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## How Las Vegas Hospitals Responded to Nation's Deadliest Mass Shooting

*Patients continue to present to EDs in the region with PTSD-like symptoms and anxiety related to the mass shooting*

**S**unday evenings tend to be relatively quiet in the ED, but on Sunday, Oct. 1, hospitals in Las Vegas were tasked with responding to the worst mass shooting in U.S. history when a gunman using automatic weapons opened fire on a large crowd attending a music festival on the Las Vegas Strip. Fifty-nine people were killed and more than 500 injured, many of them with severe gunshot wounds.

At first unclear on the extent of the injuries, hospitals in the region had to ramp up emergency operations quickly as patients began arriving by the truckload, many of them in private vehicles. Sunrise Hospital and Medical Center, a level II trauma center located just a few miles

from the festival, first received notice of a mass casualty event at 10:20 p.m.

“Once our incident command was stood up, we mobilized staff and supplies within the ED, operating room,

inpatient units, and in [our] pharmacy and supply warehouse,” explains **Jeff Murawsky**, MD, FACP, the hospital’s chief medical officer. “We also used the incident command structure to ensure protocols were enacted for managing security, visitors, and family of those impacted by the tragedy.”

**HOSPITALS IN THE REGION HAD TO RAMP UP EMERGENCY OPERATIONS QUICKLY AS PATIENTS BEGAN ARRIVING BY THE TRUCKLOAD.**

With such close proximity to the event, Sunrise Hospital received 180 patients, more than any other hospital in the region, 124 of whom had sustained gunshot wounds. Dozens of physicians,

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## ED MANAGEMENT®

### ED Management®

ISSN 1044-9167, is published monthly by AHC Media, a Relias Learning company  
111 Corning Road, Suite 250  
Cary, NC 27518  
Periodicals Postage Paid at Atlanta, GA 30304 and at additional mailing offices.

### POSTMASTER: Send address changes to:

AHC Media, LLC  
PO Box 74008694  
Chicago, IL 60674-8694

### SUBSCRIBER INFORMATION:

Customer Service: (800) 688-2421  
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### SUBSCRIPTION PRICES:

Print: U.S.A., 1 year with free AMA PRA Category 1 Credits™: \$519. Add \$19.99 for shipping & handling.  
Online only: 1 year (Single user) with free AMA PRA Category 1 Credits™: \$469  
Outside U.S., add \$30 per year, total prepaid in U.S. funds

Back issues: \$82. Missing issues will be fulfilled by customer service free of charge when contacted within one month of the missing issue's date. GST Registration Number: R128870672.

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This activity is intended for emergency physicians, ED nurses, and other clinicians. It is in effect for 36 months from the date of the publication.

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nurses, and support staff were called in to manage the influx, and staff essentially tripled the size of the ED, explains **Scott Scherr**, MD, FACEP, Sunrise's medical director of emergency medicine.

To organize care, arriving patients were tagged to go to designated areas. "We used the Sunrise Children's Hospital pediatric ED for the 'green'-tagged patients, the chest pain observation area for 'green- and yellow-' [tagged patients], and the PACU [post-anesthesia care unit] for 'yellow' patients," Scherr notes. "I was able to assign one to two providers per station with a scribe. We moved all 'red' patients to the trauma bays and station one."

## Prepare for Non-local Patients

When yellow-tagged patients began to decompensate, they were moved to the trauma bay or station one, Scherr explains. "Since we had four neurosurgeons in house on Sunday night, we sent all isolated gunshot wounds directly to the neuro ICU. Orthopedic surgeons were following patients on the PACS [picture archiving and communications system] machines and admitting isolated surgical patients," he says.

A radiologist followed patients with a portable X-ray machine to give clinicians instant "wet" reads, Scherr observes. In addition, transporters were assigned to each station so they could help move injured patients to radiology for CT scans, upstairs to the ICU, or to the operating room, he says.

With so many patient arrivals, the hospital quickly bypassed standard registration processes, moving instead to a system it uses in mass casualty situations to capture an alias on every

patient treated. "After the emergent stabilization was completed, we were able to establish and verify the identity of every patient who was evaluated and treated," Murawsky notes. "Those who were treated and released did not necessarily complete the evaluation process."

Because Las Vegas is a prominent tourist area, it is not unusual for the hospital to treat patients from other regions, and this often requires coordinating with hospitals in other states. However, Murawsky notes that this was an added challenge in the wake of the mass shooting because so many patients were not local. Nonetheless, Murawsky explains that the hospital regularly practices for mass casualty events that may involve a large number of tourists.

"We do both table top preparedness exercises on MCI [mass casualty incidents], simulating a large [number of] casualties, and also annually plan for and execute a New Year's Eve emergency preparedness response to meet the influx of emergency issues among revelers each year," he says.

Murawsky anticipates that there will be many lessons to incorporate into these exercises from the massive response to this unprecedented event, but that will take some time. "At present, we are focused on the healing of our patients and staff," he says. "A structured review will be completed and coordinated across the community to ensure that others benefit from our experience."

## Consider Geographic, Travel Challenges

University Medical Center of Southern Nevada (UMCSN), the state's only level I trauma center, received 104 patients the night of the shooting, creating multiple challenges

for staff. For instance, **David Obert**, DO, the assistant medical director of the ED, immediately headed to work when he heard about the shooting by phone from a colleague, but he ran into obstacles related to law enforcement's response to the incident.

"The biggest issue was that they were setting up roadblocks throughout the city, so it was actually very difficult for me to get to the hospital," he recalls. "I had to go through several roadblocks, show them my ID and tell them where I was going, and I was able to get through." However, traveling to the hospital took extra time, and other staff faced similar challenges, Obert notes.

Other difficulties stemmed from the unique organizational layout at UMCSN. "We have a freestanding trauma center, which is in a completely separate building," Obert explains. "It has 11 trauma bays, and then attached to that is a CT scanner, an angio suite, three operating rooms, and then the trauma ICU."

Separate from the trauma center is an adult ED with 55 beds. Three floors up is a pediatric ED. Although the resources are plentiful and state of the art, the layout was confusing to arriving patients, many of whom had to be transferred between the trauma center and the ED, depending on what their needs were.

"The medics know where to go, but it is different for people coming in private vehicles," Obert observes. "They just see an ED and don't differentiate because most places don't have their own separate trauma center."

## Familiarize Staff With Resources

The night of the shooting, the initial patients were triaged through the adult ED, and then if needed, trauma

## EXECUTIVE SUMMARY

Hospitals in Las Vegas scrambled to respond to the deadliest mass shooting in U.S. history after a gunman opened fire on a large crowd attending a music festival on Oct. 1, which left 59 people dead and more than 500 injured.

- Sunrise Hospital and Medical Center received 180 patients, including 124 with gunshot wounds. The incident command structure was used to mobilize staff and supplies and to ensure protocols were enacted to manage security as well as the visitors and family affected by the tragedy.
- With so many patient arrivals, the hospital quickly bypassed standard registration processes, moving instead to a system it uses in mass casualty situations to capture an alias on every patient treated.
- University Medical Center of Southern Nevada (UMCSN), the state's only level I trauma center, received 104 patients from the shooting, creating multiple challenges for staff. The hospital maintains a separate, freestanding trauma center, which offers advantages in expediting care to critically injured patients. However, patients arriving by private vehicle presented to both the trauma center and the adult ED, necessitating triage operations in both locations as well as continuous travel between the two buildings as patients were transferred to the appropriate location.
- Providers rushing to work to care for victims of the shooting ran into roadblocks set up by law enforcement, in some cases delaying their arrival to UMCSN.
- Providers emphasize the importance of developing a versatile emergency response process that can be deployed in any type of mass casualty event.

then was alerted. However, it wasn't long before truckloads of people began arriving at the trauma center. To manage the influx, there needed to be an immediate operative intervention on both ends to ensure that patients were directed to the right facility for their needs, Obert explains. "Patients were crisscrossing back and forth, and, unfortunately, there is some geographic distance between these departments."

Patients with local extremity wounds showed up to the trauma center, and the majority of these patients would get transferred to the adult ED.

"We set up a receiving area in the PACU to do secondary triage on people who just showed up on the doorstep so that we could find out who needed to go straight to

the operating room and who could be delayed and then transferred [to the adult ED] and get an extremity evaluation and management," Obert explains.

When Obert arrived at the hospital at 11:15 p.m., he went to the trauma center.

"At that point, a car load of four or five patients showed up. They all had extremity wounds, so I basically followed all of those patients, went over to the adult ED with them, and then assisted in the care of all of them," he explains. "I then found another eight patients who had extremity wounds that I helped to manage [in the adult ED]."

Another challenge of operating separate trauma and ED buildings is that staff members tend to be familiar with one area or another, but not

necessarily with all areas. This became evident the night of the shooting.

“We had an onslaught of help, but there was a lack of familiarity with where resources were,” Obert observes. “There is not much cross-over between the nurses that work in pediatrics or work in the adult ED or work in trauma. They typically focus on one of those three areas.”

As a result, when clinicians ran out of chest tubes or other needed supplies, staff didn’t necessarily know where those resources were stored, so it would take added time to track them down.

“That was a bit of an issue because we had a lot of people to help, but they didn’t have familiarity with what was there.”

## Take Advantage of Military Training

Another issue that arose was a lack of some basic supplies such as tourniquets and chest seals, things that typically are not used in the ED. “It is very rare that we put a tourniquet on in the department. We will put a blood pressure cuff on, but when you have 20 people with arterial extremity wounds that are all heavily bleeding, you don’t have 20 blood pressure cuffs,” Obert notes.

Consequently, a lot of the equipment emergency staff members were using was coming from first responders. “Our physicians who support the police department have actually built kits for [first responders] to use on scene, so we ended up using a bunch of those kits,” Obert recalls. It is one issue that definitely will be addressed in the post-event analysis, he adds.

Given the fact that patients were triaged to two separate buildings, good communication between the ED and the trauma unit was

important. In fact, the hospital’s emergency planning calls for the availability of two-way radios, but this aspect did not go as smoothly as intended, Obert observes.

“Once they set up the incident command center and started going through the equipment, they discovered some technical issues,” he explains. “The equipment is checked every once in a while, but some of it was not properly charged.”

Clinicians were able to work around the problem by using telephone communications, but it is an area that clearly can be improved, Obert adds.

**FURTHER, IN THE MIDST OF THE CRISIS, IT WAS UNCLEAR HOW MANY PATIENTS WOULD BE ARRIVING, WHICH MADE DECISIONS ON HOW TO REGISTER PATIENTS DIFFICULT.**

While the distinct geography of the trauma center presented some obstacles, Obert stresses that the center is uniquely designed to respond quickly to patients with severe injuries, which certainly proved advantageous for the seriously wounded the night of the shooting.

“You have proximity to a CT scanner, you have proximity to an angio suite and to the operating rooms,” he says. “Someone can

be offloaded from a rig, get an evaluation, and get to the operating room within a few minutes, which is a pretty phenomenal process.”

As is often the case, military training proved invaluable in the hospital’s emergency response. In particular, a physician assistant’s military instincts kicked in and he took charge of the triage process, labeling patients with their injuries when they arrived. The approach deviated a bit from the hospital’s mass casualty training process, but it worked, Obert notes.

“He actually did probably 90% of the triage and he was phenomenal because he was just very focused,” he says. “He was the one directing who was going to stay in trauma if they were shot in the chest or the belly or had a significant wound that required tourniquets and things of that sort. If not, he was directing patients to the adult ED or the PACU.”

## Consider Paper Registration

While mass casualty practice drills certainly make a difference when the need arises to activate emergency plans, the magnitude of this event was overwhelming, Obert notes.

“You can drill for anything, but it is not the same when it is real time and there is real emotion and stress,” he says. “And, of course, it happened when [we were] not expecting it — 10:30 on a Sunday night, which isn’t characteristically a big trauma night.”

Further, in the midst of the crisis, it was unclear how many patients would be arriving, which made decisions on how to register patients difficult.

In the end, staff used electronic medical records (EMRs) to register patients throughout the night, which wasn’t necessarily the best option.

“They didn’t know how many patients to expect, so they went from a few patients to 50 patients within an hour,” Obert relates. “They actually pulled in registration people from all over the place, and they were out there meeting patients on the curb and were doing bedside registration as soon as the patients arrived.”

Switching to paper registration might have been more expedient, Obert observes. The hospital maintains preprinted packets for this purpose, but it was not prepared to intake 50 patients at once.

“We use paper registration for people who are suffering from a stroke or a heart attack, so some of our post-event [analysis] is that we need to have at least 100 pre-printed labels, tags, and charts,” he says. “To me, the biggest issue was the fact that we were bouncing patients from department to department and having them followed. And, unfortunately, EMRs aren’t that user friendly, so no matter how good they are, when we have three separate locations, it becomes a challenge of patient tracking.”

Despite all the challenges, Obert gives the staff high marks for their emergency response.

“They handled the incident very well,” he says. “I felt comfortable leaving at 3:30 a.m. because most of [the patients] had already been there, people were taken care of, and we were discharging a lot of people,” he says. “The patients that needed to be there emergently were there, and the rest had already been admitted or seen by consultants.”

However, even a day or two after the incident, patients from the incident continued to present to the ED.

“We were getting transfers later on, and people eventually turned up who had injuries sustained from the stampede,” Obert notes. “People were stomped on and people hit their

heads and had skull fractures, so there were some secondary effects from [the mass shooting]. And then we started getting influxes of people with degrees of PTSD [post-traumatic stress disorder] and anxiety.”

Even people who were not at the festival where the mass shooting occurred were developing symptoms, Obert explains.

“IT IS A MATTER OF PREPARING FOR A PROCESS THAT IS GOING TO WORK IN ANY CIRCUMSTANCE, AND NOT JUST MASS CASUALTY SHOOTINGS.”

“We are still seeing people who are extremely traumatized by some relation to the event, the location or something else that happened in their life. This has reactivated something,” he says. “We are seeing those kinds of patients all over [Las Vegas] Valley now.”

## Develop a Versatile Process

Some members of the hospital staff are experiencing a degree of emotional fallout from the event.

“We still have counselors [on site], and there are some people where there has been more of a delayed impact,” Obert explains. “We see things on the news all the time about patients that we have taken care of, but this has been of such great

magnitude that it is overwhelming.” However, the gratitude shown by the community has been a huge positive, Obert stresses.

“We are getting deliveries of food and gifts every single day still,” he says. “I have been in Las Vegas for 12 years, and I have never seen an outpouring from the community like anything close to this, so it’s pretty phenomenal. They have done a lot to support the nurses and the physicians and the first responders throughout the city.”

While the shooting event on Oct. 1 was unprecedented in scope, mass casualty events are not uncommon in Las Vegas, Obert says. He recalls one recent incident in which a woman who apparently had some type of psychiatric issue drove down the side of the street, running over several people.

There also have been several deadly fires in recent years. Hospital staff members know they need to be prepared.

“Unfortunately, something like this is going to happen again in Las Vegas. We just don’t know to what degree, and that is the challenge,” Obert laments. “It is a matter of preparing for a process that is going to work in any circumstance, and not just mass casualty shootings.” ■

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# Electronic Tool, Clinical Judgment Replace Electronic Severity Index Triage System

*Investigators note that the solution uses machine learning to adapt to the unique characteristics of individual EDs, patient populations*

The emergency severity index (ESI) is widely used in triage to determine the acuity level of patients so that care for the sickest patients, the level 1s and 2s, is expedited while the level 4s and 5s are deemed safe to wait. However, is there a better approach to triage that takes full advantage of IT without adding any time to the equation?

Investigators at Johns Hopkins University School of Medicine (JHUSM) think they have developed just such a method in e-triage, a tool that has been implemented fully at

Johns Hopkins Hospital for more than a year and is in the process of being implemented at other sites, too.

The primary impetus for the tool was to mitigate the negative effects of crowding, a problem that presents implications for patients with time-sensitive needs, explains **Scott Levin**, PhD, an associate professor of emergency medicine at JHUSM. “When their care is delayed, that can result in a worse outcome,” he explains. “But [e-triage] was also developed to improve satisfaction, mainly for the lower acuity group that is being

queued and waiting for resources that [these patients] may not need.”

## Differentiate Patients

While ESI is intended to differentiate patients based on acuity, Levin notes that investigators found that nearly 70% of patients who present to EDs in the Johns Hopkins system were categorized as level 3.<sup>1</sup>

“When 70% of patients are in the same bucket, you are not really [differentiating],” he says. In fact, the group of level 3 patients typically includes a mix of people, some of whom are very sick and may end up in the ICU or even die during the encounter, as well as patients who are not as sick and will be discharged within two hours, Levin observes.

“That is where we started from [in developing e-triage],” Levin explains. “And what we did is develop a decision-support tool that looks at predicting patient outcomes. The predicted risk of these outcomes is what supports a triage nurse’s decision.”

When a patient arrives and is seen by a triage nurse, the nurse will gather all the same triage information that he or she would gather with ESI, including the chief complaint and all the patient’s vital signs. “Once the nurse enters all of that information into the EMR [electronic medical record], the e-triage machine learning algorithm will issue back a triage score on the screen,” Levin explains.

The score is derived from an analysis of hundreds of thousands of patient records to calculate the

## EXECUTIVE SUMMARY

Johns Hopkins Hospital in Baltimore has adopted a new decision-support tool that enables nurses at triage in the ED to better differentiate patients based on acuity level. The electronic tool, dubbed e-triage, is able to quickly factor in a patient’s medical history, vital signs, and chief complaint, and compare this information to thousands of other patients. The tool delivers a recommended acuity score, ranging from 1 to 5. Triage nurses choose to accept the e-triage score or override it based on their observations and clinical judgment. The approach has replaced the emergency severity index (ESI) system, which is used widely in triage in EDs across the country.

- Investigators at Johns Hopkins School of Medicine developed e-triage to mitigate the negative effects of crowding.
- Although ESI is intended to differentiate patients based on acuity, investigators found that close to 70% of patients who present to EDs in the Johns Hopkins system were categorized as level 3, a group that typically includes very sick patients who will wind up in the ICU as well as patients who will be discharged within two hours.
- The e-triage tool has reduced the level 3 group to 50% of patients. It has also increased the number of patients categorized as level 4 and level 5 by 10%.
- In practice, 85% of the time the triage nurses agree with the score recommended by the e-triage algorithm, and 15% of the time they will override it.

patient's likelihood of dying, going to the operating room for an emergent, time-sensitive intervention, going to the ICU, or being admitted to the hospital. If the patient is at high risk for any of those outcomes, that will translate into the recommended triage level, Levin says. The triage nurse can either agree with the score that the algorithm is recommending or override it based on clinical judgment. For instance, while the algorithm can quickly factor in a patient's full medical record and compare it to thousands of other patients, it cannot assess the patient's appearance. In practice, 85% of the time the triage nurses agree with the score recommended by the e-triage algorithm, but 15% of the time they will override it. In those cases, triage nurses will record in the system why they overrode the recommended score.

"Through that feedback, over time we have developed and evolved the system," Levin notes.

## Expedite Triage Decisions

During the 12 months that e-triage has been in use at Johns Hopkins Hospital, the group of level 3 patients has been reduced from 70% of all patients to 50% of all patients.

"We have also been able to increase our level 4s and 5s," Levin notes. "The patients that are fast-tracked are routed differently through the ED [because they do] not need a bed or as many resources or as much of a workup. We have increased those fast-track patients by about 10%."

The level 1s and 2s are identified at a higher rate, too, expediting care to these patients. "We have gotten them out of the level 3 bucket ... which is good because [the level 1s and 2s] don't really wait, and there is evidence

that in these types of patients, if they wait they can deteriorate," Levin says.

Of course, physicians can later upgrade or downgrade a patient's acuity level once there is more information, but Levin maintains that e-triage represents a more outcomes-based way of distributing patients up front without adding any time to the process. In fact, triage now takes less time than it did before with ESI, Levin observes.

**DURING THE 12 MONTHS THAT E-TRIAGE HAS BEEN IN USE AT JOHNS HOPKINS HOSPITAL, THE GROUP OF LEVEL 3 PATIENTS HAS BEEN REDUCED FROM 70% OF ALL PATIENTS TO 50% OF ALL PATIENTS.**

"Triage should take, at most, five minutes, and we've gotten it down to less than that," he says, noting that this is the case even with the additional rigor that is applied to the process. "Nurses generally don't have time to look through the patient's medical history or anything like that. They may glance at the variables. But what this tool does is actually search through [a patient's] entire medical history, so it searches their problem list and their medical/surgical history, and it [considers] the vital signs and the chief complaint. It compares that information with all of the patients that are in the same hospital."

The result of implementing e-triage has been a 40% shift in how patients are distributed, Levin observes. For example, a young patient who arrives complaining of abdominal pain might have been triaged to a level 3 under ESI, but with all the information that is considered by the algorithm, such a patient might be considered at higher risk for appendicitis and triaged to level 2 with e-triage, he observes.

In another example, a young patient with a headache who might have been triaged to level 3 and designated to wait several hours for a bed under ESI might be triaged instead to level 4 where the patient will not require a bed and can be expedited through the fast-track area.

One significant change that Levin has noticed since Johns Hopkins Hospital began using e-triage is that elderly patients tend to be triaged differently than when ESI was used. "Using this tool, they are triaged to a higher acuity level, we believe, appropriately because it is in line with the evidence," Levin says.

## Encourage Feedback

Long before implementing e-triage, Levin worked with a core group of triage nurses who reviewed the tool and offered feedback, explains **Heather Gardner**, MSN, the program manager of clinical informatics for the ED at Johns Hopkins Hospital. "After these five or six people used the tool for a while, Scott came to the triage meetings to explain what the tool is and how it works," she says.

Nurses continued to provide feedback as the tool was refined further.

"We were familiar with the tool, but it was a slow implementation,"

observes **Sophia Henry**, MS, RN, the adult ED triage coordinator at Johns Hopkins Hospital. “We were hesitant to start using e-triage because, for us at Hopkins, getting to be a triage nurse is indicative of [having] great clinical skills ... and we were concerned about whether or not this machine learning program would eliminate the need for triage nurses to even be present.”

However, the nurses realized early that the process worked best when the e-triage tool was paired with a skilled clinician.

“[The tool] will give you an acuity, but it doesn’t see the patient, so from the computer’s perspective a patient might be a rock-solid 4, but we are looking at the patient and see that the patient is sicker than [a level 4], so we have the ability to change the acuity,” Henry explains.

In fact, using the new tool has helped the triage nurses feel more comfortable designating patients level 5, something they rarely did when using ESI.

“Before we went live with e-triage, we had less than 1% of patients at level 5 acuity. Now, almost 10% of our patients are level 5,” Gardner notes. “It made a huge jump in the number of patients that are in that lower acuity bucket.”

It definitely took some time to make the switch from ESI to the e-triage tool, but the nurses have come to trust the new approach, Gardner observes. Henry agrees, noting that she was a late adopter.

“I was very resistant to starting this, and I love it now,” she says.

## Customize to Fit Needs

While the algorithm in place at Johns Hopkins Hospital is working well, it likely would not translate

directly to another ED because every ED is different, Levin observes. “They all have unique objectives and unique patient populations,” he says.

However, the e-triage tool is designed to adapt to such differences. “That happens through the machine learning aspects of this,” Levin adds. For instance, two other hospitals in the Johns Hopkins system that are in the process of implementing e-triage, Bayview Medical Center in Baltimore and Howard County General Hospital in Columbia, MD, are working with algorithms that are built and

IN FACT, USING THE NEW TOOL HAS HELPED THE TRIAGE NURSES FEEL MORE COMFORTABLE DESIGNATING PATIENTS LEVEL 5, SOMETHING THEY RARELY DID WHEN USING ESI.

tuned to those facilities.

“At Howard County General Hospital, if you come to the ED by ambulance, you are a pretty sick patient relative to the rest of the patients they see,” Levin explains. “If you come to Johns Hopkins Hospital by ambulance, you may not be that sick. You may have used the ambulance as a mode of transportation to get to the ED to get some food to eat, so the meaning of the ambulance is pretty different to the physicians and the clinicians practicing at those facilities.”

The patient populations exhibit different characteristics as well. For

example, Levin notes that Johns Hopkins Hospital sees a lot of patients with substance use problems as well as social and psychological issues. The conditions that people present with at Howard County General Hospital tend to be different, and the algorithm must adjust to those, he says.

Levin acknowledges that well-functioning EDs that have been able to minimize waiting have no need for a tool like e-triage because everybody gets the care they need right away, but he observes that for many EDs, problems like crowding and waiting have only gotten worse in recent years.

“The reality is that something like 80% of EDs will report that they are chronically crowded ... and these triage decisions have to be made.” ■

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# Two-stage Screening Tool Improves Identification of Young Sepsis Patients in ED

*An electronic alert is paired with screening questions and a sepsis huddle to improve accuracy, reduce alert misfires*

Identifying sepsis is always complex, but there are additional challenges involved with recognizing the life-threatening condition in children. “What is normal in terms of vital signs changes by age, and so you have to think about a child as he or she relates to other children their age,” explains **Fran Balamuth, MD, PhD, MSCE**, an emergency physician at Children’s Hospital of Philadelphia (CHOP). “Then, secondly, children are more likely than adults to present in compensated shock, meaning that their low blood pressure or hypotension often happens late in the episode of sepsis.”

Consequently, clinicians often struggle early on to find signs of compensated shock such as tachycardia, altered mental status, or restlessness, but many of these signs also are common in children who do not carry sepsis, Balamuth offers.

“Healthy children with fevers who do not have septic shock often present with tachycardia, so finding the ones among all those patients with compensated shock is a big challenge,” she says.

When CHOP’s sepsis quality improvement program first put a sepsis protocol in place, it purposefully did not include any sort of vital sign-based electronic alert because investigators were concerned it would misfire too often, resulting in alert fatigue.

“We treated patients on the protocol when we were clinically concerned about them, but there was no sort of screening tool,” Balamuth explains.

However, during the first few years of using that method, investigators observed that they were missing cases of sepsis. “There were some patients ending up in the ICU with severe sepsis and septic shock that we had not identified in the ED,” Balamuth notes. “We decided that maybe it was time to reconsider whether an electronic tool would help us, but we were still concerned about the alert fatigue issue, so we decided to look at it in an evidence-based way.”

Investigators decided to examine a potential alert retrospectively in 18 months of patients who presented with fever in the ED to see if the alert would have helped to define the patients with sepsis whom clinicians had

missed in real time. “The electronic alert did help us find those patients — almost all of them, so based on that data we decided to implement a prospective alert,” Balamuth explains.

## Guard Against Alert Fatigue

To prevent the alert from triggering the sepsis protocol on too many well patients, there is a two-stage process involved.

“The first stage of the alert fires for abnormal vital signs, so either a high heart rate based on age, or for low blood pressure based on age, and this alert goes off in about 10% of the ED

### EXECUTIVE SUMMARY

Investigators at Children’s Hospital of Philadelphia have developed a two-stage process to better identify children with sepsis while also minimizing alert fatigue. The approach includes an electronic alert tool that flags children with abnormal vital signs, but includes screening questions that enable clinicians to eliminate patients with no sign of infection. This approach is paired with a sepsis huddle to bring clinician judgment into the equation.

- The first stage of the alert fires for abnormal vital signs, so either a high heart rate based on age, or for low blood pressure based on age. This alert goes off in about 10% of the ED patient population.
- A series of three screening questions eliminates some patients from sepsis consideration, reducing the number of patients with potential sepsis to 1% of the ED population.
- If a patient with an abnormal vital sign exhibits an abnormal mental status, a high-risk condition, or an abnormality in perfusion, that prompts the second stage of the alert to go off, triggering a sepsis huddle bedside.
- The two-stage process has brought the number of young patients with missed sepsis diagnoses in the ED from 17% to 18% before the process was implemented down to the 4-5% range.

patient population,” Balamuth says. For patients identified as exhibiting one or both of these abnormal vital signs, the nurse then has to answer whether the patient’s abnormal vital sign is due to possible infection.

“If the child’s heart rate is high because he or she has a broken leg or some other non-infectious reason, then the nurse can just click the alert away and does not have to answer any additional questions,” Balamuth says. “However, if the heart rate is high because of a potential infection, meaning that the patient either has a fever or there is some other reason to be concerned about infection, then this prompts the nurse to answer two additional screening questions.”

The first question asks whether the patient has any underlying conditions that may put him or her at risk for sepsis such as a history of cancer or a central line. The second question asks about the patient’s capillary refill time to assess perfusion, Balamuth explains. In addition to these questions, the alert factors in the patient’s mental status, which is assessed on all patients at triage.

“If the patient has an abnormal mental status, a high-risk condition, or an abnormality in perfusion, then that prompts the second stage of the alert to go off,” Balamuth notes. “And that leads to what we call a sepsis huddle, where the senior team is brought to the bedside to [make a decision on] whether this patient needs to be treated for sepsis or not.”

The sepsis huddle is triggered in 10% of patients who pass through the first stage of the alert, or roughly 1% of the patients who present to the ED, Balamuth explains.

“We are pretty happy that we don’t have to screen every patient who walks through the door, and that we can make an initial cut based on vital signs,” she says.

Further, while the approach isn’t perfect, it works well. “Before we put the alert in place [in May 2014], we were missing 17% to 18% of patients with sepsis,” Balamuth says, explaining that investigators define a missed patient as any patient who requires ICU care with sepsis or septic shock within 24 hours of an ED visit in which the patient was not treated with the hospital’s sepsis protocol. “We have been able to reduce that number to less than 4%, and we have been able to largely sustain that. So, over the past three years we have been in the 4% to 5% range [of missed sepsis diagnoses].”<sup>1</sup>

## Involve All Stakeholders

Balamuth acknowledges that changing behavior in a big, busy clinical setting is always challenging, but she notes that implementation of the alert tool was aided by the fact that the approach was developed by a multidisciplinary team.

“It included physicians, nurses, and nurse practitioners, and we all came up with this [approach] together, so the team-based approach really helped us on the implementation side,” she says. “We each had our stakeholder groups that we could get engaged with the process.”

Effective implementation required some learning time. For instance, at first, many of the nurses would immediately say no to the first question in the alert regarding whether they were worried about infection in the patient because they interpreted it to mean whether they were worried about sepsis rather than infection, Balamuth observes.

“We had to do some targeted educational interventions to make them understand that there is a low

bar to answer the three questions,” she explains. “The combination of repeated educational interventions and having a big team of people that were respected in the ED and that worked well together — these are probably the biggest things that helped with implementation.”

**Mary Kate Abbadessa**, MSN, RN, RN-BC, CPEN, a clinical nurse specialist fellow with the sepsis program at CHOP, agrees that gathering everyone at the beginning of the process helped mitigate barriers.

“Our nursing informatics champion was able to really look through all of the little caveats of documentation and nursing workflow,” she says. “Each person [on the multidisciplinary team] could really speak to how to best implement the tool, and what would be their own potential barriers.”

When key stakeholders are missing, decisions often are made without a full appreciation of the implications for another group, Abbadessa observes. “Also, if you are not at the table, then you are less likely to want to buy into a change if it is negatively impacting your workflow.”

With new personnel constantly rotating in and out of the ED, the multidisciplinary sepsis group focuses its ongoing educational efforts on what Abbadessa terms “the constants.”

“We do have rotating residents, so our constants are our nursing staff, our tech staff, our attendings, and our nurse practitioner group,” she says. “Really having them champion the tool is quite effective, and it helps to ensure that each one of those groups understands their own role so that they can coach the others.”

Abbadessa adds that close and regular follow-up on all the personnel involved with implementing the alert tool is essential to ensuring sustained improvement. “Especially in large

institutions, there can be misunderstandings or miscommunications on how to use a tool,” she says. “Providing one-to-one feedback to make sure all the staff know how this can positively impact patient care and ease their workload can help to increase their use of the tool. Monitoring compliance and giving quick, direct feedback will help to get it running more quickly.”

A key benefit of the two-stage sepsis alert tool is that it helps to get patients to their final destination safely and in the most efficient manner, Abbadessa offers.

“We have gotten really great at identifying these patients [with sepsis], getting them straight back to a room, and having all the providers there at once at the bedside, prioritizing their care,” she says. “For our sickest patients, that means identifying them, getting their fluids and antibiotics in quickly, getting their bed request in, and getting that report to the next team that will care for them as quickly as possible.”

## Monitor Compliance

Fortunately, CHOP put solid data infrastructure in place so that key metrics can be monitored continually. “There is an application called ‘quick view’ that is updated every day, and helps us track our performance across a number of different QI [quality improvement] projects,” Balamuth explains.

For sepsis, the team tracks how quickly patients are getting antibiotics and fluids, and the number of patients with sepsis that were missed. “We have a QI team that meets monthly in the ED to see how things are going and talk about how we can improve,” Balamuth shares. “If we have a bad month or a bad week,

we will do targeted education to the entire ED at our divisional meetings, and we send individual feedback to providers if they have missed the mark.”

If a diagnosis of sepsis was missed or a patient had to wait too long to receive antibiotics, the team will send the provider a survey to try to identify structural steps that would help improve care for the future, Balamuth adds. The hospital is eager to share its findings with colleagues. To that end, CHOP is part of a large sepsis collaborative that aims to improve sepsis outcomes across more than 40 pediatric hospitals. In addition, investigators are in the process of implementing the approach in a community hospital to see how it works in that setting.

“We have a needle-in-the-haystack problem at CHOP. We see lots of kids and most of them are OK, and we are trying to find the ones that aren’t,” Balamuth explains. “But that haystack is even bigger when you are talking about a community site that is not a referral center for kids with complicated problems, so sepsis is even more rare in healthy kids than it is in sick kids. I think there are

probably some unique challenges at community-based sites.”

However, at any type of hospital or ED, Balamuth stresses that the electronic alert will only get one part of the way there in identifying sepsis.

“It still requires that bedside judgment to find some of those patients that the alert will miss,” she says. ■

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## CME/CE OBJECTIVES

After completing this activity, participants will be able to:

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## CME/CE QUESTIONS

1. **With so many patient arrivals the night of the mass shooting on Oct. 1, Sunrise Hospital and Medical Center in Las Vegas quickly bypassed standard registration processes, moving instead to a system it uses in mass casualty situations to:**
  - a. number every patient.
  - b. capture an alias on every patient treated.
  - c. not worry about patient identification.
  - d. None of the above
2. **At Johns Hopkins Hospital, the primary impetus for the development of e-triage was to:**
  - a. reduce the time devoted to triage.
  - b. reduce costs.
  - c. reduce the number of triage personnel.
  - d. mitigate the negative effects of crowding.
3. **In a two-stage sepsis alert tool in place in the ED at Children's Hospital of Philadelphia, the first stage of the alert fires for abnormal vital signs, so either a high heart rate based on age, or for low blood pressure based on age, and this alert goes off:**
  - a. in about 10% of the ED patient population.
  - b. in about 15% of the ED patient population.
  - c. in about 18% of the ED patient population.
  - d. in about 22% of the ED patient population.



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## Revised Standards on Pain Assessment and Management Reflect Concerns About Opioid Epidemic

*Experts note that patients must understand how to use opioids safely, and that getting to zero pain may not be realistic*

**A**fter a lengthy review, The Joint Commission's (TJC) newly revised pain assessment and management standards take effect this month for all accredited hospitals (<http://bit.ly/2igjxLK>). First implemented in 2001 in response to what many experts saw at the time as a large-scale problem in the under-assessment and treatment of pain, the new standards seek to address what is a growing national crisis — an opioid epidemic that causes an astounding 91 opioid overdose deaths every day, according to the CDC.

While TJC clearly recognizes that there were unintended consequences from the earlier focus on untreated pain, with the new guidelines, the organization is nonetheless striving to ensure that providers maintain their focus on effective pain control, but in a way that is consistent with safe opioid prescribing practices and mindful of the dangers posed by addiction to powerful pain medications.

### Take a Leading Role

Based on an extensive literature review, field research, public comment period, and consultation with a technical advisory panel and a standards review panel, TJC's revised

guidelines call on hospitals to make safe opioid prescribing an organizational priority by establishing a leader or leadership team that will develop metrics and regularly monitor performance improvement in opioid prescribing.

While many EDs have already developed their own improvement programs in this area, **Stephen Cantrill**, MD, an emergency medicine physician at Denver Health and chair of the opioid guideline writing panel for a clinical policy review on the prescribing of opioids for adults published by the American College of Emergency Physicians (ACEP) in 2012,<sup>1</sup> stresses that emergency physicians must be involved in any new leadership efforts undertaken by hospitals.

"Pain is a major component of what we do in emergency medicine," Cantrill says. "Emergency medicine needs to be involved certainly in the hospital aspects of this. They need to have an active voice and make sure that what

the hospital proposes is consistent with what is achievable."

### Consider Alternatives

The revised guidelines direct hospitals to provide non-pharmacologic pain modalities, where appropriate. These

THE NEW STANDARDS SEEK TO ADDRESS WHAT IS A GROWING NATIONAL CRISIS — AN OPIOID EPIDEMIC THAT CAUSES AN ASTOUNDING 91 DEATHS EVERY DAY.

may include physical modalities such as acupuncture or chiropractic services, relaxation therapy, and cognitive behavioral therapy. While it is not clear how TJC will evaluate hospitals on this requirement, many experts agree it is an area where emergency providers can make strides, although there is no question that pressure to expedite patients through the ED presents added challenges.

Speaking on behalf of the American Academy of Pain Medicine, **Michael Hooten**, MD, a psychiatrist and anesthesiologist who specializes in pain medicine at the Mayo Clinic, suggests that it is generally not feasible to deliver non-pharmaceutical, behavioral interventions for pain in a busy ED, although he notes that this type of care frequently is part of the infrastructure in pediatric EDs.

“I think in general what [TJC] wants is for a hospital system to have these [non-pharmaceutical] services available, and then for [providers] to apply them where they are clinically appropriate,” he says.

TJC’s guidelines state that when a patient’s desire for a safe, non-

pharmaceutical therapy cannot be met, hospitals should inform the patient about where such services can be provided.

Some pioneering EDs have developed comprehensive programs and goals aimed at providing patients with alternatives for pain. For instance, the ED at St. Joseph’s Regional Medical Center in Paterson, NJ, developed the Alternatives to Opiates (ALTO) program two years ago with the primary aim of using alternative therapies for pain such as trigger point injections, nitrous oxide, and ultrasound-guided nerve blocks whenever possible. While the ALTO program first targeted five common pain conditions, including renal colic, sciatica, headaches, musculoskeletal pain, and extremity fractures, the focus has expanded.

“We are now looking always for alternative options rather than just giving opioids,” explains **Mark Rosenberg**, DO, MBA, FACEP, the chairman of emergency medicine and medical director for population health in the St. Joseph’s Health System. “It is now the culture and

strategy of the department.” Rosenberg adds that the program’s reach has expanded beyond the ED to community partners and practitioners as well as the other departments in the hospital. “We are now setting up a multidisciplinary task force of all the major specialties,” he says. “We are driving the fact that we want to use alternative treatments for pain prior to using opioids, and everybody is on board.”

## Identify Resources, Programs

TJC’s guidelines ask hospitals to provide staff and licensed independent practitioners with a range of resources and programs so that they can improve their pain assessment and pain management practices. Such resources should cover how to use opioid medications safely based on the needs of the patient population served.

Related to this requirement, the guidelines direct hospitals to provide practitioners with the services available for the referral of patients with complicated pain management needs, and to identify treatment programs for patients with opioid use problems. While such recommendations make sense, they don’t address the fact that many communities do not have nearly enough resources for complex pain management or opioid treatment, Hooten observes.

“Another problem is just because I have a fantastic treatment center in Minneapolis doesn’t mean that my patient has the correct insurance or the ability to access [this center’s] care,” he says. “So, just because you refer somebody doesn’t mean they can gain access. Insurance status doesn’t gain you access to healthcare, especially substance use treatment

## EXECUTIVE SUMMARY

As of Jan. 1, 2018, The Joint Commission will judge accredited hospitals according to newly revised standards for pain assessment and management. The standards are intended to address some of the unintended consequences of a nationwide focus on the under-treatment of pain, reflected in earlier versions. The revised standards push practitioners to offer alternatives to opioids when appropriate, and to engage patients in treatment planning for their pain so that realistic expectations are established.

- The opioid epidemic causes 91 opioid deaths every day, according to the CDC.
- The new standards advise hospitals to make pain management an organizational priority with a leader or leadership team in place to set policy and monitor key metrics.
- Hospitals are advised to identify programs for complex management and opioid treatment, and to facilitate access to prescription drug monitoring programs.

and mental healthcare. Many of those services are carve-out types of businesses. It can be difficult.”

Cantrill agrees with these sentiments, noting that losing the Affordable Care Act, which is under threat in Congress, would be a “terrible blow” in this area, further restricting access to treatment programs. “This is a woefully under-served area of medicine,” he says. “It is under-supported and under-recognized.”

## Facilitate Access to PDMPs

TJC’s guidelines direct hospitals in states that offer prescription drug monitoring programs (PDMP) to facilitate both provider and pharmacist access to these databases. However, both Cantrill and Hooten agree that there needs to be considerable improvement in the functionality and usability of most PDMPs.

“I am in a chronic pain clinic, so I have staff who help [providers] access these very clumsy programs online. These websites are not slick. They are like using something from 2005. They are ... not very efficient,” Hooten relates. “I can imagine in an ED [using the PDMP] would be a real time-killer. You would almost have to have someone whose job was to monitor the database on every patient if you are going to prescribe opioids.”

Cantrill states that PDMPs are part of a very fractured system in which every state offers its own program. This makes it particularly difficult to access data on patients across state lines. “Every program is different in terms of who gets entered, in terms of the delay time that is allowed, and in terms of who gets access to the data,” he says. “It is a real mishmash.”

However, Cantrill notes that some states have started to implement functionality where pertinent data from the PDMP will be pushed to the patient’s electronic medical record (EMR) so that the provider will see the information automatically when he or she pulls up the record. This eliminates the burden of logging into a separate program and hunting for the information. Cantrill would like to see more states add such functionality and work together to make the PDMP data consistent across different states.

**“THIS IS A  
WOEFULLY UNDER-  
SERVED AREA  
OF MEDICINE,”  
CANTRILL SAYS.  
“IT IS UNDER-  
SUPPORTED  
AND UNDER-  
RECOGNIZED.”**

Hospital leaders must work with their clinicians to identify and obtain the equipment required to monitor patients who are at high risk for adverse outcomes from opioids, according to the revised standards. Respiratory depression is the most dangerous adverse event from opioid analgesics; however, the standards note that the literature does not point to a clear, optimal monitoring strategy. Therefore, the guidance suggests that such decisions should be left to the clinical team and their consultations with leadership on obtaining appropriate monitoring equipment.

The standards state that medical staff members must be involved in pain assessment, pain management, and the safe prescription of opioids

by taking part in the establishment of protocols and quality measures, and the ongoing review of this data. Along similar lines, the standards note that hospitals must define the criteria for the screening and assessment of pain that is consistent with a patient’s age, condition, and ability to understand. However, the standards allow that different care settings may require different assessment tools or methods.

In particular, the standards state that patients will be screened for pain during ED visits and at the time of admission. The reason for this requirement is to prevent the misidentification and under-treatment of pain, according to the standards.

When pain is identified, the standards state that patients should be treated with either non-pharmacologic or pharmacologic strategies or a combination of the two, and patients with complex pain conditions or addictions should be referred to appropriate providers.

## Engage With Patients

Treatment plans for pain should be based on evidence-based practices as well as a patient’s condition, medical history, and pain management goals, according to the standards. Further, the standards state that patients should be engaged in the treatment planning process. The reason for this requirement, in part, is so that realistic expectations can be set and education can be conveyed.

While emergency providers generally are pressed for time, such conversations are important, Rosenberg emphasizes. “We are responsible for managing pain in our patients, and the success of that has to be determined by the patient,” he says. “If I sit and talk about the goals for pain

care, and then talk about why I am giving the patient these treatment options, the patient will be much more satisfied, and I will be much more successful in managing the patient's pain."

Rosenberg, who also served as a member of the technical advisory panel for TJC's revised standards, notes that engaging in such a conversation is a big change from a few years ago when his goal in therapy was to get the patient to near zero pain.

"I could give the patient large doses of opioids for relatively minor conditions because I wanted to get him to zero pain, and I wouldn't think much of it," he says.

However, Rosenberg notes that now the conversation focuses on getting the patient to the point where he or she can perform the activities of daily living rather than getting to zero pain, and the patient needs to understand that.

"We can come to a better understanding. I may even send the patient home with some opioids and tell him that I don't want him to use them unless he has severe pain and can't sleep at night," he explains.

If the patient feels the need to take the opioids, Rosenberg will advise him or her to use the medication very cautiously. Rosenberg provides only a small number of pills, and then if the pills are not used within three days, he instructs the patient to dispose of them.

"I need to set the patient's pain goals to different expectations than we had years ago," Rosenberg notes. "This is probably more important than the pain medication that I prescribe." Talking to patients about their pain becomes a major part of their treatment, Rosenberg adds. "It is important to the patient, and it is important to me."

When treating a patient for pain, the standards direct hospitals to reassess the patient's pain, checking to see how the patient is responding to the treatment and progressing toward treatment goals. The standards note that the use of numerical pain scales is not sufficient to assess pain, and that a more important barometer is how the pain is affecting the patient's ability to perform basic functions, such as the ability to take a deep breath, turn over in bed, go to the bathroom, or walk, similar to the goals Rosenberg describes.

"CAN WE ALLEVIATE THE PAIN? YES. CAN WE GET TO ZERO? WE MAY OR MAY NOT BE ABLE TO, AND THAT MAY BE AN UNREALISTIC EXPECTATION."

The standards also direct hospitals to assess for any signs of side effects or risk factors associated with the treatment.

Upon discharge, patients and families should receive education relating to pain management, according to the revised standards. This should include direction on the pain management plan of care, side effects related to the treatment, and any actions or activities that could make the pain condition worse. The education also should address how to use and store any pain medication safely, and how to dispose of any opioid medications, if they are prescribed.

The standards also call on hospitals to collect and analyze data on

pain assessment and management. This should cover information about the types of interventions used and their effectiveness as well as the timing of reassessments. The standards state that a focus of analysis should be on identifying needed changes and steps to improve safety and quality.

Cantrill notes that while he is always concerned about placing new burdens on practitioners, he believes TJC's revised standards are moving in the right direction in terms of concerns about opioid prescribing.

"Part of it is an opportunity to broach the topic [with patients] that we may not be able to always make them pain free," he says. "Can we alleviate the pain? Yes. Can we get to zero? We may or may not be able to, and that may be an unrealistic expectation." ■

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