first online publication: “acknowledgement” section added.]

Author contributions: MCS, ES, EFR, LDR—study concept/design; MCS, ES, CC, JPD, NA—acquisition of the data; MCS, DS, GYL, JJS, LDR—analysis planning; MCS—drafting of manuscript, acquisition of funding; and ES, EFR, CC, JPD, NA, DS, GYL, JJS, LDR—critical revision of the manuscript for important intellectual content.

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criminal justice system almost exclusively, but there are two problems with relying on law enforcement estimates of trafficking prevalence. First, only a percentage of all trafficking cases are identified by law enforcement officials. Second, people who have been sex trafficked are disproportionately more likely to be identified by law enforcement than those who have experienced labor trafficking, which creates a bias in available data. However, people who have been trafficked do seek health care (We do not use the words “victim” or “victimization” because these are law enforcement terms and imply a lack of agency that may not be relevant to all patients with a trafficking experience. In health care, our focus is on patients, not “victims.”), and so clinicians could be an important source of information about trafficking prevalence. As a result, in the past 10 years there has been a surge of interest among legislators and policymakers to improve the health care system’s response to this patient population. Increasingly states are mandating clinician education on the topic and requiring that health care institutions “identify,” treat, and refer patients with a trafficking experience. While both requirements are designed to better serve patients, it is premature to mandate screening because optimal ways of doing so have yet to be established.

In the health care setting, the term “identify,” rather than “recognize,” implies an active effort to discover an outcome of interest. The first comprehensive and validated tool for trafficking identification is the Vera Institute’s Trafficking Victim Identification Tool (TVIT); it is only validated for use in social service settings. It relies on subjective assessment of client responses and typically takes 45 minutes or longer to administer. The training required and time it takes to administer make it impractical for use as a screening tool in health care settings. If clinicians could comprehensively screen for labor and sex trafficking, patients who disclose a trafficking experience could be offered connection to expert assessment and, if appropriate, desired relevant social services. At present, only one validated trafficking screening tool exists for active trafficking identification in the health care setting: the Greenbaum Tool. This tool is designed to allow clinicians to screen English-speaking 13- to 17-year-olds, with specific clinical presentations, for sex trafficking (i.e., the tool does not screen for labor trafficking). Because so little is empirically known about which emergency department (ED) patients have a labor and/or sex trafficking experience, a brief, broadly applicable screening tool would be useful to ED clinicians. To address the significant gap in the field related to human trafficking screening tools, RAFT (Rapid Appraisal for Trafficking) is an ongoing, multisite study that aims to derive and validate a screening tool to allow the opportunity for identification of ED patients with a lifetime experience of labor and/or sex trafficking.

**OBJECTIVE**

Below, we provide an in-depth explanation of RAFT design and procedures, describe how to develop a rigorously derived and validated screening tool for use in the general ED population, and share a novel method of randomization of ED patient-participants, to provide a framework for others to replicate and externally validate RAFT.

**METHODS**

This study randomly approaches clinically stable adult (≥18 years) ED patients for enrollment. Eligible participants are required to present alone or have visitors who are willing to step away during the consent process and interview. Language is not an eligibility criterion; data collectors use a certified interpreter when needed. Since June 2016, data collectors pose five dichotomous candidate RAFT questions to all participants. They then administer the (previously validated) Vera Institute’s TVIT, to determine if the participant has had a lifetime experience of human trafficking. The TVIT questions examine five domains of a person’s life experience: 1) Force, Fraud, Coercion; 2) Isolation; 3) Labor; 4) Harm; and 5) Sexual Exploitation. The candidate RAFT questions are the five TVIT questions, regardless of domain, that had the highest odds ratio of predicting a labor and/or sex trafficking experience. All participants, regardless of trafficking determination, are offered the opportunity to speak with a hospital social worker. No data are collected from social workers. Data collection occurs in shifts from 8:00 AM to 12:00 AM, depending upon the site, 7 days a week. Because patients wait in the ED for hours, patients presenting between 12:00 AM and 8:00 AM and not yet discharged or moved to another location within the hospital are also eligible to participate at the start of the 8:00 AM shift. Patients who arrive and leave the ED between 12:00 AM and 8:00 AM are not able to participate. Investigators are blinded to all
participants’ identities and no identifying information is collected. The Mount Sinai Health System and John Peter Smith Hospitals’ respective institutional review boards (IRBs) deemed the study exempt from IRB review.

**Study Setting and Population**

The National Human Trafficking Resource Center publishes data on states from which it receives calls.\(^{12}\) The centers recruiting for this study are in New York (Mount Sinai Hospital, Mount Sinai St. Luke’s, Mount Sinai West, Mount Sinai Beth Israel) and Texas (John Peter Smith Hospital). These hospitals are in high-frequency call areas and have robust research infrastructures, allowing for study protocol success. All sites are geographically situated within a strong resource referral network to afford patients with a trafficking experience the necessary supports.

People who are socioeconomically disadvantaged, people of color, and people who identify as belonging to sexual orientation and/or gender minority groups are disproportionally represented among those trafficked. However, there is no demographic group unaffected by trafficking.\(^ {13}\) Hence the study’s eligibility criteria are quite broad: all adult (≥18 years) ED patients who are medically and psychologically stable (as determined by the patient’s nurse), that is, not requiring emergent, life- or limb-saving intervention, are eligible for enrollment. Participants are randomly selected based on time of arrival to the ED, using an online randomization algorithm that generates a list of times (https://www.random.org/clock-times/). This simple, systematic random sampling technique is appropriate due to the extremely diverse parameters of the trafficking population and reduces sample selection bias. Mimicking best clinical practice, certified, in-person, phone, or video interpretation is used when the participant does not speak English and the data collector is not fluent in the participant’s native language. Because Spanish is the most common non-English language in all settings of this study, the structured interview guide was translated into Spanish using a translate/back-translate/reconciliation process so that native Spanish-speaking data collectors do not need a certified interpreter.

There are no reliable trafficking prevalence or incidence data for the United States. Trafficking prevalence has been estimated in smaller populations. For example, among homeless young adults accessing social services, the prevalence of labor and sex trafficking is between 10 and 15%,\(^ {14-16}\) but the general ED population is unlikely to have such an elevated risk. To determine how to properly power this study, we accumulated data for about a year, when prevalence was 1.2% to 1.4%. We have planned for a precision of <0.10 and an instrument that will be at least 80% sensitive at trafficking recognition. Consequently, to ensure a sufficient number of cases within the sample, we will enroll at least 3,667 participants to ensure power (>0.80) to assess the primary aim of the study. Since the trafficking prevalence to be expected is unknown, data will be collected until the study is appropriately powered for the number of trafficking cases recognized. As such, there is no assigned n for each hospital site to collect.

**Study Protocol**

Each data collector (DC) was trained to administer and interpret the results of the TVIT by the principal investigator (PI; MCS), who has more than 14 years clinical experience recognizing patients who have experienced human trafficking; each DC had to demonstrate proficiency in identifying trafficking (with no missed trafficking cases during training) prior to beginning independent recruitment. All DCs were also trained on a standardized protocol for participant recruitment in the ED. The electronic medical record is used to find patients whose arrival time is closest to the randomly preselected times. The DC then consults with patients’ assigned nurses to confirm clinical

![Figure 1 RAFT study protocol.](https://www.aemj.org)
stability and decision-making capacity (see Figure 1). Patients in critical care areas are ineligible for participation. Only with approval from the patient’s nurse does the DC approach the patient; that is to say, the nurse determines if the patient is clinically stable and has capacity to consent to participate in research. If the patient is not alone, the DC invites visitors to step away (out of hearing and viewing distance) before the invitation to participate is extended to the patient. If the visitor declines to leave, the patient declines the visitor’s absence, or the visitor is a minor who would otherwise be unaccompanied, that patient is not eligible for participation.

The DC then explains the study purpose and duration (30–60 minutes) to determine potential participant interest. With IRB exemption, written consent was waived by the Mount Sinai Health System and John Peter Smith Hospital IRBs to protect the identity of the participants. No identifying information is collected for analysis about any potential or actual participants. Each consenting participant is asked the candidate RAFT questions; the full TVIT is then administered to determine trafficking experience. Only the validated TVIT is used to determine the participant’s history of trafficking. The DC enters data directly into REDCap (Research Electronic Data Capture), a secure online software for data collection, via computer tablets. DCs were trained on collection using paper materials as well, in the event that REDCap or the data collection tablets are nonfunctional.

Every time a DC identifies a participant with a trafficking experience or is unsure of how to score the results of the TVIT, the collector calls the team’s on-call trafficking expert, PI (MCS) or co-investigator (ES) to discuss the interview data. If the DC is unable to reach MCS and ES, they leave voicemails, score the case as positive, and send a secure e-mail to MCS and ES with a request to discuss the case as soon as possible. At John Peter Smith Hospital, the site leaders (JPD and NA) are also notified. All site leaders debrief with DCs on positive trafficking determinations and on cases of participants recounting experiences of psychosocial trauma. Regardless of how a DC scores an interview, all participants are offered the opportunity to speak with a social worker. If participants accept the offer to speak with a social worker, the DC alerts the participant’s ED attending physician, who arranges the consultation. Attendings are the DC’s point of contact on this to ensure that patients are not discharged prior to having their request for social work respected. ED attendings were made aware of the study at its outset and are reminded regularly to facilitate their support of the investigation.

**Clinical Preparedness.** Emergency department social workers at all sites were trained on labor and sex trafficking definitions and clinical red flags and local resources for affected patients. In New York, those trainings were performed by authors MCS and ES. In Texas, the social workers were trained by local antitrafficking organizations that first met with the PI to ensure understanding of the study goals and protocol and consistency of ethical principles. Local antitrafficking resources were contacted to determine 1) if they were willing to be listed as a resource for ED patients identified as having a trafficking experience, 2) the populations they serve, and 3) the best way(s) to contact them. Site-specific resource sheets were designed based on this information, given to the social work departments, and placed in the electronic medical record system so that any clinician could access them. ED clinicians and nursing staff were made aware of the study by the study investigators (MCS, ES, JPD, and NA).

**Data Collector Training.** Training of the DCs was extensive. Of 72 candidate data collectors (CDCs), only 36 successfully completed the training and were cleared to recruit for this study (all DCs are listed in the acknowledgments section). Training consisted of:

1. CDCs attended an 8-hour intensive, in-person training on human trafficking and how to use the TVIT to determine lifetime trafficking experiences. The day-long intensive training consisted of a 1-hour didactic, group work, and 4 hours of role-play using the TVIT and cases developed from the PI’s professional experience or that of colleagues.
2. Within 5 days of the 8-hour training, CDCs had to successfully complete a case-based online assessment. Based on information (all positive cases were adapted from real trafficking cases), learners had to determine if each case represented trafficking or not and explain their rationale, based on the Trafficking Victims Protection Act’s definition of trafficking. Any missed cases of trafficking or incorrect reasoning resulted in having to successfully complete another online assessment (again based on real trafficking cases). Before completing
the second online assessment, learners received instructional feedback on their first assessment and the opportunity to ask clarifying questions. Failure to successfully complete (perfect trafficking recognition) the second assessment meant the CDC was ineligible to serve as a DC for this study.

3. Within 2 to 4 weeks of successful online assessment completion, CDCs had to successfully complete shadowing and back-shadowing experiences. First, CDCs shadowed a RAFT-experienced DC (minimum data collection for 6 months, ideally a year). During the shadow experience, the CDC had to observe the DC use the online generator to produce the random clock times, arrange an eligible patient list, approach patients’ nurses to seek clinical stability clearance, consent potential participants, and administer at least two interviews using the data collection tablet. During the back-shadow experience, the CDC completed the same actions, while being shadowed by an experienced DC. The observing DC discussed observations with the PI, and based on performance during the back-shadow session (and prior training), the CDC was invited to perform another back-shadow experience, commence independent data collection, or work on another study at the institution. If after completing a second back-shadow experience the CDC was unsuccessful (e.g., poor attention to protocol detail, persistent poor data collection skills), the CDC was not invited to collect data for RAFT development.

4. To ensure consistent content and skill training, the CDC training and approval process was led by the study PI (MCS). At the beginning of data collection at Mount Sinai Hospital (which served as the shadow–back-shadow site for all the other Mount Sinai locations) and John Peter Smith Hospital, the shadow–back-shadow experiences were led by the PI and the sites’ project managers (CC and NA, respectively). At Mount Sinai Hospital, the first two CDCs completed steps 1 and 2 of the data collector training. These original two CDCs generated the random time selector with the PI observing; the project manager (CC) observed them generating the eligible patient list and observed them interacting with nurses, potential/participants, and attendings in the ED. The CDCs reported, in person, to the PI after each participant enrollment and received feedback in real time for two consecutive 4-hour shifts. In this way, the PI remained blind to any identifying information about study participants. At John Peter Smith Hospital, the project manager (NA) and the site PI (JPD) visited New York to observe an experienced DC (1.5 years of data collection with RAFT) during an 8-hour shift. The PI (MCS) went to Texas to train John Peter Smith Hospital’s CDCs; JPD and NA were present for the 8-hour training. NA performed the shadow–back-shadowing of the first two CDCs at John Peter Smith Hospital. Six months later, another 8-hour training took place for new CDCs. The first two John Peter Smith Hospital DCs and NA performed the shadow–back-shadowing sessions for these CDCs.

5. Every 6 months, a mandatory 1-hour refresher is conducted for all the DCs. The purpose of the data refresher is to maintain high-quality data acquisition and consistency of technique and data across DCs. The definition of trafficking and the protocol are reviewed; common questions or “unsure” cases from the previous 6 months are collectively reviewed, and any DCs’ content or study protocol–related questions are answered.

**Data Quality.** Because investigators cannot conduct the interviews themselves, the DCs need to be highly skilled at collecting sensitive data and capable of interpreting the data acquired. The comparison instrument, the TVIT, does not have a cutoff score at which a trafficking determination is made. With the TVIT, as with many social maladies and all trafficking assessments, the interviewer must interpret the data to determine if the narrator has experienced trafficking. For social malady assessments this is always the case. For example, concerns for child maltreatment and elder abuse require expert investigation and data interpretation. Steps 1 to 3 (see “Data Collector Training”) were crucial in the team determining whether a CDC had the capacity to respectfully gather sensitive information and interpret it correctly. The study protocol requires that the DCs contact MCS or ES if the DCs determine they have a positive case or are unsure of how to label a case (as trafficked or not). This means that a limitation of this protocol is that if a DC assessment results in a false negative (i.e., fails to recognize a trafficking-experienced person as such), a trafficking case is missed. This would not impact the participant, as all participants are offered the opportunity to speak with a social worker.

During the course of the TVIT administration, because sensitive questions are asked, participants
often share traumatic life experiences (e.g., physical and sexual assaults, labor exploitation, and emotional abuse). These other types of trauma, while not trafficking, result in the DC calling MCS and ES to discuss and debrief about the case. Given patient-participant willingness to disclose these traumas, it appears that the questions were acceptable and participants answered truthfully. The way the TVIT, as an assessment, is structured, no isolated question would result in a clear identification of a trafficking experience. The word “trafficking” is never mentioned in the interview questions; no participant is directly asked about being trafficked. The interviewer must synthesize the data provided to make a trafficking determination. Because of the prevalence of trauma disclosed, the team embarked on a secondary, framework analysis of the qualitative data, to examine experiences of trauma shared by ED patients who participate in RAFT. In formal qualitative analysis of more than 1,300 cases, using the mandatory free-text input by the DCs, no additional cases were found to be trafficking cases. Hence, we believe it is extremely unlikely that the DCs have missed any trafficking cases based on the data gathered from participants.

**Data Analysis**

**Selection of Items: Construction Identification.** The TVIT was designed to assess five construct domains validated in initial exploratory factor analyses and follow-up qualitative adjustments. The five construct domains were operationalized with different numbers of items assessing employment and sexual exploitation: 1) Force, Fraud, Coercion (eight items); 2) Isolation (three items); 3) Labor (four items); 4) Harm (four items); and 5) Sexual Exploitation (four items). From this pool of items, we plan to identify and validate a set of items to reflect two higher-order constructs of labor and sexual exploitation for RAFT, with sufficient domain representation to provide brief, reliable, and valid screening and identification of candidates for intervention.

**Psychometric Methods: Item Response Theory.** To identify reliable and valid Labor and Sexual Exploitation screening measures as described above, we plan to use innovations in Testlet Response Theory (TRT) and item response models (IRM). These hierarchical models can evaluate: 1) the effectiveness of items in measuring each of the five individual domains (i.e., testlets) and 2) the effectiveness of items in measuring an overarching shared primary construct underlying Labor or Sexual Exploitation experiences. While accounting for associations within individual testlets, models provide quantification of each item’s ability to distinguish levels of exploitation (discrimination parameter) and the levels of exploitation associated with each item endorsement (threshold parameters). Prior to fitting IRM, full information maximum likelihood confirmatory factor analysis will evaluate fit of unidimensional, multidimensional, and proposed hierarchical bifactor models, which add organization to the five originally assigned scales’ items within two higher-order Labor and Sexual Exploitation constructs. Final item selection for RAFT will proceed by favoring TVIT items with the strongest relationships with exploitation experiences and content targeting levels of exploitation associated with positive assessment allocations. Item-information functions will summarize item performance across a full range of exploitation experiences. Additive properties of item-information functions allow generation of test-information functions that then enable an understanding of both 1) how much information a given set of items provides and 2) at what level of exploitation experiences sets of items provide the most reliable assessments. This process will be designed to select sets of items to increase reliability of instruments (i.e., maximize information functions) within regions where positive assessment allocations are made on each targeted construct. We will target reliability > 0.80 within the range of observed scores to maximize sensitivity to the presence of sufficient exploitation experiences to declare a positive assessment. We will also compute scale-level reliability estimates including internal consistency (coefficient alpha) and composite reliability that takes into account the hierarchical organization of items within testlets (coefficient omega). Test-information functions from reduced RAFT scales will be compared to full sets of TVIT scales to quantify the relative measurement effectiveness (i.e., total information) of RAFT. This approach favors sensitivity of trafficking identification over quantification of a full range of exploitation experiences.

The refined set of items will comprise the RAFT screening instrument; the team will demonstrate the items’ construct validity, describe each items’ relative effectiveness using item response models, and then estimate criterion validity using the current standard scoring by trained interviewer agreement. We expect a
significant association between RAFT and final decisions made with the full TVIT. When the final components of RAFT are available, we will describe the lack of independently assessed criterion of trafficking experiences as a limitation.

**Criterion Validation.** We will validate the scores on the Labor and Sexual Exploitation scales from RAFT using logistic regression models adjusted for planned covariates, using results of the full TVIT higher-order constructs as the criterion. Diagnostic efficiency indices, including sensitivity, specificity, and classification accuracy of item and scale combinations, will be examined.

**Ineligible Patients.** Emergency department patients not eligible for participation in the study may be at higher risk for having a trafficking experience (e.g., patients with visitors who refuse to leave, or patients that are seen and leave the ED between 12:00 AM and 8:00 AM). There are no data available for such patients. For patients that are deemed medically and psychologically able to participate in research but who decline to participate, DCs are collecting demographic and chief complaint data only. This patient population can only be described and is not included in data analysis for RAFT derivation and validation.

**External Validation.** Because trafficking-type ratio may differ according to geography and this could impact RAFT composition, RAFT will be derived based upon data collected at the hospital sites in New York. After construct identification, psychometric analysis, and criterion validation, the TVIT questions that will compose the final version of RAFT will be determined. The relationship between the set of retained RAFT questions validated at the New York hospital sites and the full TVIT criterion will be validated independently using the data from the John Peter Smith Hospital site in Texas. The final RAFT questions’ performance will be assessed by discrimination. Discrimination reflects the ability of the tool (RAFT) to distinguish between those who did and did not meet trafficking criteria, based upon the DCs’ determinations. Discrimination will be appraised using the C-statistic.  

It may be that RAFT is appropriate for screening of labor and/or sex trafficking experiences among specific adult ED populations. Throughout the validation of RAFT, we will examine the potential influence of age, gender, race, ethnicity, language of interview, and chief complaint as potential moderators of relationships between RAFT and criterion or external validation measures in regression models.

**CONCLUSIONS**

To achieve the required sample size, RAFT derivation and validation require data collection over a period of at least 3.5 years. A study of this type requires a great deal of time, effort, and resources, at institutions with a strong commitment to the research and a multidisciplinary clinical/social support infrastructure. Health care institutions and practitioners implementing trafficking screening should understand how the trafficking screening tools used were developed to determine if the tools are appropriate for clinical use in their setting. Legislation and policies requiring clinicians to identify trafficked persons are premature as no valid comprehensive identification tools exist. Moreover, legislation and policies that use the word “testing” in conjunction with “human trafficking” are setting up an unreasonable expectation that clinicians will be able to make a definitive conclusion about patients’ experiences with trafficking. This is misleading, as there is no “test” for trafficking. However, RAFT will be a rigorously derived and validated tool and may allow patients the chance to disclose a trafficking experience. At present, RAFT is not intended to focus on one gender or one form of trafficking; it aims to allow EDs to comprehensively, systematically screen for trafficking and offer clinically stable adult patients with a positive screen referral for expert assessment, services, and support. Future research about RAFT will include implementation science testing, including usability and acceptability (by patients and clinicians).

The authors describe RAFT methods so that other EDs can externally validate the tool in their settings, if necessary based on patient demographics or local trafficking ratios and prevalence; so that other specialties can determine if RAFT is appropriate in their populations; and to elucidate what is involved in the responsible development of a social malady screening tool for use among patients. In the ED we have a high standard for the care of patients with myocardial infarction, gastrointestinal hemorrhage, and so on. “Evidence-based medicine” is the catch phrase of our time, but instead, policy and legislation are driving clinician action in the realm of trafficking. Patients with a trafficking experience are among our most
vulnerable patients. As with other patients at high risk for harm, patients with a trafficking experience deserve high-quality care that is evidence-based. A rigorously developed RAFT, with transparent, reproducible methodology, is a step toward evidence-based patient care for those with a trafficking experience.

References

A Survey of the Public’s Ability to Recognize and Willingness to Intervene in Out-of-hospital Cardiac Arrest and Opioid Overdose

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Out-of-hospital cardiac arrest (OHCA) and opioid overdose (OD) are two emergencies where prompt recognition and response—typically by untrained bystanders—are critical to ensure positive outcomes. The median incidence of emergency medical services–treated OHCA across 10 urban centers in North America is 52 per 100,000,1 while the U.S. incidence of fatal OD is around 14 per 100,000.2 In both emergencies, bystanders are the first link in the chain of survival. In OHCA, bystander-initiated cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) application increases survival and functional neurologic outcomes in OHCA, and for every 1-minute delay, there is a 12% decrease in favorable neurologic outcomes.3 In OD, bystander-administered naloxone decreases mortality.4 Although public agencies have allocated significant resources providing educational courses for laypersons to conduct CPR, not all members of the public can even recognize OHCA,5-10 and it is likewise uncertain whether they could recognize or treat OD.

We conducted a multimodal in-person survey to describe the general public’s ability to recognize OHCA or OD, as well as investigate the knowledge of and willingness to administer appropriate treatments. We hypothesized that the majority of respondents would be able to recognize a person experiencing OHCA or OD. The Providence Health Care Research Ethics Board provided approval.

We selected 17 urban British Columbia locations in greater Vancouver (population 2.4 million), Victoria (390,000), Prince George (74,000), and Kelowna (132,000). We screened participants from outside public transportation stations, shopping malls, sports venues, community centers, and university campuses. Trained research assistants conducted 3-hour recruitment shifts at times of anticipated high pedestrian
traffic at these locations. Participants were required to be at least 18 years or older, proficient in English, and provide informed verbal consent. Assistants then administered a 36-item survey (Appendix S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1111/acem.13916/full) with two embedded videos (Videos S1 and S2).

We based our instrument on prior similar surveys regarding OHCA \(^5-10\) and extrapolated OD-based questions from these. We covered several domains, including respondent demographics, prior witness of an OHCA/OD, prior bystander training, knowledge of appropriate actions (including chest compressions, use of AED, and administration of naloxone), and willingness to provide these. Since laypersons are typically trained in resuscitation via multihour classroom instruction, we inquired whether participants would be willing to view short videos while waiting in line at kiosks at banks, airports, or community centers or when renewing their driver’s license, as a low-barrier alternative. The survey was expected to take approximately 20 minutes and participants were compensated $5 (Canadian) for their time.

To ascertain whether laypersons could recognize OHCA or OD, we used publicly available videos created by public service agencies. We showed footage demonstrating a person experiencing OHCA (Heart and Stroke Foundation of Canada [Video S1]) and a person experiencing OD (British Columbia Centre for Disease Control “Toward the Heart” [Video S2]). We screened videos among five emergency physicians to ensure appropriate and recognizable content. Respondents were asked to choose the condition from a list of medical emergencies. We piloted the survey for content, clarity, and length among five volunteer emergency physicians across three iterations.

Coprimary outcomes were the correct identification of the video depiction of OHCA and OD. Other outcomes included knowledge of what treatments to apply in case of the videos, as well willingness to administer evidence-based treatments in response to hypothetical OHCA and OD scenarios and desire to undergo additional training. A priori, we felt that 196 respondents would provide a margin of error ±7% (95% CI) around a hypothetical 50% recognition rate. We used descriptive statistics including frequencies with counts and proportions and describe continuous variables as means with standard deviations if normally distributed or medians with interquartile ranges if otherwise (STATA 11).

Between March 1, 2018, and December 22, 2018, we approached 980 people, of whom 582 (59.4%) endorsed a lack of time or desire to participate and 164 (16.7%) did not speak sufficient English, leaving 234 for enrollment (23.9%). Respondents were 48% female, the median (IQR) age was 38 (28–49) years, and 62% reported at least some university education (Table 1). Almost one-quarter reported having witnessed an OHCA (23%) or OD (24%), and one-third (34%) reported using opioids or knowing someone who did.

For OHCA, 26 respondents (11%, 95% CI = 7% to 15%) correctly identified this from the video clip, and 54 (23.1%) would perform chest compressions (selected from a list of options). If presented with a hypothetical scenario where a patient had OHCA, 62% were willing to perform CPR, 76% were willing to perform dispatch assisted CPR, and 47% were comfortable using an AED.

For OD, 89 respondents (38%, 95% CI = 32% to 43%) correctly identified this from the video, while 93 would administer naloxone and 33 would provide assisted ventilations. Over half (53%) were aware of naloxone kits; if provided with a hypothetical OD scenario, 16% would be willing to administer naloxone.

For further training, almost all respondents (89%) were willing to watch a 1-minute video on how to perform CPR while waiting at a kiosk. For the 197 respondents who had not received naloxone training, 54% were receptive to receiving a full naloxone training course (Table 1).

This in-person survey of British Columbia residents in a variety of urban locations found that few could correctly identify a patient having a cardiac arrest or OD from a short video clip, and few could provide the appropriate lifesaving therapy. However, when presented with hypothetical scenarios, two-thirds were willing to provide CPR, and one-sixth were willing to administer naloxone in OD. Importantly, this mismatch between recognition and willingness to assist demonstrates an urgent need for focused educational interventions to assist with recognition.

Our findings are similar to those of prior work. Breckwoldt et al.\(^5\) interviewed German bystanders who attended an OHCA, and nearly half did not appear to appreciate that a cardiac arrest had taken place. Likewise, a survey of Lebanese youth demonstrated that
most could not identify signs of cardiac arrest. However, bystanders are willing to provide medical assistance in OHCA, and questionnaires in the United States and Japan have confirmed this. Gonzalez et al. surveyed laypersons at two Philadelphia train stations and found that 66% could identify an AED while 58% were willing to use one in an emergency, results similar to those in a Viennese telephone survey.

There has been little investigation of community ability to recognize and willingness to assist in OD. Given that 47,000 Americans died from OD in 2017, this information is critical to public health and emergency educators. Our data indicate that less than half of respondents can even recognize OD, but some would be willing to administer naloxone, and most would be willing to undergo training. There is significant potential for improvement in both these statistics, and training laypersons in recognition and management of OD is likely a worthwhile investment.

Training is critical to bystander interventions, and numerous agencies have invested substantial resources in first aid and medical response public education courses over the past few decades. Unfortunately, our results demonstrate that most laypersons cannot even

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### Table 1
Demographics and Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Respondents (n = 234)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
</tr>
<tr>
<td>Age (years), median (IQR)</td>
<td>38 (29–48)</td>
</tr>
<tr>
<td>Female</td>
<td>112 (47.9)</td>
</tr>
<tr>
<td><strong>Highest level of education</strong></td>
<td></td>
</tr>
<tr>
<td>Did not finish high school</td>
<td>20 (8.5)</td>
</tr>
<tr>
<td>Completed at least high school</td>
<td>53 (22.6)</td>
</tr>
<tr>
<td>Completed at least technical diploma</td>
<td>60 (25.6)</td>
</tr>
<tr>
<td>Completed at least bachelor’s degree</td>
<td>60 (25.6)</td>
</tr>
<tr>
<td>Completed masters/PhD or equivalent</td>
<td>34 (14.5)</td>
</tr>
<tr>
<td>Declined to answer/missing data</td>
<td>7 (3.0)</td>
</tr>
<tr>
<td><strong>Self-reported income (CAD)</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;25,000</td>
<td>65 (27.7)</td>
</tr>
<tr>
<td>25,000–49,999</td>
<td>38 (16.2)</td>
</tr>
<tr>
<td>50,000–99,999</td>
<td>62 (26.5)</td>
</tr>
<tr>
<td>100,000–149,999</td>
<td>32 (13.7)</td>
</tr>
<tr>
<td>&gt;150,000</td>
<td>30 (12.8)</td>
</tr>
<tr>
<td>Declined to answer/missing data</td>
<td>7 (3.0)</td>
</tr>
<tr>
<td><strong>Cardiac arrest: experience and recognition</strong></td>
<td></td>
</tr>
<tr>
<td>Current training in chest compressions</td>
<td>59 (25.2)</td>
</tr>
<tr>
<td>Expired training in chest compressions</td>
<td>51 (21.8)</td>
</tr>
<tr>
<td>Personally witnessed cardiac arrest</td>
<td>54 (23.1)</td>
</tr>
<tr>
<td>Recognized video of cardiac arrest from list of options</td>
<td>26 (11.1)</td>
</tr>
<tr>
<td>Correctly described “cardiac arrest” as “heart stopped beating” from list of options</td>
<td>50 (21.4)</td>
</tr>
<tr>
<td><strong>Cardiac arrest: treatment</strong></td>
<td></td>
</tr>
<tr>
<td>Would perform chest compressions if presented with the scenario in the video</td>
<td>54 (23.0)</td>
</tr>
<tr>
<td>If presented with a hypothetical OHCA, would be willing to perform chest compressions</td>
<td>145 (62.0)</td>
</tr>
<tr>
<td>If presented with a hypothetical OHCA, would be willing to perform dispatch-assisted compressions</td>
<td>179 (76.5)</td>
</tr>
<tr>
<td>Aware of the existence of AEDs</td>
<td>186 (79.5)</td>
</tr>
<tr>
<td>Correctly identified appropriate level of training required to operate an AED</td>
<td>73 (31.2)</td>
</tr>
<tr>
<td>Aware of location of nearest AED</td>
<td>35 (15.0)</td>
</tr>
<tr>
<td>Unaware of location of nearest AED but able to quickly determine</td>
<td>70 (29.9)</td>
</tr>
<tr>
<td>Aware of apps such as PulsePoint</td>
<td>24 (10.3)</td>
</tr>
<tr>
<td>Comfortable using AED</td>
<td>110 (47.0)</td>
</tr>
<tr>
<td><strong>OD: experience and recognition</strong></td>
<td></td>
</tr>
<tr>
<td>Current training in naloxone use</td>
<td>38 (16.2)</td>
</tr>
<tr>
<td>Taking opioids or knows someone taking opioids</td>
<td>79 (33.8)</td>
</tr>
<tr>
<td>Personally witnessed OD</td>
<td>57 (24.4)</td>
</tr>
<tr>
<td>Recognize video of OD from list of options</td>
<td>89 (38.0)</td>
</tr>
</tbody>
</table>

(Continued)
recognize OHCA or OD: if the emergency cannot be recognized, even the most rigorous training will be of little assistance. Therefore, we advocate that current first aid training programs provide ample and diverse opportunities for recognition of OHCA and OD in addition to teaching appropriate bystander treatments. Since the cost and time of many first aid courses may be a barrier to laypersons, it is worth assessing whether current educational opportunities are maximized. Planners may consider from our results that people seem willing to engage in low-barrier training in public spaces, such as video kiosks while people wait in line, or at sporting or community events. Such relatively low-cost methods have the potential to reach large numbers of people quickly and at multiple times. These may be a viable avenue to address public knowledge and recognition deficits in order to align the skills and desire of the public to help those with medical emergencies.

We note some limitations. We surveyed the public in numerous urban locations in a single province with the majority of respondents declining. A shorter survey, or one conducted via telephone or online or better-compensated, might have achieved a higher response rate. Our participants were younger with higher levels of postsecondary education and income, and some subgroups may be more able to recognize OHCA or provide assistance,\(^{10}\) social desirability bias may have influenced respondents. Our recognition rate was lower than anticipated, potentially affecting power of the survey. Our choice of videos —although they were developed and are used by public agencies—may have influenced the recognition rate; other videos may have led to different results. Naloxone can also be administered intranasally and public acceptance rates may be higher using this route. This is a snapshot taken over a few months during an opioid epidemic that has been heavily featured in the media and cannot measure changes over time.

REFERENCES


Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1111/acem.13916/full
Appendix S1. Questionnaire.
Video S1. Heart stroke
Video S2. Toward the heart.
The confirmed and suspected cases of the 2019 novel coronavirus disease (COVID-19) have increased not only in Wuhan, Hubei Province, but also China and the world. Enormous demand for handling the COVID-19 outbreak challenged both the health care personnel and the medical supply system. In West China Hospital, emergency department (ED) undertook the mission of clinical reception, primary diagnosis, and interim treatment for the suspected cases of COVID-19.

The pathogen of COVID-19, severe acute respiratory syndrome coronavirus 2, was confirmed to have human-to-human transmission. Therefore, COVID-19 has expanded the infection risk from Wuhan to cities throughout China and even the world via case transportation. Providing qualified personal protection equipment (PPE) to health care personnel plays an essential role in avoiding occupational exposure and infection. U.S. Centers for Disease Control and Prevention for COVID-19 infection control of health care personnel recommended gloves, gowns, respiratory protection, and eye protection as standardized PPE. However, protective clothing, N95 respirators, and goggles are not commonly used in clinical practice and hence are not in bulk stock. This brief report aims to present our interim hospital management measures on the health care personnel protection in West China Hospital under the condition of intense workload and PPE supply shortage after the outbreak of COVID-19.

We retrospectively reviewed the daily ED visits and PPE supply records from January 13 to February 1, 2020. The fever visits at the ED soared from January 20 to January 25. The ratio of fever patients at the ED exploded to a peak of over 40% on January 25 and then fluctuated at about 30% (Figure 1A). Protective clothing, N95 respirators, and goggles could only ensure the daily supply for <15% ED personnel (Figure 1B). However, West China Hospital adopted a series of measures to achieve “zero infection” among health care personnel.

- First, the online clinic was set to facilitate the patient triage (Figure 1C). Through free online consultation, the hospital preliminarily judged the treatment urgency, recommended nonemergency patients to delay hospital appointments or visit other nonantiepidemic hospitals, provided low-

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YC, QL, and JC contributed equally to this work.

The authors have no relevant financial information or potential conflicts to disclose.

Authors’ contributions: YC—conception, literature search, figures, data analysis, data interpretation, writing, and final approval; QL—conception, data collection, data analysis, data interpretation, and final approval; JC—conception, data collection, data analysis, data interpretation, and final approval; XG—writing, major revision, and final approval; CM—major revision and final approval; HY—major revision and final approval; ZC—conception, data interpretation, writing, and final approval; LL—supervision, major revision, and final approval.

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suspected patients treatment instruction when self-isolating at home, and invited high-suspected patients to the Fever Clinic via the green channel. The online clinic effectively alleviated the ED workload and facilitated early detection of potential cases.

- Second, the interim visit triage and ED region separation were established (Figure 1D). The assigned personnel conducted preexamination and triage to divide visits into low-suspected, high-suspected, and other patients and required different patients to follow the specified routines to enter ED and separate the intra-ED space into high-risk and low-risk regions. For suspected cases, the hospital assigned an independent fever clinic room, fever observation room, and CT examination room. Cases confirmed through qRT-PCR and/or CT were transferred to quarantine ward while excluded patients went to other departments or back home. The ED region separation triage system reduced the cross-infection by restricting the activity ranges of both patients and ED personnel.

- Third, the ED requirement had the highest priority. The hospital established a capable command system, implemented effective coordination mechanisms, provided the ED with PPE and medical devices preferentially, equipped the triage and high-risk-region personnel with standardized personal protection, withdrew or postponed nonurgent appointments and operations, and dispatched aid personnel from other departments to ED. These measures concentrated the limited supply through the hospital on the staff who mostly needed protection.

Emergency- and disaster-preparedness was an important issue and a global problem. Most hospitals could not maintain their routine work for a week due to the disaster-related resource shortage. A previous review highlighted the challenge of the emergency ordering of standardized PPE supply. The hospital invested greater efforts to establish an emergency management system based on the anticipated hazard. However, the unpredictable epidemic rendered the interim PPE preparedness impossible, especially for less-used PPE, protective clothing, and N95 respirators in daily work. It might be more practical to prepare a flexible hospital contingency plan than abundant PPE preparedness.

Our hospital adopted interim measures, including online consultation, region separation, and epidemic priority, to alleviate the pressure in the clinical work, reduce the cross-infection, and strengthen the protection...
of high-risk staff. Our hospital held the “zero infection” record, which was far lower than the simultaneous outside-Hubei mean level of 3.4% in late January. The zero infection indicated the flexibility and validity of our interim hospital management strategy.

However, there were still some limitations. First, the supply protocol compromised the health protection of low-risk personnel without standardized PPE. Second, the interim management strategies could not resist large-scale outbreak and long-term PPE shortage. Nevertheless, our management strategies, as a temporary emergency plan, created the biggest benefits of extremely limited resources to meet the emergency need. The long-term solution should be a sustainable supply chain. Fortunately, the government of China recovered the PPE production supply in February, which alleviated the supply shortage significantly.

In conclusion, the hospital emergency management plan of West China Hospital could alleviate the ED workload, protect health care personnel, and control the cross-infection during the COVID-19 epidemic. We advocate that every hospital should create the contingency plan suited to their conditions.

We acknowledge the colleagues at Emergency Department of West China Hospital and also all the colleagues combating COVID-19.

References

Emergency Management of the Prevention and Control of Novel Coronavirus Pneumonia in Specialized Branches of Hospital

Xiuqing Ma, MM, Shiyu Li, BD, Shaobin Yu, MM, Ying Ouyang, BD, Lin Zeng, BD, Xiao Li, BD, and Hai Li, BD

A related article appears on page 341.

In December 2019, an epidemic of novel coronavirus pneumonia (NCP) broke out in Wuhan, Hubei Province. The outbreak was severe and coincided with the Spring Festival travel season. On January 15, 2020, the West China Hospital of Sichuan University, a large hospital in China, held a seminar on prevention and control in accordance with the requirements of the National Health Commission on Prevention and Control. On January 16, the emergency plan for the prevention and treatment of NCP in West China Hospital of Sichuan University was formulated for the first time. The president of the university was named secretary of the “Respiratory Infectious Disease Prevention and Control Leading Group” and medical treatment expert group. Wenjiang District Hospital of West China Hospital, a branch of West China Hospital of Sichuan University, is located in Wenjiang district of Chengdu, 23 kilometers away from the main hospital district. It mainly focuses on specialties, such as rehabilitative medicine, lung cancer, and sports medicine. It does not have a separate emergency department and fever clinic but implements integrated and unified management with the main hospital area. In the face of such an unusual and unpredictable epidemic, how to ensure smooth government order, effective measures, and prevention and control to prevent outbreaks in the subdivision area of hospitals is a new test for specialized subdivision areas of hospitals. The following sections present the emergency management experience of Wenjiang Hospital in West China in the prevention and control of the NCP epidemic.

SET UP A LEADING GROUP FOR EPIDEMIC PREVENTION AND CONTROL

Faced with the severity of the Wuhan epidemic situation, all departments and personnel attach great importance to positive response, and taking effective epidemic prevention measures is particularly important. As a subhospital of West China Hospital, Wenjiang Hospital maintains the same level of care as the related article appears on page 341.
main hospital at all times. According to the actual situation and architectural characteristics of the hospital, prevention and control measures are rapidly deployed according to the local conditions to prepare for the outbreak before it arrives. According to the overall requirements of the hospital, under the organization and leadership of the director of the subdivision hospital, the NCP epidemic prevention and control working group of the branch was established. The head of the subdivision hospital serves as the group leader; the chief of the medical section, the infection control administrator, and the director of the outpatient department serve as the deputy group leaders; and the heads of the respiratory specialty, ICU, lung cancer center, laboratory, equipment department, logistics, security, radiation, color Doppler ultrasound, cleaning, and other related departments serve as team members. All members work together; closely monitor the development of the epidemic situation in the whole country, hospitals, and hospital areas; report the epidemic situation to relevant departments in an accurate and timely fashion; and organize regular meetings to discuss, formulate, and revise prevention and control plans and measures and are responsible for the full implementation of plans, resource organization, and coordination.

MAKE CONTINGENCY PLANS

According to the report, NCP is highly contagious, and most of the deaths are from heart, lung, and other chronic underlying diseases. Due to the Spring Festival, the number of patients in the hospital is <40, but they cannot be discharged because of the relatively serious basic diseases. Once outpatient clinics are opened, patients from all over the country will become vulnerable to nosocomial infection of NCP. In accordance with the technical guidelines for the prevention and control of NCP in medical institutions (first edition), suspected cases of fever must be isolated in place. To minimize cross-infection in the hospital caused by NCP. On January 17, 2020, the NCP epidemic prevention and control working group of Wenjiang District carefully studied the architectural features and space utilization of the district, formulated an emergency plan for the prevention and control of NCP in the affiliated district, and set up a preexamination and triage station and a tent observation area for patients with fever at the entrance of the hospital. The isolation observation room was rebuilt according to the relevant provisions of the “technical code for hospital isolation.” The objective is to isolate patients with fever or suspected cases for early detection and minimize cross-infection in the hospital. The NCP emergency plan regarding guidelines for prevention and control in subhospital areas will be regularly adjusted and improved according to the provisions and control requirements of the country and the hospital in different periods.

STRENGTHEN PERSONNEL EDUCATION AND TRAINING

The outbreak of the NCP in Wuhan has much to do with people’s early cognition of and attention to the epidemic and the lack of epidemic prevention knowledge; from organizations to individuals and from professionals to ordinary people, there is a lack of knowledge to different degrees. Therefore, it is particularly important to prevent and control the epidemic in subhospital areas and strengthen education and training for all kinds of personnel. Wenjiang Hospital in West China intends to strengthen the education and training of staff regarding knowledge, information and regulations related to epidemic prevention and control through WeChat, QQ, TV, video, and other media as well as through listening to important speeches and work arrangements online. For the patients and their family members, they should receive education and training on epidemic prevention knowledge and information about special management requirements of the hospital during the epidemic through small unit modes such as bedside or nursing groups as well as through television, posters, and admission propaganda and education communication. Through multiple approaches, employees, patients, and family members can pay more attention to and understand the epidemic situation; gain enhanced awareness of prevention and control; master the right protection skills; and reduce the chance of cross-infection.

ORGANIZE AND COORDINATE RESOURCES

For the prevention and control of any outbreak, personnel and material organization and preparation are necessary. As a noninfectious hospital, the hospital’s stock base of protective materials for outpatients without fever is limited. Wenjiang Hospital in West China immediately mobilized reserves for major epidemic
prevention and control. First, all the protective equipment in stock is sorted and listed. Supplies are mobilized and reserved based on the estimated safety stock and minimum basic requirements for the area of operations that may be involved in protection. The materials in each department are under special management according to the postclassification accounting, and quantitative distribution, zero inventory, real-time distribution at the initiative of the whole hospital, and saving are advocated. Important and scarce materials, such as goggles and medical isolation clothing, should be rationed reasonably according to the three-level protection guide by the infection control administrator, and the dynamic balance of protection materials should be regularly monitored to ensure necessary protection and avoid waste. Emergency rescue teams and volunteer service teams should be established to achieve the required manpower for prevention and control work.

**IMPLEMENT A THREE-LEVEL PREVENTION AND CONTROL MECHANISM**

To ensure the effective implementation of NCP prevention and control measures and to effectively and resolutely control the occurrence of NCP, a three-level prevention and control monitoring system was adopted in Wenjiang Hospital in West China. Primary prevention and control monitoring are set up at the gate of the hospital, secondary monitoring is set up at the only entrance of the building, and tertiary monitoring is set up at each reception point and ward in the building. At each gate, professional nurses and security personnel are responsible for strict temperature monitoring, personnel identification, source inquiries, and registration of the personnel coming in and going out. The key questions are whether people entering the hospital come from Wuhan or other key epidemic areas, key patients are interrogated and closely monitored, and suspected patients are observed in time for timely isolation and treatment. To further ensure the effective implementation of various measures, the subdivision hospital also adopted a three-level supervision mechanism. The first level is the director, who conducts site inspection once a week and carries out in-depth supervision of the effectiveness of epidemic prevention in hospital areas, understands the daily epidemic situation and work situation, and then provides timely guidance and coordination in case of difficulty or doubt. The second level is the supervision of the department of infection control. Each unit is inspected at least three times a week to check whether the protective measures of various departments and personnel are in place and effective. The third level is the daily routine inspection of monitoring and protection of each unit of the hospital by the head nurse. The head nurse supervises the key monitoring links in the first and second levels to ensure the effective implementation of the measures in each link. In addition, the hospital accepts the supervision and inspection of local health law enforcement departments, thus forming the joint prevention and control of multiple departments.

**ENVIRONMENT AND ACCESS MANAGEMENT**

The outbreak is fierce and insidious, spread mainly by droplets and contact\(^4\) and clearly can be transmitted from person to person.\(^5\) To completely cut off the source of infection, the country urgently took decisive measures to seal off cities in some areas, and various provinces and cities have issued a variety of bans and closed public places, such as tourism sites, restaurants, and cinemas.\(^6\) On February 18, 2020, the diagnosis and treatment program for new coronavirus pneumonia (trial version 6) made it clear that asymptomatic infected people could also become a source of infection, and there was a possibility of aerosol transmission under the condition of prolonged exposure and high concentration of aerosol in a relatively closed environment.\(^7\) Therefore, in accordance with relevant regulations, a series of more stringent control measures have been adopted. To avoid crowd gathering and reduce the close contact between people, the subdivision hospital and departments strictly implement the management of three channels. The patient channel is completely separated from the staff. Patients enter and exit the hospital following one way, and the staff enter and exit through another channel. Given that the main building of the hospital has only four floors, the elevators are divided into patient elevators and logistics elevators, and the employee elevator is no longer in use to encourage employees to use the stairs. All other channels are closed. Each channel has clear and eye-catching signs for guidance; additional security, nursing personnel, volunteers, and other specially assigned staff are assigned supervision and guidance roles; and crowds are dispersed 1 meter apart to avoid contamination and close contact. Moreover, hospital
fire inspection should be strengthened to ensure a special control period of fire safety. Canteen service is canceled, and delivery service is provided to enhance the cleanliness and disinfection of the hospital floor and surface of objects. According to regulations for strengthening the management of medical waste of NCP, special routes are planned to strengthen the disinfection of sewage, and the frequency of testing is increased from quarterly to monthly. The cleaning, disinfection, and operation modes of the air-conditioning ventilation system are in line with the requirements of the “cleaning and disinfection code for centralized air-conditioning and ventilation systems in public places” (WS/T 396-2012). The operation mode is changed to the fresh air mode, the return air system is closed, the fresh air volume is increased, and the windows are frequently opened for ventilation.

WARD AND BUSINESS MANAGEMENT

During the epidemic prevention and control period, access control management was strictly enforced in the ward. Each unit was separated by access control or a temporary fence, forming a relatively independent and safe area. The entrance and exit were carefully managed and guarded by professional nurses, and access was restricted. Every person entering the ward must verify his/her identity as an employee, patient or visitor, have his/her temperature monitored, and wear a mask, and the residence history of accompanying visitors was carefully checked. All personnel were required to refrain from unnecessary medical activities and prohibited from walking to other places. To reduce crowd gathering, the number of companions was limited to one per patient, and whether visitors were allowed to stay depended on the condition of the patient. Each patient admitted to the hospital was required to fill out the “outbreak-related investigation form” and signed the “informed consent form for accompanying management” and “epidemic commitment form.” The management of all staff in medical care, work, property, administration, etc., was strengthened; those who had an epidemiologic history, fever, or other discomfort were strictly isolated, and daily monitoring and reporting were performed. Ophthalmology, otolaryngology, physical examination, endoscopy, etc., were stopped. The number of outpatients and inpatients was reduced, and all departments were to be gradually opened to the public according to the epidemic situation. The admission and treatment of patients were carried out according to priority procedures, such as critical illness and restrictive surgery.

The outbreak of the NCP was so severe that it quickly broke out in Wuhan and spread across the country, making prevention and control extremely difficult. As of 12 PM on February 27, 2020, a total of 31 provinces (autonomous regions and municipalities directly under the central government) and the Xinjiang production and construction corps had reported 1,770 deaths and 78,824 confirmed cases. The state took national efforts to protect Wuhan, Hubei Province; many cities in Hubei Province were closed off; and more than 30,000 medical personnel were mobilized from all over Hubei Province to help. The situation is extremely serious. The specialized branch area of West China Hospital of Sichuan University, under the leadership of the local government, attaches great importance to the sub-hospital director to lead the whole team; achieve quick, sustained, and orderly response; achieve effective organization; achieve full mobilization of resources and epidemic prevention; play the role of gatekeeper; and protect the general staff and the patients’ lives. From January 25 to February 27 (during the epidemic prevention and control period), a total of 8,863 outpatient patients, 3,874 hemodialysis patients, 3,400 inpatients, 119 surgeries, and 10 fever patients were protected from NCP, and no NCP occurred in the hospital. The control of epidemic prevention in the subdivision area was effective. Of course, all epidemic prevention measures are not immutable and need to be revised and adjusted according to the development of the epidemic situation and gradually improved. The only constant is the high and close attention to the epidemic situation. Effective emergency plans should be formulated from the very beginning, and safety control measures should be taken decisively. Only in this way can the infection be controlled to the minimum.

The authors thank all the participants and the nursing team of West China Hospital of Sichuan University who helped to collect and organize the data.

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Wellness for the Future: Cultural and Systems-based Challenges and Solutions

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ABSTRACT

The goal of the 2019 Society for Academic Emergency Medicine Consensus Conference was to explore the current cultural and systemic issues in emergency medicine that impact the individual well-being of every emergency physician and to make recommendations for future study. Burnout is epidemic in emergency medicine. Physician wellness is required to enhance patient clinical outcomes as well as to ensure professional satisfaction and longevity. For conference preparation, a consensus steering committee was created, and a decision was made to use the groundbreaking model of the National Academy of Medicine’s “Factors Affecting Clinician Well-Being and Resilience” to further identify areas of needed study. On May 14, 2019, the Wellness Consensus Conference was attended by over 50 faculty physicians from across the United States. These attendees discussed key concepts and prior research presented by content experts. Groups of participants engaged in crowdsourcing techniques to consolidate ideas derived from those discussions. These consensus concepts were recorded and are presented within this article. A repetitive theme noted at the conference was the overwhelming effect of the system and organization factors on individual physician well-being. The concept of ongoing assessment of professional fulfillment over the life span of the emergency physician was felt to be crucial in guiding wellness and resilience interventions in a timely manner. Examining ways to enable physicians to flourish rather than experience burnout are strong future directions for study.

Research promoting clinician well-being and preventing burnout has shifted from analyzing personal wellness and resilience to addressing organization and system actions that directly impact clinical practice and the work environment.1–3 The absence of burnout does not equal physician personal and professional fulfillment, so it is important to closely examine joy in emergency medicine practice as well as burnout prevention.1 Participants at the 2019 Society for Academic Emergency Medicine (SAEM) Consensus Conference focused on well-being in clinical practice and the work environment by closely investigating the emergency medicine workforce in its entirety, rather than focusing on personal burnout or individual distress.4

Burnout is widespread in emergency medicine.2,5,6 Most emergency physicians experience burnout as a state of mental and sometimes physical fatigue due to work-related activities. More formally, burnout has been defined as a triad of emotional exhaustion, mental distance from one’s job or negative feelings toward one’s work, and reduced professional productivity or efficacy.7–10 According to a 2019 Medscape survey of more
than 15,000 physicians across 29 specialties, burnout rates vary from 28% to 54%, with a mean of 46%.11 Multiple studies have looked at the prevalence of burnout in both medical students and residents, and the incidence of burnout is high in these young doctors as well.7,12–14 One systematic review found that as many as 75% of residents met criteria for burnout15. Burnout may contribute to thoughts of self-harm and increased risk of suicide.11,16 Depression, substance abuse, burnout, and anxiety all have consequences for both physicians and patients.9,10 Decreased empathy, perceived and self-reported medical errors, intent to leave the profession, poor job satisfaction, decreased patient safety, and lack of professionalism have all been linked to burnout.9 Less focused medical care takes a toll on patients, and the costs of replacing a physician due to turnover are well-documented and ranging in the hundreds of thousands to the millions of dollars depending on location and specialty.12 Increase in burnout is also associated with increased intent to leave the practice of medicine. This further depletes health care availability to patients in an already shrinking pool of providers.4

Abundant background literature on individual physician burnout and resilience is available.2,8,13,14,17 In 2012, Shanafelt et al.15 published one of the landmark studies demonstrating that emergency physicians reported the highest rates of burnout when compared to other specialties in medicine.

The 2019 SAEM Consensus Conference convened to take advantage of a collective strength across multiple stakeholder institutions to enable physicians to discover the most vital directions for study into future solutions enabling physician well-being. The research community has comprehensively assessed interventions such as meditation, mindfulness, fatigue mitigation, and physical exercise as means toward promoting wellness. However, these types of interventions primarily target individuals and individual behaviors. In contrast, the unique stressors to emergency medicine lie outside the realm of the individual and fall squarely in the realm of systems. The Consensus Conference attendees made clear the need for research into systems solutions rather than individual skills.11,18,19

**MATERIALS AND METHODS**

**Study Design**

We recruited a steering committee of six wellness experts and sought opinions from other experts to organize a wellness consensus conference. Our goal was to identify critical issues needing further research to facilitate wellness in emergency physicians and increase joy in the practice of emergency medicine.1 Joy in work in medicine is an increasingly recognized concept of finding a sense of joy from making a positive difference in a patient’s life. Work continued with monthly conference calls during years 2017 to 2019 to refine and plan the wellness consensus conference scope and methods with 22 subcommittee chair calls, as well as physical meetings twice per year.

**Selection of Steering Committee Members**

Steering committee members were recruited based on active involvement in national efforts to improve wellness in emergency physicians. All were well-known leaders in the field, involved in wellness initiatives, and all answered affirmatively when asked to be involved in this process. These committee members served as content experts as well as recruiters for subcommittee members, using snowball sampling technique. All of the subcommittee members had established areas of expertise and interest in wellness and were sought out by the subcommittee chairs.

**Selection of Model**

On January 6, 2017, the National Academy of Medicine (NAM) hosted the first meeting of the Action Collaborative on Clinician Well-Being and Resilience and since then has continued to pursue means of improving clinician wellness and resilience. One year later the NAM Action Collaborative on Clinician Well-Being and Resilience posted an article by Brigham et al.20 that identified and categorized internal and external factors affecting physician well-being. This model (Figure 1) served as a conceptual framework for the overall process and conference proceedings, underscoring that external systemic factors impacted wellness to a far greater degree than internal individual factors.

**Process and Outcomes**

**First Phase (Literature Review).** Each steering committee member was designated a subcommittee chair, assembled two to five additional content experts in each factor topic, and led a review of the literature related to their assigned factor to identify top areas of wellness research to pursue for the consensus conference. The rules and regulations section was not selected as a separate category, as there was overlap of
these topics in the other categories, and some of the subject areas in this group were added to other subcommittees for review.

**Second Phase (Presentation Preparation).** Through conference calls, each subcommittee produced a PowerPoint presentation for the consensus conference detailing pertinent literature. These presentations provided a background of the current status of the literature for the conference attendees.

**Third Phase (Conference Preparation).** All subcommittee chairs presented their group’s overview of the literature for the conference twice to the steering committee. This was done to streamline the presentation, determine if any confusion existed, and remove overlap in review of topics.

**Conference Day.** The initial orientation presentation was given and then participants broke into three breakout sessions in the morning and three breakout sessions in the afternoon. Each breakout session opened with a brief review of the literature and then the floor was opened to discussion using established crowdsourcing techniques, such as Discovery and Action Dialogue (DAD) (http://www.liberatingstructures.com/10-discovery-action-dialogue/ and 25/10 http://www.liberatingstructures.com/12-2510-crowd-sourcing/). Crowdsourcing techniques are predefined methods used to systematically gather content, ideas, or solutions from a group encouraging creativity that promotes innovative solutions. All potential research questions generated during the breakout groups were assigned a final ranking of importance to the conference attendees. These ranked ideas were then presented in a summary session at the end of the day. Following this presentation, the conference attendees voted on what they perceived to be the most critical research areas. Results were tabulated and simple descriptive statistics were used to review results (Table 1).
RESULTS

Fifty-three participants attended the 2019 SAEM Wellness Consensus Conference as interested academic faculty from across the United States. Gender breakdown was 25 female and 28 male attendees. The individual groups identified at least 134 areas of concern and proposed future research questions. Ten potential research questions were derived by the Organizational Factors Subcommittee distilling topics down to professional satisfaction, organizational assessment tools, patient outcomes, and barriers to well-being. The research question gaining the most consensus throughout the entire conference was: Does improvement of physician well-being metrics have an impact on patient outcomes, satisfaction, errors, and quality of care? Proposed research focusing on professional satisfaction included self-evaluation after each shift and faculty bonus plans incentivizing wellness.

Obstacles to accessing institutional wellness initiatives and the association of positive or negative language with departmental health were identified as barriers to well-being necessitating further investigation. Committee participants agreed that two types of assessment tools should be developed: one to assess the ability of leaders to encourage well-being at an organizational level and the other to evaluate burnout and work stress that can be used in diverse practice settings.

The conference subcommittee examining possible research options for society and culture factors came to consensus on nine prospects that included social determinants of burnout, empathy, mental health considerations, and litigation. The most unique research question derived by this group was: Could a patient-centered outcome be added to the RVU system, so that physician assessment is not only financial? All agreed that social determinant topics should include a survey to assess violence, safety, and transparency;
determine how a sense of community impacts well-being; highlight the cumulative burden of social determinants of burnout; and describe the impact of social media on physician wellness. Possible future research on mental health emphasized “check-up” assessments for emergency physicians and examination of the “Flourishing Index” to reimagine health and wellness. This subcommittee also pondered the correlation between empathy and the emergency medicine environment. Finally, they proposed further investigation of the impact of litigation environment on emergency physician well-being.

Fifteen potential research questions were derived by the Learning and Practice Environment Factors Working Group with specific concentration on learners in the emergency department (ED), evolution of practice principles, and environmental modifications. Learner-related research included normalization of the concept of well-being, provision of meaningful feedback, standardization of a debriefing format, changing the hidden curriculum without being punitive, and decoding the process of difficult conversations. For evolution of practice principles, the group agreed that future focus be channeled to personalized communication between learners and teachers; expansion of interdisciplinary teams with integration of all members; creation of a nondiscoverable peer support group for lawsuits; and identification of gender-, age-, and race-specific factors that might increase well-being. Consensus was adopted on environmental modifications with specific attention on electronic health record (EHR) alerts to mitigate ED violence, effect of health care team roles on confrontational patients, strategy for patients who have been “fired” from outpatient clinics, and secure messaging to reduce interruptions. This group also proposed studying the impact of the work environment on lactating mothers and their sense of well-being.

The subgroup working on health care responsibilities research priorities agreed upon eight research questions that involved lifestyle options, shift responsibilities, and learners in the ED. Of most importance was a future research project which examined lifestyle and work options based on the stage of career and life. Additionally, the group agreed that researching facilities with the most burnout and pinpointing when burnout originates in residency were lifestyle questions that required answers. Shift-related research included ideal shift length, effect on patient safety by taking breaks, balancing shift responsibilities, and win–win consultant strategies. The final research question focused on the correlation of attending physician burnout on learner experience.

The subcommittee examining future research on skills and abilities came to consensus on 12 research questions that involved health information technology (HIT), workflow, and organizational skills. Optimal e-mail management for effective communication, the use of scribes, improved time management to reduce nonessential skills, and EHR coaches for improved proficiency were areas of research in HIT that this consensus group designated as essential research topics. Future investigation into workflow issues included quantifying the toll of inpatient boarding on physicians, determining optimal physician/patient ratios, assessing the impact of regular meetings with C-suite leaders, investigating the effect of a physician in triage, determining best practices for medical student and resident education in the ED, and illuminating the most common interruptions to workflow. The subcommittee agreed that potential research should determine which key organizational skills need to be taught to residents to decrease burnout.

Nine future research questions focusing on personal factors were derived by this subcommittee breakout group that determined joy in work, social media and communication, mentoring, and evaluations to be of highest priority. Questions centered on the impact of social media on support and mentorship, choice of informal mentoring networks, the effect of a diverse faculty on inclusion, and which communication styles improve well-being. The subcommittee agreed that the sense of joy while working should be further studied looking at the effect of gratitude, community involvement, sense of “calling,” and reflection of positive aspects of working in the ED. There was emphatic consensus that a Wellness 360 Degree evaluation tool be developed for physicians and C-suite leaders. Of all the research questions envisioned, the following 34 research questions, identified by group voting during the “Final Discussion – Pulling it all Together” session, garnered the most consensus (Table 2).

**DISCUSSION**

Top future research endeavors distilled from each of the six subcommittee breakout groups are summarized below.
### Table 2
Top-ranked Future Research Questions from SAEM Wellness Consensus Conference 2019

<table>
<thead>
<tr>
<th>Future Research Questions</th>
<th>Rank # out of Top 34 Research Questions (#/34)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational</strong></td>
<td></td>
</tr>
<tr>
<td>Does improvement of MD well-being metrics (to be developed) have an impact on patient outcomes, i.e., patient satisfaction, medical errors, quality of care?</td>
<td>1/34</td>
</tr>
<tr>
<td>What type of assessment tool which measures the ability of leaders to encourage well-being at an organizational level should be developed? (Look at Stanford Model)</td>
<td>5/34</td>
</tr>
<tr>
<td>Create and validate a brief burnout/work stress tool that is sensitive to the unique dynamic factors experienced in the ED.</td>
<td>6/34</td>
</tr>
<tr>
<td>What is the optimal work load for EP’s in relation to being well?</td>
<td>7/34</td>
</tr>
<tr>
<td>Does scheduling according to “chrono-type” (day person vs. night person) improve EM well-being? Should there be a national age cap for night shifts?</td>
<td>15/34</td>
</tr>
<tr>
<td><strong>Society and culture</strong></td>
<td></td>
</tr>
<tr>
<td>What is the impact of the litigation environment in the United States on emergency physician well-being?</td>
<td>9/34</td>
</tr>
<tr>
<td>Investigate a sense of community, specifically impact on wellness, groups, and connectedness. Have an emotional response team.</td>
<td>14/34</td>
</tr>
<tr>
<td>What is the correlation between empathy and the emergency medicine environment? Follow up with residents every 6 months with enthusiasm and empathy study.</td>
<td>19/34</td>
</tr>
<tr>
<td>Understand the impact of social media and social media education on physician wellness.</td>
<td>23/34</td>
</tr>
<tr>
<td>Reimagine health and study the Improved Flourishing Index with 0-, 6-, and 12-month questionnaires.</td>
<td>24/34</td>
</tr>
<tr>
<td>Develop mental health assessments and check-ups for emergency physicians.</td>
<td>25/34</td>
</tr>
<tr>
<td>Study the addition of patient-centered outcome to RVU system so that physician assessment is not only financially measured.</td>
<td>29/34</td>
</tr>
<tr>
<td><strong>Rules and regulations</strong></td>
<td></td>
</tr>
<tr>
<td>Do regular meetings with the C-suite improve the adoption of suggestions by the ED?</td>
<td>28/34</td>
</tr>
<tr>
<td><strong>Learning/practice environment</strong></td>
<td></td>
</tr>
<tr>
<td>Create a nondiscoverable peer-support group for lawsuits.</td>
<td>13/34</td>
</tr>
<tr>
<td>Can we identify additional gender-, race-, and age-specific risk factors that could be addressed to increase well-being?</td>
<td>16/34</td>
</tr>
<tr>
<td>Determine how to normalize the process of difficult discussions.</td>
<td>18/34</td>
</tr>
<tr>
<td>Explore effect of expansion of interdisciplinary teams on clinician well-being and patient outcomes.</td>
<td>21/34</td>
</tr>
<tr>
<td>What is the effect of an alert in the EMR for aggressive patients?</td>
<td>22/34</td>
</tr>
<tr>
<td>Can secure messaging reduce interruptions?</td>
<td>27/34</td>
</tr>
<tr>
<td>What is the plan for patients who get “fired” by their outpatient doctor and end up in the ED?</td>
<td>34/34</td>
</tr>
<tr>
<td><strong>Health care responsibilities</strong></td>
<td></td>
</tr>
<tr>
<td>How is patient safety affected by physicians taking breaks (or not)?</td>
<td>12/34</td>
</tr>
<tr>
<td>What is the correlation of physician burnout with the perception and experience of learners?</td>
<td>20/34</td>
</tr>
<tr>
<td>Create win–win consulting approaches</td>
<td>30/34</td>
</tr>
<tr>
<td><strong>Skills and abilities</strong></td>
<td></td>
</tr>
<tr>
<td>Develop a menu of work options/lifestyle options based on stage of life.</td>
<td>3/34</td>
</tr>
<tr>
<td>What are the most common interruptions and how can we decrease them?</td>
<td>8/34</td>
</tr>
<tr>
<td>Implement a workflow program for the entire ED team. What would be the impact on well-being if all clinical process changes were viewed by a panel of end-users (nonleadership MDs or nurses) for impact on well-being specifically prior to moving forward with implementation?</td>
<td>11/34</td>
</tr>
<tr>
<td>Quantify the toll of inpatient boarding on flow and emergency physician burnout.</td>
<td>17/34</td>
</tr>
<tr>
<td><strong>Personal factors</strong></td>
<td></td>
</tr>
<tr>
<td>Create a “Wellness 360” degree evaluation tool—What do we include?</td>
<td>2/34</td>
</tr>
<tr>
<td>Who do we choose for informal mentoring networks?</td>
<td>26/34</td>
</tr>
<tr>
<td>How do you retain a high sense of calling?</td>
<td>32/34</td>
</tr>
<tr>
<td>Does social media increase support and mentorship?</td>
<td>33/34</td>
</tr>
</tbody>
</table>

EMR = electronic medical record.
**Organizational Factors Future Research**

There is a lack of research examining systems-level change and broad-based interventions at a departmental or institutional level. No studies identify which interventions—at the broader systems level—are effective. The participants in the organizational factors group distilled the greatest deficits in knowledge down to six areas: organizational mission, leadership and staff engagement, assessments, support for health care team members, power dynamics, and workload and performance.

**Strategies for Workplace Well-being.** The group unanimously agreed with the Institute for Healthcare Improvement initiatives affecting wellness that recommend receiving input from everyone, especially those from the work unit level—nurses, advanced practice providers, technical and administrative staff, and physicians—who could accurately identify local issues deemed most important for well-being, but possibly different from what leaders think should be done. The consensus group that decided the best way to achieve this goal would be to analyze how departmental leadership actively listens to work unit level concerns and acts on the suggestions. The group further agreed that organizational leadership impacts the professional satisfaction and burnout of individual physicians, concurring with a Mayo Clinic study. Informed leaders decreased the likelihood of burnout and workers expressed satisfaction with their work and well-being when a leader who understood the value of well-being was in charge. The resulting recommendation of the consensus group included activating the research community to investigate the development of an assessment tool measuring the ability of leaders to encourage well-being at an organizational level. Discussion centered on what qualities might need to be assessed in leaders.

**Assessment Tool for Unique Factors in the ED.** A recent World Health Organization publication featured a report that the ICD-11 code for burnout is now classified as an occupational phenomenon and not a medical condition. This classification of burnout illuminates systemic factors as the etiology for the syndrome. Preconference research identified three tools classifying dimensions of physician well-being (Well-Being Index, Meyers-Briggs Inventory, and the Stanford Professional Fulfillment Index), which are national benchmarks for physicians. Consensus participants had differing opinions on which tool best captured the dimensions of physician well-being and concluded that a tool specifically oriented to emergency medicine burnout and work stress be developed that is sensitive to the unique dynamic factors experienced in the ED. The consensus was to focus future studies on the effects of governmental agencies, regulatory agencies, and insurance companies who set emergency medicine policies and procedures.

**Moral Injury.** Preconference preparation also illuminated the concept of moral injury, recently identified in the emergency medicine literature as internal suffering that results from doing something against one’s own conscience. An example of this is the current unsustainable C-suite–mandated process that includes caring for more patients during the same amount of time and in the same environment but with significant expense reductions to decrease the cost of care delivery. Essentially doing more with fewer resources causes moral injury, which when repeated thousands of times, lays the foundation for burnout. Many consensus conference participants were uninformed about moral injury and agreed that there is significant lack of information surrounding the impact of physician well-being metric improvement on patient outcomes, satisfaction, medical errors, quality of care, etc. They concurred that the first step forward should be to measure physician well-being outcomes, followed by an intervention and assessment.

**Scheduling With Balance in Mind.** The consensus group acknowledged that a large number of studies have shown excessive workload, home–work conflicts, loss of support for colleagues, deterioration of control, autonomy, and meaning are associated with burnout. Workflow and patient and health care team interactions have been altered by increased measurements of performance at work, the increasing complexity of medical care, implementation of EHRs, and profound practice environment inefficiencies. Consensus participants specifically called for future research identifying optimal workloads for emergency physicians and optimal scheduling practices according to “chrono-type” (day shift vs. night shift preference).

**Resilience Metrics.** Research has shown that physicians who spend 20% of their work effort on the activity they find most personally meaningful are three times less likely to be burned out when compared to
colleagues who do not have that opportunity. With this in mind, the consensus group agreed that future research should concentrate on the development of a metric that focuses less on deficit measurement (burnout) and more on understanding the causes and consequences of emotional thriving and resilience. Studies also show that interventions targeting specific drivers of burnout (workload and job demand, control and flexibility, work–life integration, social and community support, organizational values, and efficiency and resources) lead to improved physician well-being. Consensus participants clearly wanted emphasis on investigating the difference in barriers to accessing those institutional interventions between medical students, residents, and staff. There was agreement that future inquiry could elucidate if these interventions would affect patient care, efficiency, and productivity. Answers to such questions would help promote wellness programs and may include physician wellness as a quality indicator.

Conference participants were intrigued with the association of language and departmental well-being. Possible solution research will need to focus on how to open meaningful conversations for the clinician, decrease isolation, and move away from the concept of emergency physician invulnerability. There was consensus to study natural language processing to determine the negative and positive tones of residency social media platforms and official websites.

**Wellness in Nonmedical Organizations.** Looking to the business world for examples of how to proceed because of minimal research at the system level addressing emergency physician wellness was a concept relatively new to conference participants. For instance, Alcoa, the world’s 6th largest producer of aluminum and one of the safest organizations in the world focuses on workers finding joy and meaning in their daily labor and aspires that each worker answer three questions daily to assess their sense of meaning to the organization. All conference participants agreed that it is very rare in medicine that clinicians are asked questions like these, which are asked every day of aluminum workers at Alcoa. Distillation of these concepts resulted in the consensus that emergency medicine researchers may be able to translate practices like Alcoa’s, which have the potential to affect individual well-being as a result of system innovations.

**Society and Culture Future Research**

Many ED encounters involve patients with unrealistic expectations and complex interactions. Patients have a poor understanding of the limitations placed by medicine, life, science, and time constraints. Some of the limited understanding felt by patients is due to the physician playing the hero role and not portraying that physicians, too, are human. The best solution to these issues is to take the patient on a “ride along”—inform them of the vagaries of medical care, encourage them to participate in the medical decisions, and modify solutions for the best fit. The society and culture factors subcommittee questioned whether there are ways to approach these issues with better success, to improve the patient–physician interaction, and whether these actions would possibly reduce burnout.

**Mental Health Check-ins.** Several working groups at the conference agreed that it was extremely important to consider future mental health check-ins for physicians. However, all groups agreed that it was necessary to do this unobtrusively and without punitive consequences. There was consensus in making third-party proprietary mental health offerings available to emergency physicians, such as Talkspace or Headspace. Participants proposed that there would be an increased desire to seek care for mental health disturbances if providers had access to such options. Scheduled social outings have already been studied and noted to be effective in decreasing burnout among physicians at the Mayo Clinic. Conference participants wondered if this benefit could be replicated at other institutions. Participants also arrived at the idea of studying clinical cases that went well and demonstrated positive coping mechanisms, well-being, and resilience to determine if this had any effect on provider burnout. This “well-done conference” should happen in addition to the standard mortality and morbidity conferences. Participants proposed that the relationship between provider empathy and burnout is ripe for further investigation. A starting point for research would be assessments of empathy on a routine basis and correlation with burnout. The consensus group questioned whether a decline in empathy predicts descent into burnout and whether improvement in empathy can be facilitated and taught.

**Professional Boards and Mental Health.** Similar to a mental health check-in, the group was also interested in investigating provider mental health in
terms of current practices of licensing, educational, and professional boards. Patient safety must be considered simultaneously while physicians access help without fear of retribution. The group agreed that a good first step would be to make information requested by various regulatory boards uniform across the United States to ensure consistent and fair application of recommendations for patient safety and physician well-being. Patient care by burned out or dysfunctional physicians is a concern at all levels of training and practice. It is well known that burnout is associated with many types of errors including medication, surgical, or testing.

Replacing Versus Replenishing Providers. The cost of replacing providers and the cost of decreased work output were agreed upon as important bargaining chips with administrators to facilitate adoption of burnout interventions. It is unclear if a decrease in burnout is effective in improving errors, improving work effort, decreasing physician turnover, decreasing substance abuse, and decreasing suicide events. Would physicians who were less fearful of getting help with mental health issues function better?

Is It Possible to Thrive and Flourish? The group also identified that in addition to studying ways to reduce burnout, it might be informative to follow a flourishing index at regular intervals. Instead of the negative spin of burnout, should the focus be on determining positive situations that enable physicians to flourish and be well? If we understand how physicians thrive professionally, we could replicate those systems and situations utilizing surveys or testing the related factors. The group came to consensus regarding the need for meaningful human interaction in encounters with patients. They proposed that physicians have an RVU system that measures patient-centered outcome in a meaningful way to determine if both patients and physicians might have more interactions that are satisfying.

A popular item among conference participants was a better understanding of how litigation impacts physician mental health and which options might make that journey less lonely and unsupported. Although discussed in several groups, the learning/practice environment working group addressed this more thoroughly in their session. Multiple groups who independently brought up this issue in the conference underlines the importance of the problem. Another topic of importance to this group was social media and wellness. Participants discussed utilizing social media for mentoring and connectedness. They noted that nonmedical studies show social media use has not enhanced wellness. Specific medical studies of this issue would be helpful.

Learning/Practice Environment Future Research

Due to broad concepts, topics were grouped into three discrete subcategories: learners in the environment, the practice of emergency medicine, and environmental factors of the practice. Independent of the topic, the group uniformly recommended adding information about provider gender, race, and age in further studies to determine where there may be additional variables which merit further exploration.

Mental Health Support. As was identified by the society and culture group, the concept of support for the mental health of the provider dominated discussions. For many physicians, the pursuit of mental health services has carried a form of taboo. As society progresses in its understanding of the importance of mental health well-being, physicians and other ED providers have lagged behind in pursuit of such services. In some states physicians are asked to clarify any treatment they may be receiving as a criteria for consideration in licensure and privileging. Questions generated from the conference focused on finding ways to ensure access to resources for the pursuit of mental health support and normalization of these difficult discussions. This subgroup, along with the organizational group and the personal factors group, independently discussed the creation of a study to assess overall provider well-being using a standardized measuring tool. Administered pre- and postintervention, this study could determine the impact on clinician well-being both in newly established and in previously established wellness programs.

Litigation Stress. Mindful of the resources needed for both clinicians and learners, one of the greater challenges to a provider’s well-being stems from lawsuits and the general silence imposed on the provider(s) involved. Investigation is required to determine the medicolegal interplay of physicians discussing with other physicians the struggles they have had regarding a challenging patient case that may or may not have resulted in a lawsuit. For preliminary exploration, investigators must be able to further
identify the complex interplay of emotions, self-doubt, and uncertainty which arise from these cases. Typical cases may drag on for 3 to 4 years during which time physicians are unable to have meaningful discussions with other providers about their worries and fears. The working group participants discussed potential strategies to study the development of a peer-support network for those involved in cases to share their experiences, thoughts, and fears in a nondiscernable venue. Retrospective review of surveys from providers who have navigated these lawsuits may begin to elucidate the challenges they face, but further work may be able to clarify the more immediate challenges of the lawsuit for the provider.

Difficult Communication. The final component of the pursuit of mental health support focused on the normalization of holding difficult discussions. Whether sharing tough news with a patient, intervening with a peer who is struggling, debriefing a critical incident, or addressing a learner error, difficult conversations occur each day in the ED. When the thought of having a challenging conversation creates its own impediment to clinician well-being, a potential study could identify ways to make these talks easier on the providers. Exploration of the baseline frequency and challenges associated with having difficult conversations followed by training with a posttraining assessment may be a first step.

The EMR. Group discussion of optimizing the EMR spurred great interest. The group proposed an observational study of the number of provider interruptions and task switching on shift before and after the implementation of a secure messaging platform. While extensive literature exists on optimization of the EHR,59,60 discussants also explored a different avenue of utility focused on mitigating workplace violence.61,62 If the EMR identified patients at increased risk of aggression with an alert to the treatment team, discussants hypothesized that the frequency of workplace violence incidents might decline or the alert might be ignored due to alert fatigue. Further baseline studies of workplace violence incidents with clarification of what workplace violence looks like on a macroaggression and microaggression level are needed.

Team Dynamics. Regarding the interplay of clinical personnel in the practice environment, the creation of a strong team dynamic has been shown to improve provider job satisfaction, and discussants advocated for investigation of such.53 Beyond the department, challenges with patients dismissed from other clinics for various reasons from noncompliance to inappropriate behaviors were identified as an area requiring further study. Because of institutional silos created within a given hospital system, patients may be discharged or “fired” from one site only to show up in another site, often the ED where everyone must have a federally mandated medical screening examination. Discussants recognized that identification of these patients with the construction of interdisciplinary care plans and management strategies could improve the well-being of emergency clinicians while advancing patient health and well-being concurrently.

Health Care Responsibilities Future Research
Little research on burnout has specifically focused on the roles and responsibilities of emergency physicians, and most studies have been performed in academic settings. Both these facts limit the applicability of existing literature. Topics agreed upon by the group included the alignment (or lack thereof) of authority and responsibility; the balance of clinical, administrative, teaching, and research responsibilities; the effect of location of practice; and the variation in stressors across the generations in the life cycle of the emergency physician. Sources of burnout must be defined to generate effective solutions. Another definition of burnout relative to the topic of health care responsibilities is “the chronic condition of perceived demands outweighing perceived resources.”54 As the perceived demands are generated within the work environment, any solution must gain the support of hospital senior leadership by defining the return on investment for the cost of any changes.

Loss of Autonomy. A major source of stress for emergency physicians is the discordance between authority and responsibility in the work environment. Emergency physicians often feel responsible for giving optimal care to their patients without the associated authority to structure or shape the environment or the resources they have to deliver that care. This is perceived by other specialties as a loss of autonomy, although in emergency medicine it is commonplace. The increased boarding of inpatients awaiting bed placement, EMR documentation demands, quality
payment performance metrics, and the pressure to do more with less are generic to our specialty. Group consensus indicated that more research is needed on the way that the ED setting is structured, including the effects of shift work and the disruption of circadian rhythms, length of shift, psychological stresses of working in an unpredictable chaotic workplace, and difficulty with consultants. While it is generally understood that the longer the shift the greater the fatigue and impaired performance, 12-hour shifts are still commonplace in emergency medicine. Discussants agreed that further research should include a study on scheduling according to “chrono-type” (day person vs. night person) in relation to improved well-being, shorter shift lengths, and the possibility of the need for limiting those who can work nights based upon age (e.g., no night shifts after age 60).

**Life Cycle of the Emergency Physician.** A major discussion point was the recognition that the sources of burnout for emergency physicians are not singular and monolithic but will vary depending on generational differences, gender identity and race, location of practice, and where physicians are in the life cycle of the practice of emergency medicine. A recent survey conducted by the American College of Emergency Physicians found that the greatest professional challenges are different depending on the length of time in practice. Burnout was highest in physicians who had been practicing for 6 to 15 years and 9% higher than those who were emergency physicians for less than 5 years. Paying off student debt was a major issue for those out 5 years or less and almost no issue for those out more than 15 years; the biggest challenge for those physicians was administrative burden (including the EMR). With regard to gender differences, the rate of burnout among women physicians is 11% higher than that for their male counterparts. Several studies have reported higher levels of burnout in the urban practice setting as opposed to rural environments. The conclusion of the consensus group was that these factors must be considered in research defining the sources of burnout and creating and implementing solutions.

**Stressors in the Work Environment.** Elements of the work environment which are integral to the practice of emergency medicine are the experience of psychological stress and the constant need to call upon other physicians as consultants. Group participants called for more research should be done to develop tactics to transform those stresses in a creative way. Not only do emergency physicians witness emotionally taxing situations on each shift (fear of error, observing death, family member response to death, abusive patients, etc.), they also have to deal with emotionally challenging interactions with consultants and the lack of availability of those consultants. This prompted a research question examining optimal solutions in settings where there is difficulty with availability and interaction with consultants.

**Balance.** Finally, the need to balance one’s academic, clinical, administrative, and research responsibilities was discussed by the group. One interesting article written by a thoracic surgeon likened the need for professional balance to that of a balancing a financial portfolio. He determined that his long-term professional and personal medical “investment” plan needed to be diverse, balanced, and reviewed regularly with trusted mentor or advisors for his own professional growth and stability. The group agreed that this suggested the need for further inquiry into the development and choices of informal mentor networks.

**Skills and Abilities Future Research**
Preconference literature searches by the skills and abilities group revealed that three of the subfactors did not have extensive research: delegation, organizational skills, and mastering and optimizing new technologies. Subsequently, at the conference, the small-group discussion focused on these factors.

There is a paucity of literature on delegation as a specific “skill and ability” and its link to physician well-being. However, there was little consensus regarding delegation, and the group did not vote to include it in the top 34 research priorities selected at the conference. In the small-group discussion, using the 25/10 crowdsourcing technique, areas of focus were discussed for further study related to this topic. The questions developed centered on criteria for delegation, education for delegation skills acquisition, and creating standard work/communication with metrics on delegation to better understand the threshold for positive and negative effects on well-being.

**Individual Organizational Skills.** Minimal research exists exploring the link between individual organizational skills and well-being. One would hypothesize that
robust organizational skills could contribute to personal well-being and potentially mitigate burnout. Current literature shows that improving time management skills can lead to enhanced career satisfaction, promote career sustainability, and align work tasks with personal career goals for success.61–63 In addition, use of interruption management strategies for emergency physicians was noted to help decrease disruptiveness on shift and improve patient safety.64 The subgroup identified several potential research questions surrounding this topic. The top question selected was “What key organizational skills can be taught to residents to decrease burnout?”

To answer this question, first we need to define what constitutes “key organizational skills” (e.g., time management, goal setting, management of interruptions). Once these skills are defined, the next step will be to study how to recognize when an individual is deficient or needs assistance in building this skill set. Finally, further research would be needed to determine the best modalities of teaching these organizational skills, including options such as coaching, workshops, or other teaching sessions.

HIT. Mastering new technologies is another factor affecting clinician well-being and resilience. HIT-related stress is measurable and specialty-related. It is an independently predictive factor of burnout symptoms in physicians.65 Health care organizations should identify HIT-specific factors associated with burnout to measure and rectify burnout among their staff. During the small-group discussion about HIT, various research questions were raised related to the EMR, technology training, and e-mail communication.

Workflow Program to Enhance Well-being. The last factor this group explored was optimizing workflow and the effect on wellness. Increasing workload contributes to decreases in patient safety and satisfaction and increases in morbidity and mortality.9 Watson et al.66 highlights the perception that workload contributing to patient harm may be associated with emergency medicine burnout. In addition, research demonstrates that burnout levels have risen and satisfaction with work–life balance has decreased.10,25 A study using the abbreviated Maslach Burnout Inventory to assess factors affecting work–life balance in physicians and advanced practice clinicians found that there a significant level of burnout in these groups and workload, workflow, and scheduling issues were major factors affecting work–life balance.67 Dunn et al.68 developed a study to determine whether data-guided interventions and a systematic improvement process to enhance physician work–life balance and organizational efficacy can improve physician and organizational well-being. The study found that physician control over work environment and workflow included work customized to meet physician goals and the establishment of group meetings to elicit physician concerns. The consensus group proposed research to identify other factors contributing to physician burnout related to workflow and to create solutions that mitigate their effect on wellness.

Personal Factors Future Research
Wellness 360-Degree Evaluation Tool. Several tools currently exist to measure different aspects of a comprehensive model of well-being:14,69 These include well-known survey instruments previously discussed and the physician Well-Being Index and Professional Fulfillment Index.70 Participants in the personal factors subgroup acknowledged the multifaceted nature of physician well-being and voiced a need for best practices on conducting a comprehensive 360-degree wellness evaluation tool that would extend beyond simple self-reported survey measurements. Proposed additional components included a personality survey, coping mechanisms, physical health metrics, and strength of social support networks. Specific future research questions would address which components might contribute the most valuable information and how those components of the 360 tool would be measured and assure physician confidentiality. Follow-up questions could address optimal timing and frequency of administration.

Sense of Calling in Emergency Medicine. Possession of a high sense of calling has been demonstrated to be a protective factor against burnout.41,42 Increasingly, physicians face system-based issues that have resulted in an unreasonably high burden of clerical and bureaucratic responsibilities, which have been proposed to be a major contributing factor to burnout. Participants in the consensus conference recognized the importance of retaining a high sense of calling, and research questions for discussion focused primarily on how to maintain this elusive protective factor. A starting point for future studies may consider the use of focus groups and qualitative data analysis to develop a model of “purpose” that could inform more targeted interventions.
**Informal Mentoring Networks.** Mentoring relationships may be broadly described as either formal or informal.\(^{71}\) Formal mentoring often occurs within the workplace or may be part of a dedicated program designed to foster such relationships. Informal mentoring relationships may seem randomly chosen and somewhat less rigid with more mercurial goals and timelines. Both types of relationships have their respective pros and cons. Much of the current literature on mentorship in academic medicine focuses on establishing and maintaining more formal mentoring relationships.\(^{72}\) However, participants in the consensus conference proposed that informal mentoring relationships may have an equal if not greater positive impact on well-being and felt that this area would be worth further exploration to complement what is already known about formal mentorship. For example, a potential study could quantitatively or qualitatively compare the informal relationships of physicians with high and low levels of burnout.

**Social Media and Mentoring.** With the rise of social media platforms such as Facebook and Twitter, it is easier than ever to stay connected to others. This includes establishing and maintaining professional networks such as mentoring relationships. By the year 2020, millennials will have entered the physician workforce in droves and, as digital natives, they will have the potential to change the mechanisms by which our social networks support well-being—for better or for worse. Unfortunately, the nonmedical literature suggests that the effect of social media may do more harm than good.\(^{44}\) Participants in the consensus conference recognized the distinct lack of guidance in this area specifically as it applies to mentorship. While it seems intuitive that social media would increase the potential pool of accessible mentors, and thus support well-being, evidence also suggests that there may be indirect psychological harms as well.\(^{73}\) Future studies could attempt to quantify mentorship networks established by mentees and level of happiness while controlling for frequency of social media use.

**LIMITATIONS**

Limitations include a smaller conference attendance size than typical, although we recognized that all present were committed wellness advocates. Discussions were influenced by the presentations at the beginning of each breakout session. While the subcommittees summarized the literature and gave some framework for the discussion, it is possible that slightly different results may have occurred on repeat attempts to discuss the same material. Validation by another wellness group might have helped determine if this was the case. Also, each subcommittee had so many topics included by the NAM model that it was not possible to review every single line item per topic due to time constraints. The purpose of intense literature review and discussions prior to preparing the literature overview at the consensus conference served the purpose of determining the most critical areas to discuss.

**CONCLUSIONS**

The 2019 Society for Academic Emergency Medicine Wellness Consensus Conference illuminated the lack of wellness research examining systems-level change and broad-based interventions at the departmental or institutional level. Four of the top seven research ideas were specifically focused on organizational factors, dealing exclusively with the system and its effects on individual wellness. Participants emphasized the need to identify and research which wellness interventions—at the broader systems level—are effective. Since discussions about organizational and departmental stressors affecting wellness must include everyone, and especially those from the work unit level who can most accurately identify local issues, studies must elucidate how to obtain feedback from those at every level in the emergency medicine environment.

The conference proceedings revealed the progression of research focus on individuals determining their own wellness to innovative approaches which embrace the concept of system and organizational responsibility for the well-being of emergency physicians. One-third of attendees considered mentoring a vital part of well-being. Evaluating the benefits of informal versus formal mentorship may be a future innovative research endeavor that might enhance well-being early in an emergency physician’s career which might be long-lasting.

There is a shift in thought that was evident among conference attendees in choosing to focus on an emergency medicine–wide evaluation using a validated wellness assessment tool to examine factors affecting clinical practice and the work environment. This is in stark contrast to the myriad burnout assessments utilized in prior years. The task for the future will be to focus on a baseline assessment of all facets of well-being, rather than primarily burnout.
The results of the conference indicate a great need for culture change. Assessment of well-being with positive flourishing indices, rather than negative burnout indices, may stimulate new perspectives in how we view well-being in emergency medicine. Further research must encompass an enlightened understanding that a true culture change must occur so that well-being in organizations is considered seriously and incorporated as a measure of the success of the system.

**APPENDIX A**

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**REFERENCES**


ABSTRACT
Atrial fibrillation (AF) is a significant dysrythmia that often requires treatment in the emergency department (ED). This can be performed with rhythm control using electrical or chemical cardioversion or with rate control. There is widespread variation in management of AF within Canada and worldwide. This study focuses on rhythm control techniques, comparing ED length of stay when using an electrical-first strategy versus a chemical-first strategy of cardioversion.

BACKGROUND
Atrial fibrillation (AF) is the most commonly encountered significant dysrythmia in the emergency department (ED).1 In uncomplicated patients with symptoms less than 48 hours and no stroke or transient ischemic attack in the past 6 months, the 2018 Canadian Cardiovascular Society guidelines permit rate or rhythm control.2

There is significant variability in the management of patients with acute AF, with the proportion undergoing rhythm control ranging from 42% to 85% in Canadian academic centers.3 The rhythm control strategies typically employed are chemical cardioversion with procainamide infusion or electrical cardioversion.3–6 Both strategies appear safe from prior studies, but comparative effectiveness data are lacking. Thus, Canadian management varies, with 56% of patients receiving a chemical-first approach and 44% an electrical-first approach.3

ARTICLE SUMMARY
This study asks whether sinus rhythm is achieved more rapidly with electrical-first rhythm control when compared with chemical-first rhythm control in ED patients with AF. Hemodynamically stable adults aged 18 to 75 with a primary presenting complaint of AF for less than 48 hours’ duration and a CHADS2 score less than 2 were enrolled. In the chemical-first group, chemical cardioversion with procainamide infused over 1 hour was performed primarily, with electrical cardioversion performed if procainamide was unsuccessful. In the electrical-first group, electrical cardioversion was performed primarily, with
procainamide being given if unsuccessful. The primary outcome was the proportion of patients discharged within 4 hours of ED arrival.

QUALITY ASSESSMENT

Overall, this was a well-performed multicenter randomized study performed in six Western Canadian urban EDs. Allocation was concealed, although it was unblinded given the difficulty of blinding a group to electrical cardioversion. The EDs ranged from tertiary care referral centers to small community hospitals. This strengthens the external validity of this study and is important given the inter- and intranational variation in management of acute-onset AF.

A full medical workup was completed on all patients in this study including bloodwork and a chest x-ray. We questioned the necessity of this workup. In the podcast, the primary study author said that although this is not recommended in the 2018 Canadian Association of Emergency Physicians guidelines for patients with obvious low-risk AF, it was performed as an evaluation of safety.7 Furthermore, it is known that patients with AF secondary to medical causes (e.g., acute coronary syndrome, heart failure, pneumonia, pulmonary embolism, sepsis) are likely to have worse outcomes.7 Patients over the age of 75 were excluded in this study because they have a higher incidence of underlying comorbidities driving their illness.

Originally the primary outcome in this study was ED length of stay. It was later changed to the dichotomous outcome of patients discharged at less than 4 hours for ease of sample size calculations. It was changed after two patients were enrolled in the trial per Dr. Scheuermeyer.

KEY RESULTS

Overall, 222 eligible patients were screened and 84 were enrolled and randomized (41 chemical-first and 43 electrical-first). The median age was in the late 50s, more than one-third were female, and three-quarters had a history of AF.

The primary outcome was the proportion of patients discharged within 4 hours of ED arrival. In the chemical-first group, 13 of 41 (32%) were discharged within 4 hours, compared with 29 of 43 (67%) in the electrical-first group. The difference was 36% (95% confidence interval = 16%–56%, p < 0.001) for a number needed to treat of 3. Ultimately, 100% of patients were discharged from the ED in this study.

Secondary outcomes included additional median time intervals, ED-based adverse events, and 30-day patient-centered outcomes. The chemical-first group had 10 adverse events (24%) and electrical group had 11 (26%). All had minimal-risk outcomes.

There were no strokes or deaths in either group at 30 days. Quality-of-life scores at 3 and 30 days were similar for both groups across all domains.

AUTHORS’ COMMENTS

Quality of life is an important outcome that has not been a traditional focus of prior ED-based AF literature. From this study, it appears that patient satisfaction and quality of life were high 30 days after their initial ED presentation.

TOP SOCIAL MEDIA COMMENTARY

On Twitter, Steve Carroll (@embasic) commented:
I have said this ad nauseum. These older patients (let’s say 60 and older) who know their exact onset of afib are a rare zebra in my experience- they get rate control. Younger patients feel worse with their afib and can pinpoint the onset- they get rhythm control if recent onset.

Ken Milne (@TheSGEM) responded:
[In a recent New England Journal of Medicine study of early or delayed cardioversion for AF] The mean age was 65yo with half of the 437 getting early cardioversion (electrical or chemical).

Steve Carroll (@embasic) responded:
I hear you but I can only say that this has not been my experience- perhaps a combination of different patient populations and concerns re: malpractice risk of cardioversion without knowing exact onset.

Ken Milne (@theSGEM) responded:
Absolutely. It all depends. Different practice populations, different patient expectations, different medical/legal environments, different clinical judgement. The literature only guides us it does not dictate our care.
TWITTER POLL

The Twitter poll results were interesting given that almost half of voters still elected for rate control.

The lead author, Dr. Scheuermeyer, comments: “Interesting. I wonder if this report, and others by Burton (Ann Emerg Med 2004), Stiell (many reports) etc. regarding the safety and efficiency of rhythm control (whether chemical-first or electrical-first) will provide emergency physicians with the confidence to use rhythm-first strategies in patients with uncomplicated acute AFF. The 2018 Canadian Association of Emergency Physicians guidelines on AFF now promote a rhythm control first strategy for such patients.”

PAPER-IN-A-PIC FROM KIRSTY CHALLEN, @KIRSTYCHALLEN

TAKE-TO-WORK POINTS

In patients in whom a rhythm control strategy is deemed appropriate, this study supports an electrical-first cardioversion strategy for low-risk patients with acute uncomplicated AF. Both chemical-first and electrical-first strategies appear to be successful and well tolerated; however, an electrical-first strategy results in a significantly shorter ED length of stay.

References

**Proton Pump Inhibitors for Acute Upper Gastrointestinal Bleeding**

Mark Serpico, MD and Matthew Riscinti, MD

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### NNT color recommendation

**RED (no benefit)**

### Summary heading

Intravenous proton pump inhibitors do not reduce mortality, risk of rebleeding, or need for surgery in patients with upper gastrointestinal bleeding.

### Benefits in NNT

No one was helped (no death, rebleeding, or surgical intervention was prevented).

### Benefits in percentages

No one was helped (no death, rebleeding, or surgical intervention was prevented).

### Harms in NNT (NNH)

Not reported.

### Harms in percentages

Not reported.

### Efficacy endpoints

Mortality, need for surgical intervention, rebleeding, blood transfusion requirements, length of hospital stay.

### Harm endpoints

Not reported.

### Who was in the studies

2,223 adults with acute upper gastrointestinal bleeding, enrolled in six randomized controlled trials.

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**NARRATIVE**

Upper gastrointestinal bleeding (UGIB) is common, with an annual incidence of approximately 67 to 150 per 100,000, with estimated mortality rates between 6 and 15%.[1] Many patients require hospital admission and ultimately endoscopic evaluation for diagnosis and treatment of the hemorrhage. It is standard practice to start patients with undifferentiated UGIB on acid suppression therapy with an intravenous proton pump inhibitor (PPI) in the emergency department (ED) prior to admission or endoscopy.[2] This practice is based on data that the most common cause of UGIB is peptic ulcer disease. Intravenous PPI may create optimal conditions for clotting over arteries at ulcer bases, as neutralization of gastric acid leads to stabilization of blood clots.[3,4]

The Cochrane systematic review discussed here[5] included six randomized controlled trials enrolling 2,223 patients with undifferentiated UGIB evaluating the use of PPI therapy prior to endoscopy compared to placebo, H2-receptor antagonists (H2RA), or no treatment. Some trials included patients who had been admitted to the hospital for other reasons and subsequently developed UGIB. The trials were not confined to patients with peptic ulcer bleeding as three of the trials included patients with UGIB due to esophageal varices. The included trials compared oral PPI to placebo, intravenous PPI to placebo, intravenous PPI to H2RA, or intravenous PPI to no treatment.[5]

This systematic review[5] showed no statistically significant benefit in the primary outcomes of mortality, risk of rebleeding, or need for surgical intervention. Secondary outcomes did show significantly reduced proportion of patients with stigmata of recent hemorrhage (visualizing lesions showing evidence of recent bleeding) at index endoscopy when comparing PPI to control (odds ratio \[OR\] = 0.67, 95% confidence interval \[CI\] = 0.54 to 0.84, absolute risk difference \[ARD\] =
9.3%; number needed to treat [NNT] = 11). The systematic review also showed significantly reduced need for endoscopic therapy at the index visit (OR = 0.68, 95% CI 0.50 to 0.93, ARD = 3.1%, NNT = 33). These secondary outcomes are at best surrogate outcomes that did not translate into patient-centered outcomes such as survival benefit. Therefore, we did not report them in the summary table.

There was not sufficient evidence to assess for amount of blood transfused or decrease in hospitalized days. The preplanned subgroup analyses controlling for type of comparative (placebo or H2RA, route of PPI administration, and application of initial endoscopic hemostatic treatment) similarly revealed no significant differences in mortality, rebleeding, or surgery.

A subsequent Cochrane meta-analysis of 22 randomized trials assessed the use of high-dose bolus PPI with continuous infusion compared to lower doses given by continuous infusion, intravenous bolus, or orally after an endoscopic evaluation of peptic ulcer bleeding. There was no significant difference in mortality, risk of rebleeding, surgical interventions, length of hospital stay, or blood transfusion requirement between higher versus lower-dose regimens. Finally, a 2014 systematic review by Sachar et al. found that intermittent PPI therapy after successful endoscopic treatment of high-risk peptic ulcers was not inferior to high-dose PPI therapy plus continuous infusion in terms of rebleeding within 7 or 30 days, mortality, and requirement for blood transfusion. The systematic reviews did not report adverse events related to PPI use.

CAVEATS

The meta-analysis discussed here enrolled patients with undifferentiated UGIB before endoscopic diagnosis. Patients with peptic ulcer and specifically high-risk peptic ulcers might still benefit from PPI. However, the systematic review points out that the two trials that entirely focused on bleeding peptic ulcers also did not report survival benefit or significant reduction in the risk of rebleeding.5

The Cochrane systematic review summarized here did not report significant statistical heterogeneity for the major outcomes of 30-day mortality, rebleeding, or need for surgery. Length of hospital stay could not be pooled due to differences in reporting method for this outcome. Only one trial included in the

Cochrane systematic review was rated high quality.5 However, the sensitivity analysis deemed the study results reliable.

The American College of Gastroenterology recommends the use of preendoscopic intravenous PPI (80-mg bolus followed by 8 mg/hr infusion) for UGIB secondary to suspected or confirmed peptic ulcer disease. The guidelines also state that PPI can be discontinued after endoscopy if a nonulcer cause of bleeding is found, and if endoscopy needs to be delayed then PPI should be continued until endoscopy to decrease the risk of further bleeding.8 These recommendations for the use of PPI in ulcer bleeding are most likely based on the data, suggesting that this therapy decreases the stigmata of recent hemorrhage and need for endoscopic intervention.

One caveat worth mentioning is that in the trials that reported stigmata of recent hemorrhage, time to endoscopy varied significantly (within 24 hours in two trials, 24-48 hours in one trial, and mean time to endoscopy in the fourth). Additionally, definitions for rebleeding were variable between the six trials.5

The data pertaining to the use of intermittent versus continuous infusion PPI therapy mainly apply to patients after endoscopic treatment and not prior to endoscopy. This strategy is not directly generalizable to ED populations with UGIB prior to endoscopy. Further research is needed to determine if intermittent PPI therapy is not inferior to bolus infusion in undifferentiated UGIB in the ED.

In summary, intravenous PPI therapy in undifferentiated UGIB does not improve survival and does not reduce the risk of rebleeding or need for surgery. Therefore, we have assigned a color recommendation of RED (no benefit) to this intervention. Large trials specifically targeting patients with documented peptic ulcers might provide different results. Since a large percentage of UGIB is not actually from peptic ulcer disease,7 the practice of intravenous PPI administration in all patients with undifferentiated UGIB may be unnecessary and costly. The risks related to adverse effects of PPI as well as cost analyses are important considerations, although beyond the scope of this review.

References


Octreotide for Gastrointestinal Hemorrhage from Esophageal Varices

Jia Jian Li, BS1, Priscilla Chao, MD1, Joel Gernsheimer, MD1, and Rajesh Verma, MD2

The NNT Color recommendation Red (No benefit)

Summary Heading Octreotide and other somatostatin analogues do not reduce mortality or risk of rebleeding but can reduce the average units of blood transfused

Benefits in NNT No one was helped (no survival benefit) No one was helped (no rebleeding was prevented) Reduced the units of blood transfused by an average of 0.7 units

Benefits in Percentages No one was helped (no survival benefit) No one was helped (no rebleeding was prevented)

Harms in NNT (NNH) Harms were not assessed

Harms in Percentages Harms were not assessed

Efficacy Endpoints All-cause mortality, rebleeding, transfused blood

Harm Endpoints Not assessed

Who was in the studies 2588 subjects with bleeding from esophageal varices.

NARRATIVE

Acute esophageal variceal bleeding is an important cause of morbidity and mortality in patients with cirrhosis. Pharmacological agents used to treat such hemorrhages include somatostatin, a vasoactive agent that reduces splanchnic blood flow and thus portal pressure.1

The systematic review discussed here2 included 21 randomized trials with 2588 subjects in aggregate and compared somatostatin analogues to placebo or no treatment for variceal bleeding. The review found adding somatostatin to routine care did not reduce all-cause mortality or the risk of rebleeding, but reduced the average units of blood transfused by 0.7 units (95% Confidence Interval [CI] 0.2-1.1) in trials with a low risk of bias and 1.5 units (95% CI 0.9-2.0) in poor quality trials at moderate/high risk of bias.2

One additional systematic review and network meta-analysis, published in 2016, compared somatostatin to placebo, proton pump inhibitors, and histamine H2 receptor antagonists in patients with upper gastrointestinal hemorrhage (not limited to variceal bleeding). The authors included 47 randomized trials (n = 9528), reporting no significant all-cause mortality benefit or the risk of rebleeding,3 similar to the Cochrane review. Somatostatin was not superior to other pharmacologic agents.

CAVEATS

Because variceal bleeding is uncommon, enrolling many patients in a consecutive manner is difficult. As expected, there was significant clinical and statistical heterogeneity within and between trials in the meta-analysis. Endoscopic confirmation of variceal bleeding was performed in less than half of trials. There were also marked differences in dosing and duration of somatostatin administration: boluses varied from 0 to 250 micrograms; infusions were up to 50 microgram/hour but sometimes not done; and duration was
anywhere from 1 to 5 days. Finally, no harms were tracked or reported in most trials, and therefore were not included in this review. Somatostatin analogues are generally well tolerated but can have side effects such as transient gastrointestinal symptoms (diarrhea, abdominal discomfort, nausea and flatulence) attributed to inhibition of pancreatic exocrine secretions. Additionally, somatostatin analogues inhibit gallbladder contractions and may increase the risk of gallbladder sludge and gallstones. Exposing already ill patients to these side effects should be weighed in any clinical or summary recommendations.

Among somatostatin analogues, only octreotide is available in the United States and it has been recommended as an initial IV bolus of 50 μg followed by a continuous infusion of 50 μg/hour for 3-5 days. Currently, one vial of Octreotide (5 ml, 200 mcg/ml) costs approximately $30.

Lastly, while the modest reduction in blood transfusion requirements is an important finding, especially in terms of costs, resource utilization, and risk of transfusion-related adverse events, this endpoint is not a patient-centered outcome. In case of somatostatin, a reduction in blood transfusion requirements did not translate into a survival benefit, which is the most important patient-centered outcome in clinically significant gastrointestinal bleeding.

In summary, in this update of a prior NNT summary we find no change in the nature or findings of existing trial data. Adding somatostatin or its analogues to routine care does not reduce mortality or rebleeding, and likely reduces blood transfusion by less than one unit. Therefore, we have assigned a color recommendation of red (no benefit) to this treatment for variceal bleeding.

References
A Critical COVID Metric: Your ED Staff Infection Rate

If you are like me, in recent days you have experienced moments of fear. Feelings like when you woke up in bed at night as a kid, and saw a dark shadow in the corner, and wondered if it was going to get you. If you are like me, in recent days you have also experienced awe at so many triumphs over such fear, individual, and collective – our 65-year-old ED clerk showing up to their shift, through great anxiety, or healthcare providers boarding buses heading into the teeth of the Wuhan epidemic. The pages of AEM this month provide further examples of such triumphs, of individuals in a time and place of great stress overcoming the impulse to curl up and focus on themselves, and instead expanding beyond themselves to help others. This is the finest tradition of humanity and medicine, and all of these efforts at service through science inspire and give heart.

Within this tradition, the report of Ma et al (REF) from Sichuan University serves as a powerful reminder that we must work to protect each other. Ma et al describes the development of a set of hospital measures to protect COVID frontline workers, at a time when protective clothing, N95 respirators, and goggles could only be provided to <15% of ED personnel. They maximized ED staff safety via measures including: (1) instituting online clinic/triage to reduce low acuity volume, (2) directing high-risk patients to different ED areas via specific routes, (3) creating a triage area with protected health care workers to risk stratify and deliver patients to different parts of the ED via the safest route, and (4) triaging PPE to ED staff as the highest priority in the hospital. Together these measures achieved the lowest ED infection rate outside Hubei province.

Similarly, if you do not have a team of ED staff working closely with ED leadership to maximize the care and safety of your ED personnel, you need one now. Your hospital infection control is unlikely to understand the ED environment and have the time necessary to optimally address ED staff safeguards. For example, both my own major medical center and the one a few miles down the road had early hospital infection control pathways that called for ED personnel to wear only mask and gown with potential COVID cases, yet had hospital personnel donning full personal protective equipment (PPE), including N95 and face-shields once the same patient arrived on the floor. This policy seemed to be based on the concept that full PPE should not be wasted on a fever/cough patient who subsequently tested COVID negative, rather than assuming all patients are COVID positive until proven otherwise. In short, not all ED plans are as wise as those at West China Hospital, who recognized the ED as highest chaos/risk/priority, and infection control procedures developed outside the ED need to be carefully vetted and reviewed.

EDs around the US are struggling with the same sets of questions: is local N95 status such that extended use (supported by a large literature, e.g., see https://bit.ly/2TYm9Sx) should be employed? Are shoe covers necessary? Should you wear shoes with rubber/optimal surfaces (e.g., clogs), to facilitate wipe down at end of shift and minimize tracking to home/other areas? Is there mechanism for ED staff to use hospital scrubs and drop-off at end of shift? Are shower facilities on site and a place to store “home clothes” to change into? Is there an SOP for stethoscope use in COVID high/low risk ED areas? We as a community urgently need means to rapidly share ideas and methods across institutions addressing these and other questions. Given the pace of the pandemic and COVID morbidity, we want a community learning curve and not individual institutional ones. Perhaps the SAEM website could host an area where individual ED safety protocols and videos are shared. SAEM should also consider hosting a series of webinars in
the next few weeks, where different institutions can present their current staff safety methods for shared discussion and comment. Publications of best practice, such as the publication of Ma et al, are also critical.

Any single staff member, or staff member’s family, that is saved from infection via a tweak in methods is a huge win. We are dedicated to our patients. We will serve our patients. That is our pride, our meaning, and who we are. Amidst the current chaos, let us not forget to take care of each other.

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On March 13, 2020, the United States declared the novel coronavirus (COVID-19) pandemic a national emergency. By March 18, 2020, according to the Centers for Disease Control and Prevention, COVID-19 had spread to all 50 U.S. states, with 7,038 cases and 97 deaths.\(^1\) The trajectory of cases mirrors that of Italy, where doctors are forced to consider who is more deserving of a ventilator.\(^2\) In response, social distancing measures are being promoted across the United States in the hopes of slowing the growth in new cases, i.e., “flattening the curve.” This could maintain the demand for acute care within the health care system’s capacity to treat.\(^3\) Travel has been curtailed, conferences and concerts have been canceled, and schools and universities have moved students off campus and classes online. Medical schools are following suit, with added motivators. In canceling classes and rotations, medical schools hope to promote social distancing, limit the risk of students contracting the virus, limit the number of health care workers who might spread the virus to unaffected patients, minimize the teaching burden on frontline providers, and preserve personal protective equipment (PPE) for essential personnel. These are logical reasons for removing students from hospitals. But, despite our best efforts, there may come a point in the US when, as is set to happen in Italy, medical demand outpaces medical capacity.\(^2\) If the same happens here, is there a plan in place for incorporating senior medical students into emergency relief efforts?

One group of students notably missing from this discussion, however, are senior fourth-year medical students who have completed their clinical training and, in many cases, all of their medical school requirements. These students discovered on March 16, 2020, whether or not they matched into a residency program, and on Match Day, March 20, they will learn where that program will be. Last year, approximately 18,000 U.S. medical students matched into first-year residency positions. The only mention of graduating students in the AAMC guidelines is to discourage Match Day celebrations. While senior medical students are unprepared to be frontline providers, they are experienced navigators of hospitals and hospital teams. They are trained in health information privacy and electronic medical record systems, and they have security clearance to work in local hospitals. They have spent hundreds of hours obtaining patient data from outside hospitals; speaking with pharmacists, lab
technicians, residents, and nurses to coordinate patient care; assisting in simple procedures; and speaking with patients and their family members about next steps. Medical students are often given the advice that to succeed on clinical rotations, they must find ways to minimize resident workload, i.e., to save more time than they take up. By graduation, this is a skill at which most students are adept.

The United States may succeed where other countries have failed and sufficiently flatten the curve through social distancing, but there is a very real possibility that, here too, medical demand will soon outpace medical capacity. Given the recommendation that anyone testing positive for the virus self-quarantine for 2 weeks, the pool of available health care providers could rapidly decline. An emergency medicine doctor in New Jersey and another in Washington State who tested positive for COVID-19 are in critical condition. Approximately 24% of U.S. doctors are above the age of 60, placing them at high mortality risk if they were to contract the virus.6 In China, thousands of health care workers were infected. In the Lombardy region of Italy, one of the most affected areas of the world, approximately 20% of health care workers were infected, with some dying.2 This has led Italian officials to promote 10,000 senior medical students 8 to 9 months ahead of schedule.7 England’s Chief Medical Officer, Chris Whitty, has acknowledged that responding to the pandemic may require expanding prescribing and treatment privileges of first-year residents and final-year medical students. In New York, one of the most affected U.S. states, Governor Andrew Cuomo has reached out to medical schools to identify possible reserve health care professionals.

Approximately 18,000 residency-matched students could offer a significant boost to a beleaguered medical workforce. Students are at lower risk of negative outcomes from infection than older providers, but they are also less important to critical care. Students could therefore be restricted to working with low-acuity COVID-19 patients. Alternatively, if PPE supplies remain limited, senior medical students could assist in nonpatient facing tasks and in the care of patients hospitalized with noninfectious diseases, effectively freeing more time for frontline providers to treat the critically ill. Senior students stand to benefit from participating in the pandemic response as well: there is a real possibility of a second peak in COVID-19 cases this fall, when these students will be on the wards as residents.3 Either way, this will almost certainly not be the last pandemic of students’ lifetimes, and being a part of the response now could be important to preparedness in the future. Many of the countries proving more successful in responding to COVID-19 are the same ones that successfully contained previous outbreaks of severe acute respiratory syndrome and the H1N1 flu virus. Finally, if senior medical students are called on to assist, medical schools should consider discounting final-year tuition. No medical provider should incur further debt while assisting in the COVID-19 response.

Medical schools in the United States prepare students to effectively support medical teams. The COVID-19 pandemic is likely to test the capacity of our health care system, and students may be called on to participate in the response. Now is the time to develop plans for making that transition as safe as possible for students, medical teams, and most importantly, for patients. Students can receive online training specific to COVID-19 and disaster-preparedness, and health care systems can develop workflows that integrate students where they can be most effective. Early recognition that senior students can contribute meaningfully to the U.S. COVID-19 response can bolster the current healthcare workforce and increase preparedness for future pandemics.

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To the Editor:

We read with great interest the article by Driver and colleagues\(^1\) that investigated the optimal order of drug administration (i.e., sedative first vs. neuromuscular blocking agent first) in the process of rapid sequence intubation (RSI), focusing on the time elapsed from the first RSI drug administration to the end of first-attempt success at intubation. The authors demonstrated a 6-second reduction in time from drug administration to the end of intubation (95% confidence interval = 0 to 11 seconds) if neuromuscular blocking agent was administered before sedative agent compared with the other way around, thereby suggesting that administration of neuromuscular blocking agent first may be a logical approach to minimizing apnea time during intubation.

Nevertheless, one major concern regarding the practice of administering neuromuscular blocking agent before sedative is the role of sedation in the intubation process. Although sedative apparently plays no role in facilitating intubation, it is critical for alleviating pain and anxiety that could cause adverse physiological consequences, including an elevation in sympathetic tone, coagulation cascade, inflammatory reaction, and oxygen consumption,\(^2,3\) thereby protecting the patient from organ ischemia, multi-organ failure, and even mortality.\(^4\) The other concern is ethical: albeit controversial, paralysis before sedation, however short it may take, could still be a psychologically traumatizing experience to the patient. The study did not provide information about patients’ memories to either support or rule out the possibility.

Besides, a previous study has demonstrated that bag-mask ventilation during RSI could significantly elevate oxygen saturation in the circulation before intubation.\(^5\) Other studies have also shown the use of high-flow oxygen to avoid hypoxemia during intubation.\(^6,7\) Therefore, taking into account the potential risks of not sedating the patient first before induction of paralysis and that shortening the time between drug administration and intubation is not the only means of avoiding hypoxemia in the process of RSI, flexible approaches to improving apneic oxygenation\(^5-7\) rather than alternation of drug administration sequence may be adopted to achieve optimal RSI with minimal sequelae. More evidence is needed to support the routine practice of “paralysis before sedation.”

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References

Near-simultaneous administration of a sedative and neuromuscular blocking agent (NMBA) defines the process of rapid sequence intubation (RSI). Sedation for this procedure is brief (e.g., etomidate lasts 5–10 minutes) and should not be confused with the ongoing sedation during mechanical ventilation in the intensive care unit (the setting for the authors’ references provided as evidence that insufficient sedation is associated with patient morbidity and mortality). It is physiologically implausible that a several-second delay sedation during RSI could be associated with subsequent organ dysfunction or death; furthermore, administering the NMBA first in RSI does not result in an unsedated paralyzed patient.

This is a major concern of the authors, who are concerned that ED patients who receive the NMBA immediately before the sedative agent might have the awareness of neuromuscular blockade. Given the rapid succession of RSI drug administration (the sedative bolus effectively acts as the intravenous flush for the NMBA, then a saline flush is administered last) and pharmacodynamics of these agents, this concern is unfounded and directly refuted by existing data.

Administration of the NMBA 20 to 30 seconds before the sedative agent has been described in dozens of studies conducted in the operating room; this practice, termed the “timing principle,” is performed to align the onset of sedation and neuromuscular blockade to prevent sedative-associated apnea from occurring before maximal muscle relaxation. In five representative studies, investigators administered rocuronium or vecuronium, subsequently administering the sedative after a set time period had elapsed (20 seconds) or after ptosis or weak hand grip was present (about 20–30 seconds after rocuronium, specifically).1–5 In these studies, investigators noted that “[n]o patient in either group reported sensations of weakness or ‘smothering.’... During postoperative follow-up, no patient recalled unpleasant experiences during induction of anesthesia”,1 “in the postoperative interview, none of the patients complained about weakness or shortness of breath before induction of anesthesia”,2 “[t]hree patients felt discomfort but only one patient was dissatisfied with the anaesthetic technique”;3 “[o]nly one patient verbalized discomfort, and was unable to cough; anesthesia was promptly induced... This patient had no postoperative recall of any discomfort... Postoperatively no patients had recall of weakness and were very satisfied with their anaesthetic technique”;4 and “[a]ll patients were satisfied with the induction technique used in this study and none of them complained of any discomfort or shortness of breath during induction of anaesthesia.”5

In these studies, the delay in sedative administration following NMBA was much longer than is typical for RSI. In our study, the median elapsed time between the first RSI medication and complete administration of the second RSI medication was 10 seconds.6

Thus, the available evidence on patient memory when the NMBA is administered before the sedative agent to facilitate endotracheal intubation is derived from relatively healthy patients undergoing general anesthesia in the operating room (perhaps more likely to remember awake paralysis than the majority of ED patients who are intubated) and employed a longer time interval between NMBA and sedative administration; both factors should increase the likelihood, compared to RSI, that unpleasant sensations before or during intubation would be recalled by patients. However, this was not observed.

The authors highlight several strategies to prevent hypoxemia during or after intubation, such as bag-mask ventilation or high-flow nasal cannula, and suggest that these should be used in lieu of administering the NMBA first. Notwithstanding the fact that these studies did not enroll ED patients and may not generalize to this setting, it is prudent for emergency physicians to use all, not some, of the available techniques.
to maximize the chance of first-attempt success without hypoxemia or other complications. This means using the best available preoxygenation method(s), best airway positioning, best intubation devices, and perhaps best RSI drug order.

It is premature to conclude that a NMBA-first approach is superior to sedative-first approach in RSI; this remains unknown and more prospective investigation is needed before that claim can be made. Based on the available evidence, however, it seems safe and acceptable to administer the NMBA first. This practice might shorten intubation time very modestly. To our knowledge, there are no data supporting the dogmatic assertion that the sedative must be administered first during RSI.

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References
COVID-19: A Singapore Orthopedic Resident’s Musings in the Emergency Department

Please check your email. You have been rostered to help in the emergency department.

I felt my heart skip a beat as I took off my lead gown, preparing to put in my postoperative orders for a patient with an ankle fracture I had just operated on. A transient wave of apprehension, and I daresay fear swept past me that very moment. It has been a good 8 years since I’ve graduated medical school, with nary an exposure to emergency medicine since my intern days. I wasn’t sure I could remember how to read an EKG accurately, much less manage a patient in respiratory failure.

Now, where is my stethoscope?

Do I have to perform COVID-19 swabs for all my patients with respiratory symptoms?

These were just among the many fleeting questions racing through my head as I commuted home that evening. Sadly, my stethoscope was nowhere to be found despite my best efforts. I ended up borrowing one from a good friend. The first few shifts went by in a blur, largely uneventfully under the guidance of, fortunately, very approachable and forgiving attendings. We trudged through patients presenting with a myriad of complaints, from the worried wells to the traumatic arrests. And with each patient encounter, I was slowly reintiated back to the heart of clinical medicine. It has been close to a month since I’ve started—a month of tremendous personal growth and introspection. While equally important, the biggest lessons I took away were interestingly not related to the actual management of the various conditions I encountered. Instead, personally, the richest and most precious lessons were learned from my daily interactions with each and every individual on the shop floor—patients, porters, administrative personnel, nurses, and fellow doctors. All banded together in our fight against COVID-19, albeit each in our own different way.

NOT EVERY PATIENT IS A FRACTURE TO BE FIXED OR A JOINT TO BE REPLACED.

Despite our attendings’ reminders to always be holistic, I had found myself to become almost methodical when managing patients. Define the orthopedic issue, explore treatment options, assess surgical fitness, and lastly plan for surgery. Through various patient encounters, this ED stint has, again, repeatedly reminded me that medicine is beyond that. The patient who overdosed on paracetamol. While I now remember that the toxic acetaminophen dose is 140 mg/kg, what struck me more was the human condition behind the medical diagnosis. She was a single parent and unemployed and had overdosed on pills as a form of escape. Examples like this were aplenty. What they taught me was that to be effective as a doctor, it is imperative that we tease out the root issues underlying our patients’ medical complaints. The patient who keeps returning to see us for stable mild arthritis—more than being troubled by pain, may actually just need counsel and a listening ear. These are precious lessons I will bring back to my orthopedic practice, long after the dust settles on this COVID-19 crisis.

IF YOU WANT TO GO FAST, GO ALONE; IF YOU WANT TO GO FAR, GO TOGETHER

It was an extremely busy shift again at the ED. Patients were arriving in throngs, and exhausted as I was, I had found myself assigned to yet another...
patient. I took a quick look at the triage note—“26 years old male, abdominal pain, not better despite analgesia. No fever.” I did a mental checklist of the important aspects of history and physical examination to look out for and the labs I needed to send off. With that in mind, I trudged toward the patient, determined to see him quickly, so as to have some time for dinner before the next patient came along.

I arrived at the patient’s bedside only to find his intravenous cannula nicely inserted. The nurse-in-charge was in the midst of preparing his medications.

“Is that for the right patient? I haven’t seen him nor ordered anything yet ...” I asked, bewildered.

“Yes, I know you haven’t. Your senior has swung by to see him and has given her instructions already ...” the nurse replied, smiling reassuringly.

As it turned out, my attending, seeing that I was busy, had seen the patient earlier and given her initial orders. This was one of the many examples of camaraderie and teamwork displayed by each and every individual I worked with on the shop floor. From the porters who unfailingly deliver our patients’ samples to the laboratory, to the phlebotomists we turn to when we have difficulty with our blood draws. All fulfilling their individual roles to make light work. For the doctors, we were now no longer responsible for just an anatomical body part or body system. We had our sights on a common goal—the faceless enemy that is COVID-19.

THE CAVE YOU FEAR TO ENTER HOLDS THE TREASURE YOU SEEK

I learned to confront my fears on many fronts. Having not done medicine for years, I was fearful of not being adequately equipped to manage patients coming through the ED doors. Add on the COVID-19 crisis and I was fearful of the repercussions of my deployment. COVID-19 was reported to be infectious even when asymptomatic. I was fearful of potentially passing it on to my elderly grandmother at home. And, most unjustifiably, I feared embarrassing myself in front of my juniors. I’m a PGY-8 but still relatively junior in residency, having taken time off for graduate studies. My medical school classmates and juniors were already full-fledged attendings in the ED department I was rotating to. I did not want to embarrass myself in front of them.

These fears all turned out to be unfounded. And through them, many precious lessons were learned. I learned to discharge my duties because it was the right thing to do, wherever I was deployed. I learned to put my own fears (and pride) to rest, because as doctors, we are all called to a greater cause much bigger than ourselves. I learned to be versatile and adaptable. Crises like these are extremely fluid, and I learned to adapt to ever-changing plans. I learnt to empathize, to allay my patients’ fears especially those who were COVID-19 suspects. I learned to trust my colleagues to discharge their duties so that I can better perform mine.

This is the true test that medical school and residency have been preparing us for. Not passing finals nor board exams and certainly not the number of fractures we fixed or joints we replaced. COVID-19 is a test of our resilience, our courage, and our togetherness. We can and we must rise up to the challenge.

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Supervising Editor: Brian Zink
CORRIGENDUM

Re: Screening and Treatment for Subclinical Hypertensive Heart Disease in Emergency Department Patients With Uncontrolled Blood Pressure: A Cost-effectiveness Analysis

In Twiner et al.¹, there was an error in the second sentence of the “Results” section, where “female” should have read “male”. The sentence should have read: “The study population was mostly male (66%), and African-American (95%), with a mean (±SD) age of 49.2 (±8.3) years.”

Reference
