Clinical Emergency: Are You Ready in Any Setting?

ABSTRACT

Emergency equipment and supplies often are not readily available when a patient experiences a life-threatening emergency. The location of these clinical emergencies varies, but there is a common theme: lack of the correct equipment and supplies to optimally manage the emergency. There are three distinct factors of rapid response preparedness that must be addressed in virtually every clinical point of care area: (1) rapid access to functioning equipment and up-to-date supplies; (2) knowledgeable and trained staff to manage the clinical emergency; and (3) after systems are in place, maintaining a state of readiness to manage a clinical emergency at any time. The Pennsylvania Patient Safety Authority identified 56 reports over the course of a 12-month reporting period specifically related to emergency equipment; 35 reports referenced issues with emergency carts and 21 reports referenced issues with missing supplies or malfunctioning equipment during an emergency situation. Strategies for facilities to achieve preparedness include convening a team to evaluate the needs of the floor or unit, establishing a written plan, selecting appropriate equipment and supplies (e.g., automated external defibrillators, rapid response teams), training and educating staff, and maintaining a state of readiness (e.g., through mock drills). (Pa Patient Saf Advis 2010 Jun;7[2]:52-60.)

Introduction

The Pennsylvania Patient Safety Authority conducted a data review encompassing a 12-month reporting period (2008) to determine whether or not there may be an issue with event reports related to crash carts and missing or unavailable equipment, specifically during a clinical emergent or rapid response situation. The review identified 56 reports that highlighted emergency or rapid response situations in which supplies or equipment were missing or outdated. The locations of these incidents varied as did the types of medical emergencies (see Table 1), but the common theme was *lack of the appropriate equipment and supplies to successfully manage the emergency in a timely manner.* Reports identified issues such as incorrect size supplies, missing items, empty oxygen tanks, drained batteries on equipment, or unstocked or unlocked crash carts.

Analysis of the event reports submitted to the Authority and review of the literature identifies three factors of clinical emergency preparedness that warrant attention in virtually every clinical point of care area: (1) having rapid access to functioning equipment and up-to-date supplies; (2) having knowledgeable

and trained staff to manage the clinical emergency; and (3) once systems are in place, monitoring those systems to ensure that clinical staff maintain a state of readiness to manage clinical emergencies.

This article describes means to assess and evaluate the ability of a clinical setting or facility to manage a rapid response or a clinical emergency and offers specific strategies to improve preparedness. While much of the literature written about managing clinical emergencies deals with the office setting, many of the concepts are appropriate for a clinical emergency in any setting (e.g., inpatient unit, outpatient unit, other ambulatory setting in a hospital).

Evaluating Needs and Risk

The first step in assessing preparedness for a clinical emergency is convening an interdisciplinary team within the clinical area or department to review specific needs. This is important because there may be specific logistics, space, or staffing issues that need to be considered when planning for an emergency situation in a given clinical setting.

While published data may help identify areas of focus within an identified clinical area, physicians should be prepared to treat the emergencies most likely to occur within the patient population of the clinical area or department. For example, a clinical unit with many patients with epilepsy must be more prepared to treat seizures. Units with children or adolescents should have a wider range of equipment sizes as well as specific medications which may be more appropriate for this age group. Physicians should also prepare for any possible adverse reactions resulting from common procedures.[1]

The following questions can help evaluate the facility's ability to manage a clinical emergency.

1. What is the patient population and age range of the unit?[2]

2. What types of procedures are performed in the clinical area (e.g., invasive procedures, cardiac testing)?[2]

3. Are injectable drugs administered?[2]

4. How comfortable and skilled in emergency care are the physicians?[2]

5. Is staff trained in and competent to assist with emergency care?[2]

6. What equipment, drugs, and supplies are available? What additional equipment, drugs, and supplies might be required?[2]

7. Where are the supplies kept? How often are they inventoried and updated?[2]

8. What is the location of the clinical area in relation to emergency care at a hospital, and what is the typical response time for those attending the emergency?[2]

9. If the facility is located outside of a hospital, how long does it take the emergency medical services (EMS) in the area to respond?[3,4]

While the probability may be low of a life-threatening clinical emergency occurring in certain clinical settings, the possibility remains. For example, behavioral health and psychiatric units may be vulnerable to cardiac or respiratory arrest through coexisting physical illness, self-harm, and the effects of medication, including rapid tranquilization. These patients are also vulnerable to choking or aspiration associated with illnesses like dementia, food bolting, substance abuse, or intentional self-harm.[5] As clinical teams convene in these seemingly low-risk areas, having plans in place to manage the infrequent emergency may be a wise patient safety strategy. For hospitals in the United States, the Joint Commission states that "Resuscitation services [must be] available throughout the hospital." The phrase "throughout the hospital" is crucial. It implies that equipment, supplies, oxygen, and medical personnel must all be present and ready to respond to cardiac arrest—not just in emergency departments (EDs), intensive care units (ICUs), and wards but also in less acute areas, such as inpatient mental health facilities.[6] In many cases, facilities also must be prepared for clinical emergencies that may happen with family members or visitors.

Establishing a Written Plan

After evaluating the potential needs of a clinical area, the next step is developing or adopting a written emergency response plan.[7] Questions to consider about existing plans include the following:

- When was the last time the clinical emergency or rapid response plan had been reviewed?

- Do staff know that a plan exists; if so, do they adhere to it? Is it included as part of new employee orientation?

- Is the plan still current and appropriate for the clinical services and procedures that are performed on the unit?

For facilities accredited by the Joint Commission, there are requirements that speak directly to the provision of emergency services and the need for a written plan. When emergency services are provided at the hospital or one or more off-campus locations, the medical staff must have written policies and procedures for appraisal of emergencies, initial treatment, and referral of patients at the off-campus locations.[8]

The written plan should include clinical protocols, specific employee responsibilities during the emergency, and details on where and how the emergency care should be delivered. Written clinical protocols for clinical emergencies typically follow the "airway, breathing, circulation" model of emergency care taught in formal life support classes.[9] Additionally, protocols should account for the emergency skills of each employee and the assignment of each employee to specific responsibilities. Designating a location for the delivery of emergency care and for storing all emergency equipment is a good start to the planning process. If the layout of the clinical area makes this difficult, emergency equipment should be portable (e.g., on a rolling cart, within carrying cases) and stored in a common location.[9]

At a minimum, a written plan addresses equipment, supplies, medications, ordering and maintenance, emergency protocols, training and competency of staff, emergency drills, and assignment of responsibility for continued oversight of the process.[2] Consider the following aspects of a written plan:[10]

- How will staff notify others in the clinical area to a life-threatening emergency?

- Who will contact the code team, the rapid response team (RRT), or EMS?

- Who will bring the emergency supplies to the scene?

- If the patient requires a backboard, is staff trained and competent in how to position the patient?

- Who will initiate cardiopulmonary resuscitation (CPR)? Who will assist?

- Who will document the emergency? In what format is documentation supposed to occur?

- Who will take vital signs?

- What information should be provided to EMS, the code team, or the RRT? Who will assemble that information?

- Who will start an intravenous line, if necessary? Who will help set it up?

- Who will administer medications?

- Who will assist family members during an emergency?

- How will staff be educated about the emergency plan?

- How often will practice drills be conducted?

- Who is responsible for the supplies (e.g., inventory and maintenance)?

- Who will manage other patient needs on the floor during the emergency?

Since the written plan should include specific details about supplies, equipment, and medications to be used, the next step is to outline items that are needed for the specific clinical area and who needs to be involved in the selection process (e.g., hospital administration, pharmacy, central supply).

Table 1. Pennsylvania Patient Safety Authority 2008 Reports and Corresponding Failure Modes

LOCATION OF EVENT	DESCRIPTION OF REPORT	FAILURE MODE*
Cardiac intermediate unit	The crash cart defibrillator battery was dead. The oxygen tank was empty.	Failure to identify expired materials.
Cardiac unit	[There was an] expired code cart. It was not replaced until 24 hours later.	Code cart refurbishment does not occur after usage and will be missing essential items. No one responsible for delivery, maintenance, or refurbishment.
Cardiology—invasive	During code/intubation, staff found a suction canister on the code cart that was not functioning. Equipment services examined the suction apparatus and determined the regulator was broken. The equipment was removed from service.	Failure to identify expired materials.
	Ambu bags were missing from the code cart. Suction was not located in the proper place.	Incomplete list of items in the crash cart.
Cardiovascular/surgical intensive care unit (ICU)	Patient was in ventricular fibrillation. The defibrillator on the crash cart would not charge on paddles. The second defibrillator was readily available for use. The patient was successfully defibrillated.	Failure to identify expired materials.
Emergency department (ED)	Staff discovered [during a] check of crash cart drawer that only one epinephrine [injection was] used. Two epinephrine [injections were] ordered by the doctor. The patient was in cardiac arrest. [The patient arrived at] ED via ambulance. Patient was in ventricular fibrillation/asystole on arrival. Nurse involved was unable to reconcile discrepancy.	Crash cart refurbishment does not occur after usage and will be missing essential items. No one responsible for delivery, maintenance, or refurbishment.
	The crash cart was used for this patient during the night. The [ED registered nurse (RN)] never called for the crash cart to be replaced, and the open cart was not found until a code was called during the next shift. [There was an] issue of safety with a used crash cart open on the unit.	
	One of the crash carts in the ED was opened [in the afternoon] and the pharmacy was not called until [the following morning] to replace the cart. [There was a] safety issue with an open crash cart if it was needed for a true code. Policy states the cart is to be replaced after being opened for any reason.	
	During rapid response, a patient needed to be intubated and the intubation box had no stylet. The RN needed to go to another unit to get a box with a stylet. The patient's intubation was delayed five to eight minutes.	Incomplete list of items in the crash cart.
Medical/surgical/cardiac intermediate unit	An intubation 16 Fr stylet was unavailable on the code cart. A stylet was retrieved from another code cart located on floor. No harm [occurred].	Code cart refurbishment does not occur after usage and will be missing essential items. No one responsible for delivery, maintenance, or refurbishment.
	A code was called and the [code] cart was opened [during the morning] The floor [staff] did not call the pharmacy to exchange the open crash cart until [late afternoon]. [There was a] safety concern that an open, incomplete [code] cart was on the floor for several hours without being exchanged.	
	Code was called for this patient. [Staff] did not call to have the [code] cart replaced until [late afternoon]. Cart was not cleaned up before the exchange, and used needles and a blade were left lying on top of the cart. Medications were used also. [There was a] safety concern with a partial cart on the floor for five hours.	
	The orange resuscitation bag [was discovered] opened [during response] to a patient needing to be intubated. Propofol and succinylcholine missing from bag. Medications obtained and patient intubated.	
	A code was called and when the physicians went to place a central line, there was no central line insertion kit on the code cart.	Incomplete list of items in the code cart.
	A code was called. [There was] no monitor on the unit. The labor and delivery staff did not bring their monitor initially.	
	Reported inadequate supplies with rapid response called. The patient was transferred to the ICU.	

LOCATION OF EVENT	DESCRIPTION OF REPORT	FAILURE MODE*
(continued)	There was no adult bag valve mask in the [code] cart during a cardiopulmonary arrest resuscitation. The code sheets on the clipboard were in the utility room instead of on the cart. The appropriate equipment was obtained from ICU and utility room. The [code] cart was restocked with medications and supplies.	Personnel working off of different check sheets for inventory.
	There was a code situation, and the airway box was needed. The box was labeled with an expiration date that had past. Upon opening the box, there were no endotracheal tubes. The patient had to be bagged until the airway box from the ICU was brought out with the proper supplies in it.	Failure to identify expired materials.
Medical ICU	Code cart opened. All epinephrine boxes in drawer had needles on them. Not able to use.	Incomplete list of items in the code cart.
	The patient's heart rate was greater than 160 beats per minute and sustained. Following American Heart Association advanced cardiac life support guidelines, adenosine was [administered intravenously]. There was not adequate stock of adenosine in crash cart to give recommended protocol. The patient was transferred to the ICU and cardioverted. A normal heart rhythm was obtained.	
	During a code, staff found that [code] cart only had one size of Mac blade. The physician was aware.	
	The red respiratory box on the low side of code cart was found to be unlocked and dirty.	Code cart refurbishment does not occur after usage and will be missing essential items. No one responsible for delivery, maintenance or refurbishment.
Outpatient dialysis unit	The Ambu bag was pulled off the code cart; the bag was sealed. When Ambu bag was opened, there was no mask in bag. [Staff were] unable to use Ambu without mask. The patient needed to be resuscitated with a nonrebreather mask.	Incomplete list of items in the code cart.
	During a code, it was noted that the triple lumen tray was not on the code cart. [Staff] used dialysis needles until triple lumen tray was obtained.	
Orthopedic unit	A patient coded and the Ambu bag on code cart did not have a mask. The patient was intubated.	Incomplete list of items in the code cart.
Outpatient area	[The patient] became unresponsive. The rapid response team was called. The code cart was brought, but then taken away. Supplies to treat the patient, including intravenous (IV) supplies were not available.	Incomplete list of items in the code cart.
Pediatric unit	Yankaur, suction tubing, and IV tubing were missing from the crash cart during a code.	Incomplete list of items in the crash cart.
	The replacement crash cart lock was never locked when received from central.	Crash cart refurbishment does not occur after usage and will be missing essential items. No one responsible for delivery, maintenance or refurbishment.
Pharmacy	A code [occurred in early morning], but no replacement crash cart was available [and none were nearly four hours later]. Central [was requested] to page nursing director when one was ready. [This was the] second time [in a] week the issue occurred in which approximately three to four hours without a crash cart [available].	Crash cart refurbishment does not occur after usage and will be missing essential items. No one responsible for delivery, maintenance, or refurbishment.
Rehabilitation unit	A [patient] was transported to the hospital's outpatient rehabilitation unit for therapy. While in the rehab unit, the patient became unresponsive. A code was called. During the code, it was discovered that the oxygen on the crash cart could not be used because the spigot was missing. Other tanks in the unit were empty. The reporting facility amended the report to indicate that other oxygen tanks were available for use.	Incomplete list of items in the crash cart.
	[Cardiac] monitor was applied to patient but was not working properly [no rhythm]. Patient monitored by electrocardiogram machine until crash cart/monitor obtained. [There was] no delay in monitoring. The monitor was tagged and sent to central.	
Telemetry unit	Stylet was not replaced in crash cart after last event.	Incomplete list of items in the crash cart.

* Source of failure modes is as follows: Long EK. Crash cart standardization. 2007 Jan 31 [cited 2009 Apr 30]. Available from Internet: http://www.ihi.org/ihi/workspace/tools/fmea/ProcessDetailDataReport.aspx?ToolId=5431&ScenarioId=6443&Type=1.

Selecting Equipment and Supplies

When determining what equipment, supplies, and medications will be available in a clinical setting, consider how much medical intervention is appropriate to the setting.[2] The physician or department chair is responsible for deciding the level of emergency care necessary for the type of practice and what drugs and equipment to stock to deliver that care.[7]

Once the equipment and supplies have been selected, maintain them in a centralized container (crash cart or emergency box) in a location easily accessible to the clinical areas, and standardize the contents of each emergency supply box or cart.[2,7,9] Standardizing the equipment and medications contributes to a safe system by improving a number of logistic issues, including staff training, performance, error reduction, equipment maintenance and replacement after a crisis, and the institution's ability to revise medication and equipment resources for crises. Improving efficiency and reliability can reduce delays and errors and contribute to the primary goal of improving patient outcomes following a crisis event.[11]

In the hospital setting, supplies may be readily available (via designated locations for crash carts or code carts), but often the stocking and replenishing of these carts is done by another department in the hospital. To avoid shortages of supplies and equipment, the Joint Commission (in its Environment of Care standards) recommends a continual process to manage its inventory.[12] If the pharmacy or the central supply departments are involved with maintaining the emergency equipment and supplies for the clinical area, representatives should be involved in the needs assessment as well as be included as part of the written plan.

Use of Automated External Defibrillators

The American Heart Association's 2005 guidelines on emergency cardiopulmonary resuscitation recommend that hospitals consider the use of automated external defibrillators (AEDs) as a way to facilitate early defibrillation.[13] AEDs may be particularly helpful in areas where staff do not have rhythm recognition skills and would not be able to use manual defibrillators, as well as in areas where defibrillators are infrequently used. Healthcare facilities must ensure that healthcare workers and other staff who may activate AEDs are properly trained in AED use, that quality improvement processes are in place to monitor resuscitation efforts, and that AEDs are properly managed.[14] Many AEDs come with a routine maintenance checklist. This checklist should be used or incorporated into the overall facility/unit emergency equipment checklist. Checklist items may include noting AED visibility and proximity to a phone, verifying battery installation, checking the status and/or service indicator light, noting the absence of visual and/or audible service alarms, and inspecting exterior components and sockets for cracks.[15]

Training and Educating Staff

While many of the issues discussed in reports to the Authority may be resolved through written policies and increased accountability among staff members, staff training and education is an essential element to ensure staff readiness for a clinical emergency.

At a minimum, all clinical staff should be certified in basic life support (BLS). Consider the value of available personnel trained in advanced cardiac life support (ACLS) in settings in which high-risk procedures are conducted. All staff should be trained on the location and use of emergency supplies.[2]

A code team or rapid response team may be able to easily reach a patient in the hospital within the established time frame. However, patients at sites away from the main hospital building may be less accessible to a code team. Patient Safety Officers can work with their facilities to ensure that a process is in place to respond to cardiac arrest at all the sites that the hospital operates, including outpatient imaging centers, physician practices, and long-term care facilities. Staff at those facilities can be trained to provide CPR and activate an AED to respond to individuals in cardiac arrest.[14] Staff training can also include an overview of the campus (e.g., map) as well as knowledge of the different clinical areas within the facility.

One of the Joint Commission's National Patient Safety Goals (Goal 16)[16] addresses improving recognition of and response to changes in a patient's condition, since a significant number of critical inpatient events are preceded by warning signs. A majority of patients who have cardiopulmonary or respiratory arrest demonstrate clinical deterioration in advance. Early response to changes in a patient's condition by a specially trained individual may reduce cardiopulmonary arrests and patient mortality. The steps include the following:[16]

- Select an early recognition and response method most suitable for the hospital's needs and resources.

- Develop criteria for calling additional assistance to respond to a change in the patient's condition or a perceived change by the staff, the patient, and/or family.

- Develop a no-blame policy that encourages use of the early recognition system. Key champions including physicians must be involved to develop a collaborative culture.

- Based on the hospital's criteria, facilitate means for staff to seek additional assistance when they have concerns about a patient's condition.

- Conduct a formal training about urgent response policies and practices for the staff, licensed independent practitioners who may request assistance, and caregivers who may respond to those requests.

Table 2. Pennsylvania Patient Safety Authority Missing Items and Equipment with Suggested Action Plan, 2008

TYPE	ISSUE*	SUGGESTED ACTION
Airway	No Ambu bag available (2)	Include on crash cart inventory checklist
	Ambu bag missing mask (2)	
	No stylet in intubation box (3)	
	Bronchial set missing prisms	
	Missing blade sizes (2)	
	Airway box missing endotracheal tube and outdated	Include expiration date checks on inventory checklist
	No adult bag mask available	Make sure inventory checklist includes all required sizes
	No suction machine available on unit (4)	Identify locations/areas for accessible suction equipment
	Suction machine failed	Include testing of suction equipment during crash cart checks
	Oxygen tank empty	Include oxygen tank level checks as part of cart checklist
	Missing spigot on oxygen tank	Include all parts in oxygen checklist (tank, tubing, spigot)
Cardiac	Red respiratory box unlocked and dirty	Set frequency of box/cart checks
	Defibrillator paddle failed	Include testing of defibrillation equipment during crash cart checks
	Defibrillator did not have pacing capabilities	Consider purchase of defibrillation equipment with pacing capabilities
	Defibrillator battery dead (3)	Include testing of defibrillation equipment during crash cart checks
	Pacemaker wire and introducer mislabeled and not compatible	Include on crash cart inventory checklist
Medication	No monitor available on unit	Identify locations/areas for accessible monitors
	Cardiac monitor failed (goes blank)	Include testing of monitors during crash cart checks
	Intravenous (IV) pump channel failed to deliver medication	Include testing of IV pumps during crash cart checks
	No IV pump available	Identify locations/areas for accessible IV pumps (including backups)
	No IV tubing available	Include on crash cart inventory checklist
	No IV supplies available	
	No central line insertion kits available	
	No propofol or succinylcholine on cart	Include on crash cart medication inventory checklist
	Insufficient amount of adenosine on cart to comply with American Heart Association protocols†	
	No amphodextrose on cart	
	No vasopressin on cart	
	No triple lumen tray on cart	
	No epinephrine on cart	
	Mislabel ephedrine versus epinephrine	Educate staff on sound-alike, look-alike medications
	No atropine syringes available	Specify type(s) and dosages on the medication crash cart inventory checklist
	Wrong doses of epinephrine stocked on cart	
	Lack of knowledge in use of calcium glugonate	Include medication guidelines (dosage) in crash cart
Communication/Training	Busy signal when trying to call code blue (2)	Include testing of communication system as part of mock drill
	Code intercom announcement not heard in all units	
	Pagers did not notify all code responders	
	Inadequate training in an emergency	Develop and review training to a rapid response with identified staff
Other	Used medications found in crash cart	Include disposal of equipment/medications as part of postcheck following a rapid response
	Incomplete crash cart (not restocked after last emergency) (6)	Set time frames for exchanging and restocking crash carts within facility
	Unlocked cart (2)	Include locks with numbers as part of the crash cart inventory checklist

* Number in parentheses signifies the number of reports or the number of times that the issue was identified, if greater than one.

† The 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care are discussed in context in the main article.

Considering Rapid Response Teams

More than 3,000 hospitals—representing an estimated 75% of all U.S. hospital beds—have signed on to the Institute for Healthcare Improvement (IHI) 5 Million Lives Campaign, implementing six quality improvement changes in their facilities aimed at saving lives. One of the six measures is the advent of a RRT.[17,18]

Healthcare facilities and departments have found success in the use of RRTs to manage clinical emergencies. A RRT consists of ICU personnel who can be summoned to assess and treat any patient outside the ICU who shows signs of deterioration and who may be at risk for cardiac arrest or death. Team makeup varies, but often includes one or more ICU nurses, a respiratory therapist, and a physician who can be called upon when needed.[19]

Maintaining a State of Readiness

The final, and arguably most critical, step (based on events reported to the Authority) is putting systems in place that can ensure that all of the preceding steps are up-to-date and that the clinical area is in a state of readiness to manage a clinical emergency, no matter how infrequent, at any time.

Checking and Maintaining Inventory

Outdated medications or supplies on an emergency crash cart pose two problems: (1) the outdated medications or supplies can expose a delay in treatment if discovered when a clinical emergency arises, and (2) the fact that the equipment or supplies have not been regularly checked may result in additional problems such as malfunctioning or powerless equipment. In an ambulatory surgical facility, crash carts should be checked weekly (and include the disposal and replacement of outdated medications) and always after use in an emergency.[20] In the hospital setting, standards for checking vary and are governed by hospital policy. Checking and documenting the lock numbers of the emergency crash cart and testing the defibrillators can be done as frequently as every shift.

Nursing staff should check the carts and kits daily to ensure that seals are unbroken and all expiration dates are acceptable. This is often one of the first tasks to be abandoned at change of shift, when staffing tends to be short. Further, the monotony of checking without finding problems day after day often leads to a lackluster approach, increasing the chance that problems will be missed. Staff must be trained to review checklists properly and to conduct more thorough preventive maintenance periodically.[21]

Many facilities find it helpful to develop and use a standardized checklist for the crash cart. Designated staff members use this checklist to ensure that the emergency supplies and equipment are periodically monitored and evaluated. (A reprinted, sample checklist, titled "Emergency Crash Cart Checklist (2010)," is available from the Authority online at http://www.patientsafetyauthority.org/EducationalTools/PatientSafetyTools/Pages/home.aspx.)

As an example of an innovative way to manage emergency crash cart checking in a large institution, a Florida hospital developed a Web-based crash cart tracking system that enabled the nursing management team to remotely track and monitor which departments or units in the hospital checked their crash carts. This Web-based system replaced paper logs on each crash cart. In addition to monitoring the carts, monthly cart checks alert staff to any item near expiration, prompting the appropriate departments to change the medicines and supplies. The system sends the management team three notifications daily, beginning at noon, of which carts have and have not been checked. By 7 p.m., management can be assured that they are 100% compliant in checking the crash carts. The system also helps to identify the clinical areas where there are opportunities for improvement.[22]

Performing a Failure Mode and Effects Analysis

IHI hosts on its Web site a failure mode and effects analysis (FMEA) tool that addresses the risk of nonstandardized crash carts.[23] After considering these failure modes, facilities may develop policies to address the facility-specific failures of the crash cart system that may occur over time. As an example, Table 1 correlates events by location reported to the Authority with the failure modes identified in an FMEA posted on IHI's Web site.

Conducting Mock Emergency Drills

When properly conducted, mock drills allow the staff to practice all steps in the emergency protocol as well as individual lifesaving skills. Often, unanticipated problems with the protocol or medical equipment can be identified and corrected.[7]

In one study, 11 group pediatric practices participated, which were representative of urban, suburban, and rural offices in southwestern Pennsylvania. Ninety-seven of a total 164 (59%) physicians and staff members completed both pre- and postintervention surveys following completion of an emergency mock drill. Practitioner participants were analyzed in two groups. Group 1 consisted of physicians, nurse practitioners, and physician assistants; group 2 consisted of registered nurses, licensed practical nurses, and medical assistants. Comparison of pre- versus postintervention surveys in both of these groups revealed significant improvement in reported confidence to perform resuscitation skills that were included in the mock drill after the training.[24]

Mock drills may help hospitals nationwide improve dismal outcomes by focusing attention on fast action and the highly detectable events that lead up to such failures before they occur in real patients.[25]

Consider conducting an emergency or "mock code blue" at least twice a year so the staff remains familiar and comfortable with the protocol and equipment and the emergency response protocol can be evaluated for efficacy.[2] All staff on all shifts should be included in at

least one mock drill annually to ensure familiarity with emergency response protocols at all times.

Conclusion

Emergencies can and do occur, and being prepared for them requires an investment of time, effort, and resources. As is evidenced by the types and clinical locations of the Authority reports, emergencies can and do happen anywhere (Table 1). Even though the incidence of an emergency occurring in a given clinical area may be low, the risk to patient safety associated with not being adequately prepared or not managing one efficiently is high. Organization and planning are important for preventing chaotic emergency responses.[2]

Analyzing specific needs and types of emergencies that may occur in the particular department or clinical setting is an important first step towards determining the selection of supplies, medications, and equipment as well as the development of a written plan.

Identifying equipment failures as well as missing equipment may assist facilities in ensuring the development of thorough emergency checklists that address the specific needs of the unit's patient population. (See Table 2.)

Staff education and training is another essential element to ensuring adequate response to an urgent clinical situation. Documented training as well as periodic retraining of staff is warranted. Such staff training, when used effectively, can create accountability among both clinical and nonclinical staff members and can cultivate a proactive team approach in responding to emergency situations. Use of RRTs may also ensure that responding staff are both experienced and knowledgeable in the management of supplies, medication, and equipment during an emergency.[18]

Creating checklists and conducting mock codes can go a long way towards monitoring and maintaining a constant state of readiness. Periodically reviewing that checklists are being completed within the regularly scheduled intervals may prevent faulty equipment, missing items, or outdated medications when they are needed. Walking through and analyzing the steps of an emergency following a mock drill may help clinical areas identify opportunities for improvement or the need for additional clarification in procedure.

Finally, analyzing or conducting a post-review after a real emergency can ensure that all staff provide input regarding target areas for improvement.

Notes

1. Trachtenbarg D. Pediatric emergencies: preparedness and prevention. *Am Fam Physician* 2000 Jun 1; 61(11):3237-8.

2. Wisehart C. Office preparedness for emergency care. 2004 Oct [cited 2009 Apr 28]. Available from Internet: http://www.magmutual.com/mmic/articles/2004_10_24_office.pdf.

3. National Highway Traffic Safety Administration. Guide for Interfacility Patient Transfer. 2006 Apr [cited 2009 Jul 31]. Available from Internet: http://www.nhtsa.dot.gov/people/injury/ems/Interfacility/images/Interfacility.pdf.

4. 42 CFR § 413.65 (2009). [cited 2009 Sep 1]. Available from Internet: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=6a9a737e992e01e97bfc6a37681c2823&rgn=div8&view=text&node=42:2.0.1.2.13.5.53.3&idno=42.

5. National Patient Safety Agency. Resuscitation in mental health and learning disability settings [rapid response report online]. 2008 Nov 26 [cited 2009 Apr 30]. Available from Internet: http://www.npsa.nhs.uk/nrls/alerts-and-directives/rapidrr/mental-health-resuscitation/.

6. Standard PC.02.1.11 In: Joint Commission. 2009 accreditation manual for hospitals. Oakbrook Terrace, IL: Joint Commission Resources. [cited 2009 Sep 1]. Available from Internet: http://www.jointcommission.org/NR/rdonlyres/20C2A724-1C5C-4C9F-843A-E1052EC1003E/0/HAP_PC_09_to_08.pdf.

7. Toback SL. Medical emergency preparedness in office practice. *Am Fam Physician* 2007 Jun 1;75(11):1679-84.

8. Standard MS.03.01.01. In: Joint Commission. Revised 2009 accreditation requirements as of March 26, 2009 [standards online]. 2009 Mar 26 [cited 2009 Apr 30]. Available from Internet: http://www.jointcommission.org/NR/rdonlyres/C9298DD0-6726-4105-A007-FE2C65F77075/0/CMS_New_Revised_HAP_FINAL_withScoring.pdf.

9. Toback S. Prepare your office for a medical emergency. *Contemporary Pediatrics* 2002 Apr 1;19(4):107-21.

10. Reese C. Are you prepared for office emergencies? FP Report 2001 Dec [cited 2009 Jul 6]. Available from Internet: http://www.aafp.org/fpr/20011200/web2.html.

11. Delgado E, Wendeline JG, Kowia J, et al. Equipment, Medications and Supplies for a Medical Emergency Team Response. Chapter 19. In: DeVita MA, Hillman K, Bellomo R. *Medical emergency teams: implementation and outcome measurement.* New York (NY): Springer New York; 2006: 199-216. Available from Internet: http://www.springerlink.com/content/m164601875321822.

12. Joint Commission. Maintain supplies during an emergency [environment of care standards online]. 2009 Mar 9 [cited 2009 Apr 30]. Available from Internet: http://www.jointcommission.org/AccreditationPrograms/Hospitals/Standards/09_FAQs/EC/Maintaining_Supplies.htm.

13. ECC Committee, Subcommittees, Task Forces of the American Heart Association. 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2005 Dec 13;112(24 Suppl):IV1-203.

14. ECRI Institute. Automated external defibrillators. *Healthc Risk Control* 2009 Jan; Emergency care 11 (Suppl A):1-13.

15. American Heart Association. Automated External Defibrillator Checklist [online]. [cited 2009 Nov 30]. Available from Internet: http://www.quickmedical.com/pdf/zoll/aed_maintenance_checklist.pdf.

16. Joint Commission. National Patient Safety Goals: Hospital Program [online]. 2008 Oct 31 [cited 2009 Jun 15]. Available from Internet: http://www.jointcommission. org/PatientSafety/NationalPatientSafetyGoals/ 09_hap_npsgs.htm.

17. Institute of Healthcare Improvement. Overview of the 5 million Lives Campaign. [cited 2009 Sep 1]. Available from Internet: http://www.ihi.org/IHI/Programs/ Campaign/Campaign.htm?TabId=1.

18. Bunch D. When help is needed fast, rapid response is on the scene. AARC Times 2006 Dec [cited 2009 Apr 30]. Available from Internet: http://www.aarc.org/ members_area/aarc_times/12.06/12.06.052.pdf.

19. Molyneux J. Do rapid response teams save lives? *Am J Nurs* 2009 Mar [cited 2009 Apr 30]. Available from Internet: http://journals.lww.com/ajnonline/ Fulltext/2009/03000/Do_Rapid_Response_ Teams_Save_Lives_.11.aspx#.

20. Burling-Philips L. Emergency in the ASC: are you prepared? EyeNet Magazine 2007 Oct [cited 2009 Apr 30]. Available from Internet: http://www.aao.org/aao/ publications/eyenet/200710/comprehensive.cfm.

21. Wick JY. Emergency carts and kits: determining appropriate content. Consultant Pharm 1999 Mar [cited 2009 Jun15]. Available from Internet: http://www.ascp.com/ publications/tcp/1999/mar/carts.shtml.

22. Hilton L. Crash carts get colored & counted. Nurs Spectrum 2008 Jul 28 [cited 2009 Jun 15]. Available from Internet: http://news.nurse.com/apps/pbcs.dll/ article?AID=/20080728/FL02/107280027.

23. Long EK. Crash cart standardization. 2007 Jan 31 [cited 2009 Apr 30]. Available from Internet: http://www.ihi. org/ihi/workspace/tools/fmea/ProcessDetailDataReport. aspx?ToolId=5431&ScenarioId=6443&Type=1.

24. Toback SL, Fiedor M, Kilpela B, et al. Impact of a pediatric primary care office-based mock code program on physician and staff confidence to perform life-saving skills. *Pediatr Emerg Care* 2006 Jun;22(6):415-22.

25. Walker A, et al. Mock CPR 'codes' expose weaknesses in hospital emergency response for children. Science Centric 2008 February 9 [cited 2009 July 30]. Available from internet: http://www.sciencecentric.com/news/article. php?q=08020914.

PENNSYLVANIA PATIENT SAFETY ADVISORY

THE PENNSYLVANIA PATIENT SAFETY AUTHORITY AND ITS CONTRACTORS

The Pennsylvania Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error ("Mcare") Act. Consistent with Act 13, ECRI Institute, as contractor for the Authority, is issuing this publication to advise medical facilities of immediate changes that can be instituted to reduce Serious Events and Incidents. For more information about the Pennsylvania Patient Safety Authority, see the Authority's Web site at http://www.patientsafetyauthority.org.

ECRI Institute, a nonprofit organization, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for nearly 40 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research. More than 5,000 healthcare organizations worldwide rely on ECRI Institute's expertise in patient safety improvement, risk and quality management, and healthcare processes, devices, procedures and drug technology.

The Institute for Safe Medication Practices (ISMP) is an independent, nonprofit organization dedicated solely to medication error prevention and safe medication use. ISMP provides recommendations for the safe use of medications to the healthcare community including healthcare professionals, government agencies, accrediting organizations, and consumers. ISMP's efforts are built on a nonpunitive approach and systems-based solutions.