# Simulation-Based Education Improves Patient Safety in Ambulatory Care

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## Abstract

High-fidelity simulations of patient scenarios have been used successfully to promote critical thinking and staff teamwork in emergency departments, critical care, and medical transport. In contrast, this strategy has been little studied in ambulatory environments. *The First Response: The First 10 Minutes*, a two-phase, simulation-based education program, was designed to help staff from 21 primary/specialty clinics and five urgent-care clinics improve the immediate care of patients with chest pain or anaphylaxis until the arrival of ambulance crews. Key components included updated standing orders, easy-to-use documentation tools, interactive learning stations with expert faculty, on-site education, and scenarios based on real-life situations with immediate debriefings. The effects of this program on clinic staff were increased knowledge, confidence, and skills that translated into better management of actual patient emergencies. An unanticipated benefit of the *in-situ*, simulation-based education was the discovery of 40 safety concerns that were readily addressed.

## Introduction

In response to the Institute of Medicine (IOM) report "To Err is Human: Building a Safer Health System,"[1] "Crossing the Quality Chasm,"[2] the 5 Million Lives Campaign,[3] and the Joint Commission's National Patient Safety Goals,[4] many initiatives have been developed to improve care in acute care inpatient facilities. However, most patient care is delivered in ambulatory care settings.

Although clinic staff are not expected to be experts in emergency care, they must be able to readily recognize emergent situations, assess the level of intervention needed, provide appropriate care to prevent deterioration in a patient's condition, and determine the need for activating a call to emergency medical services (EMS) responders. These abilities require a major commitment from staff and their leadership to provide education, analyze processes, identify safety concerns, and put into place many "hard and soft stops" to ensure the delivery of safe, effective patient care and to transfer patients to higher level facilities as needed. Although high-performance team behavior and crisis resource management (CRM) are often cited in the acute care literature,[5, 6, 7, 8, 9, 10, 11, 12] they are also appropriate frameworks for ambulatory care, and medical simulation with debriefing is an efficient, effective, and safe strategy to facilitating those skills.[13, 14, 15, 16]

HealthPartners, a consumer-governed family of nonprofit health care organizations, has 21 ambulatory care clinics and five urgent care clinics. Nursing leaders recognized discomfort

among clinic staff in assessing and managing patients with emergent needs. Wide disparities in approaches, unfamiliarity with equipment, lack of skills, and low confidence in handling these situations were noted, particularly during the two most common high-risk events: patients with chest pain and those experiencing anaphylaxis. Both situations require excellent assessment skills, psychomotor skills, critical thinking, and teamwork.

When considering how to improve care of these patients, three concerns were identified:

1. Past traditional "skills days" and learning packets had not been particularly effective in improving staff competence and practices.
2. Despite "standardization," the contents of code carts and pharmacy emergency drug boxes varied among clinics.
3. Roles and expectations needed to be clarified in order to improve communication and teamwork.

To better prepare clinic staff to work as a cohesive team during the first 5 to 10 minutes between recognition that patients are in trouble and arrival of the ambulance crews, an alternative educational strategy was explored.

In 2003, the medical education branch of HealthPartners collaborated with Metropolitan State University to create a Simulation Center for Patient Safety. The high-fidelity, very realistic simulation-based education provided at this site was primarily directed at teams working in critical care. Learning experiences were designed to accelerate the integration and application of knowledge, skills, and critical thinking without endangering patients. Use of the center has helped prepare these teams to respond to situations that are infrequently encountered in actual care settings. Despite the Center's primary focus on critical care, the clinics had successfully used simulation for intensive communication courses and new employee orientation. They thought that this hands-on approach could be adapted to teach clinic staff how to manage emergent situations as well.

The nurse leaders partnered with the center's PhD-prepared nurse coordinator to develop and implement a simulation-based program using a more transportable, moderate-fidelity manikin (Laerdal Mega Code Kelly™). Learning stations and scenarios were developed to provide unique opportunities for ambulatory care staff to safely try new skills and practice teamwork, help leaders discover how human factors and systems issues affected their staff's ability to deliver safe patient care, and evaluate the effectiveness of new protocols and documentation tools.

A grant from the Minnesota Job Skills Partnership was obtained to help cover some of the expenses of developing and implementing the program.

## Methods

Originally designed to facilitate staff education, this project evolved into a quality assurance/ patient safety initiative. There was no risk to patients. Data were summarized by clinic, by urgent care, and as a whole (HealthPartners ambulatory care), but only aggregate data and unidentified

quotes were included in publications. We obtained Institutional Review Board approval to share the results.

## Design and Implementation of Training

Ninety percent of Advanced Cardiac Life Support (ACLS) ambulance crews arrive at our clinics within 10 minutes of the call for assistance and often within 5 minutes. Therefore, our focus was *First Response: The First 10 Minutes* – the recognition of patients in distress, initial management, and readiness for seamless transport.

Patients with chest pain and anaphylaxis were selected as the target populations. Through collection of verbal feedback from clinic staff and observation of actual critical events, the Nursing Education Committee identified learning gaps related to initial patient management. Five learning units were identified: (1) basic airway management/oxygen delivery, (2) use of automated external defibrillators (AED)/cardiac monitoring, (3) knowledge of emergency medications available on code carts and pharmacy emergency drug boxes, (4) establishment of peripheral IV access, and (5) awareness of processes/protocols/documentation.

Clinic staff would rotate through the five stations as assigned according to their positions (RNs all stations; LPN/certified medical assistants [CMAs] airway, oxygenation, documentation; MDs/nurse practitioners drop-in). Simulated patient events would begin with the patient's arrival at the reception area, continue through emergency management (with or without a physician), and end with documentation and hand-off to the paramedics (Figure 1). Learning activities would take place *in-situ* at each of the clinics so that participants could work with their own equipment, facilities, and staff.

Preparation for the workshops included review of standardized medications and supplies. Protocols and standing orders were updated to reflect current best practice. Worksheets and other educational tools were developed and supplies purchased to support the learning activities (Table 1).

Education at the primary/specialty clinics occurred in two phases:

- **Day 1 skills stations** were available from 0830 to 1600, so that staff could rotate in and out. Faculty (paramedic educator, certified registered nurse of infusion [CRNI], and the emergency nurse/simulation coordinator) taught, discussed, demonstrated, and observed return demonstrations (e.g., basic airway management, oxygenation, AED, IV manikins) at five stations. Most medical assistants completed their assigned three stations (airway, AED, policy/documentation) within 30 minutes. RNs generally needed 2.5 hours to complete the basic three stations, in addition to peripheral IV insertion and emergency medication updates.

  To facilitate attendance during clinic operations, some clinics added personnel, while others had clinic educators or managers cover for staff. The faculty also inspected code carts and pharmacy emergency drug boxes for adherence to the clinic-approved lists, ensured inclusion of appropriate supplies, checked for outdates, reviewed medications for congruence with

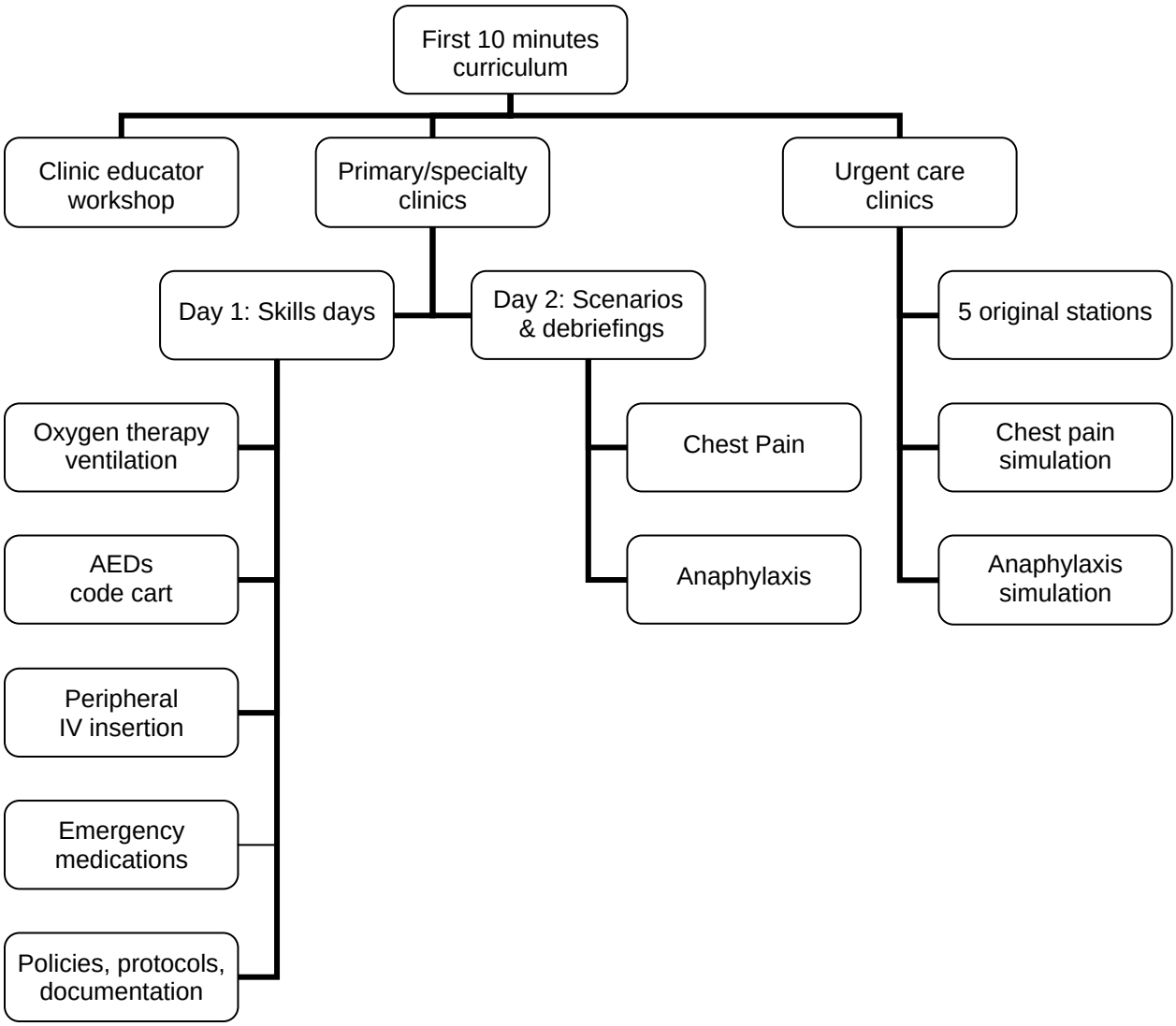


**Figure 1.** Schematic of training curriculum.

national standards, identified safety concerns, and 6) outlined potential solutions to discuss with clinic leaders.

- **Day 2 scenarios** occurred 1 to 4 weeks later, depending on the clinic's schedules. Over lunchtime, or occassionally dinner, staff (receptionists, nurses, assistants, pharmacists, lab technicians, and sometimes physicians) applied their skills during chest pain and anaphylaxis scenarios. Protocol-driven worksheets were used to guide staff implementation of the revised protocols and to increase accuracy of documentation. The paramedic skillfully guided the simulations with a moderate-fidelity, costumed manikin, while an educator or manager quietly observed and compared staff response with the desired actions (Figure 2).

  Staff debriefings followed immediately to identify what went well, what could be improved, and to suggest potential solutions. Because so many staff needed to participate and the exam rooms in which the scenarios took place were small, each scenario was offered at least twice.

The largest clinic had 60 participants over 2 skills days and 57 participants over 2 evenings of scenarios.

To accommodate staff scheduling, the format of the program was altered slightly for the urgent care clinics. A 4-hour, evening workshop was held at each of the urgent care clinics. The staff rotated through all five learning stations (2.5 hours) but practiced on the more difficult geriatric IV manikin arm. After a 30-minute dinner break, they took part in the two simulation scenarios (1 hour). Staff were encouraged to attend workshops at their home sites. However, if they had a scheduling conflict, they had the option of attending a workshop at another urgent care clinic.

As the workshops rolled out, the curriculum was modified to meet newly identified needs, particularly related to the emergency medications.

**Table 1. Preparation for workshops**

**Review**

- List of standardized medications on code carts and in pharmacy drug boxes.
- List of standardized supplies and equipment on code carts.
- Competency checklists for inserting peripheral IVs, using AEDs, placing airways, and ventilating via bag-valve-mask.

**Update**

- Chest pain standing orders.
- Emergency management procedures using standard template.
- Emergency management record.

**Create**

- Chest pain worksheet to match the standing orders.
- Competency checklists for delivering oxygen, changing regulators.
- Education module for emergency medications, charts, and quiz related to dosages, formats, and patient and nursing implications.
- Posters of documentation tools and protocols.
- Photos of each crash cart drawer and medication box.
- Two clinic patient scenarios flowing from arrival at the reception area, through emergency management, with or without a physician, and ending with documentation and hand-off to the paramedics.
- Apply for continuing education hours (CH for nurses, assistants; CME for physicians).
- Contract for paramedic educator.

**Purchase/organize**

- Supplies for oxygenation and IV stations
- Moderate-fidelity manikin (Laerdal's Mega-Code Kelly™).
- Clothing, wigs, props (e.g., bifocals, purse, winter jacket, billfold).

Three critical safety concerns were noted across all clinics:

- Most staff did not understand the potential interaction between oral nitroglycerin (NTG) and Viagra® or Viagra-like medications, nor were they skilled in soliciting information from male or female patients about their use of such medications.
- A staff member had accidentally injected an EpiPen® into himself/herself rather than the patient.
- A recent sentinel event involved a pediatric epinephrine order that fell between the two standard EpiPen doses.

It quickly became obvious during the first workshop that the content of the original medication template and quiz was critical, but that discussion rather than a self-study module was needed for staff to synthesize the information and demonstrate correct usage. During that session and all others, we changed the format and added more detailed information about medication interactions with NTG, role-playing exercises for obtaining accurate information about current medication use, critical thinking about nonstandard doses, how to clarify questionable medication orders, examination of the medications on the code cart and in the pharmacy drug box, identification of outdates, "look-alike"/"sound-alike" medications, standard dosages of emergency mediations, and demonstration/return demonstration of EpiPens. Although this station was required for RNs and optional for LPNs, all LPNs did participate.

Several modifications were implemented during the simulations. The American Heart Association-revised CPR recommendations were implemented. A new chest pain worksheet, specifically designed to complement the updated standing orders, was piloted and successfully integrated into the electronic medical record as "Smart Text." We also noticed that at some clinics, nursing staff were reluctant to actively participate in the scenarios once clinic physician(s) arrived. Therefore, we occasionally limited physician involvement and increased our discussion of principles of high-performance team behavior (i.e., role clarity, communication, resource utilization, global awareness) and SBAR communication (Situation, Background, Assessment, Recommendation) during the debriefings.

## Design and Implementation of Evaluation

Written evaluations of the experiences were kept very brief so that staff could complete them quickly and return to their patient care duties. For the Day 1 skills sessions, the questions addressed baseline comfort with emergency situations at their clinic, a post-workshop increase in confidence about their ability to perform in an emergency situation, effectiveness of instructors, clinical value of material learned, topics/content deemed to be the most valuable, topics thought to be least helpful, and identification of which stations had been completed. Additional space was left for comments. A similar tool had been successfully used after continuing education workshops for more than 4,000 nurses over the past 4 years.

Although not sophisticated, this simple tool provided valuable information in a minimum amount of time. Comfort and confidence are both affective constructs: comfort reflects a state of ease, low anxiety; confidence reflects certainty, assurance. At baseline, we wanted to know how comfortable staff were with emergency situations. A post-workshop increase in comfort, while desirable, was not as important as an increased confidence in the ability to perform effectively. It was anticipated that those who were very uncomfortable in emergencies would become more confident. It was hoped that even those who were already very comfortable in emergencies would find the sessions helpful and have increased confidence in their ability to perform. A total of 485 participants signed in for skills sessions; 454 evaluations were completed, for a return rate of 94 percent.

## Figure 2. Sample scenario for patient with chest pain

**A woman wheels a man up to the check-in desk: *"Can you help my husband? He's been having chest pain for hours and just wouldn't go to the hospital." Patient (fully clothed, jacket, glasses; skin pale, sweating): "Woke up with pain in my left arm. Kinda sick to my stomach, & it's a little hard to catch my breath."***

**Actions**

- ☐ Receptionist: notify staff per protocol; then assist family member(s) & print a copy of pertinent patient information (history, insurance, etc) for EMS.
- ☐ RN: Patient in wheelchair to cart in exam room; staff notify physician that patient with chest pain needs evaluation.
- ☐ Instruct staff to call 911.
- ☐ Identify staff roles within the clinic.
- ☐ Assess pain/intensity (1-10 scale).
- ☐ Assess pulse (apical preferred), BP, RR.
- ☐ Ask for code cart.
- ☐ Check $O_2$ sat. Start $O_2$ by cannula (2-4 LPM); simple mask (6-10 LPM), or nonrebreather (10 LPM)
- ☐ Pull up chest pain protocol & worksheet.
- ☐ Notify lab that 12-lead ECG needed.
- ☐ Check history, meds, allergies.
- ☐ ASA 325 mg (or 4 low-dose ASA) chewable. Use chest pain standing orders if MD not available.

***"The pain started out at about 4 o'clock this morning –woke me up...it's stayed about the same except when I walked up the steps, it went to a 6."* Patient has no medical problems; takes no daily meds; no allergies; doesn't smoke. His dad had a heart attack at age 62.**
**VS: BP 110/70; P 92 (irreg); R 24; $O_2$ sats 94%.**

**Actions**

- ☐ NTG 0.4 mg SL, if systolic BP >90 AND patient is NOT on a Viagra-like medication.
- ☐ Start peripheral IV (saline lock).
- ☐ Call for AED & 12-lead ECG (begin continuous monitoring once it arrives).

**As you are taking a repeat set of VS: *"Oh man, it's really hurting. Now it's an 8…I can't breathe…Give me a pan, I'm going to throw up."* He vomits twice, and then loses consciousness.**

- ☐ Actions.
- ☐ Open airway, assess for patency.
- ☐ Suction oropharnyx.
- ☐ Assess breathing.
- ☐ Place oral airway.
- ☐ Hook up $O_2$ at 15 LPM to bag-valve-mask; then ventilate at 8-10 breaths/minute.
- ☐ Assess carotid pulse. If no pulse, begin chest compressions.
- ☐ Apply AED as soon as it is available; follow AED instructions.
- ☐ Update EMS.
- ☐ Assure that personnel are waiting at door to escort EMS to patient's room.
- ☐ Assure appropriate documentation of assessments & interventions.

**Figure 2. Sample scenario for patient with chest pain *(continued)***

**After 1 shock, the AED announces, "No shock indicated, check pulse." Carotid pulse is present. He is making minimal attempts at breathing & moans to painful stimuli.**
**VS: BP 94 palp; P108; R assisted; $SpO_2$ no reading; Skin color improving as EMS arrives.**

**Actions**

- ☐ Consider continuing CPR x 1 minute while assisting ventilations.
- ☐ Give brief SBAR report to EMS.
- ☐ Assure that pertinent information is documented for EMS & update family.

**EMS leaves for hospital**

**Actions**

- ☐ Escort EMS out of the building.
- ☐ Call report to receiving hospital/emergency department.
- ☐ Debrief event with all involved staff/leadership.
- ☐ Restock emergency supplies.

Since continuing education hours (CH for nurses and assistants; CME for physicians) were awarded for participation in the simulation scenarios, Day 2 evaluations followed the standard CME format: overall reaction, effectiveness of learning activities, relevance to practice, commercial bias, and whether the course objectives had been met. Additional space was left for comments. Evaluations were handed out and completed during the post-scenario debriefings. Staff who responded to the "codes" but had to immediately return to their work areas were offered evaluations to complete but rarely did so. No attempt was made to match individuals' skills session evaluations with their post-scenario evaluations. A total of 431 participants signed in at scenarios, including 27 physicians who had not participated in the skills sessions. Additional ancillary staff attended but did not sign in; 302 evaluations were completed, for a return rate of 70 percent.

The evaluation tool for the urgent care sessions included all five CME components: pre-session comfort, post-session confidence, the most valuable/least helpful topics, and space for comments. A total of 65 participants signed in; 64 evaluations were completed, for a return rate of 98 percent.

# Results

More than 500 staff participated in the *First Response: The First Ten Minutes* program during a 12 month period. All but one person attended sessions at their home clinic or urgent care.

## Immediate Self-Report and Evaluations

At baseline, 53 percent of clinic staff stated that they were "uncomfortable in my role when a patient is critical or requires immediate transfer," or that they "really hate code-like (or potential code) situations." After completing training, participant self-reported confidence increased "very much" (51 percent) and "somewhat better" (48 percent); 86 percent of participants indicated that they had "learned a lot" that would help them clinically, and 13 percent "learned some." As expected, staff who were uncomfortable at baseline increased in confidence after the program (96 percent). However, 65 percent of staff who indicated that they were very comfortable at baseline also noted that their confidence had increased "very much." Only three staff members, all medical assistants, who "really hated" code-like situations, indicated that their confidence level had not improved.

Urgent care staff were slightly more comfortable with emergency situations at baseline than clinic staff ("very comfortable" – 55 percent vs. 47 percent, respectively); they also had slightly more confidence after the workshops ("very much" – 59 percent vs. 51 percent, respectively). Mean scores for overall reaction, effectiveness of learning activities, and "relevance to my practice" were all 4.6 (5 = excellent, 1 = poor; N = 320-329). Self-reported levels of learning for urgent care and primary/specialty clinic staff were similar.

Approximately 20 percent of all participants wrote comments and suggestions on their evaluation forms. These included 10 suggestions on how to improve the process (e.g., scheduling, practice ideal codes on skills day, have more scenarios with fewer staff). The rest of the written comments about the experience were overwhelmingly positive, such as "More self-assured. Really reinforced learning with mock situations"; "Love that it was focused on the first 10 minutes"; and "This was a very good learning experience since our clinic doesn't see much of each problem." Ten percent of participants requested more frequent mock codes. Many asked for future scenarios related to obstetric and pediatric emergencies (e.g., seizures, airway obstructions, asthma, unplanned clinic delivery).

## Subsequent Application of Learning in Clinical Settings

Even more important than participants' subjective evaluations immediately after the program were the unsolicited e-mail reports from clinic supervisors that indicated the skills had been succesfully transferred to actual patient emergencies. For example:

- "Today we had quite a serious medical emergency and one of my medical assistants thanked me for the mock code experience. Patient …was having an anaphylactic reaction… [we] knew what to do with the epi because of that drill."
- "He was pretty bad off…with a heat rate of about 212. Within minutes we had vitals done; EKG in progress; the doc summoned; nitro given; ASA given; an IV in (first try!); and an ambulance called. It was a great team effort. It wasn't until the dust settled that I realized that all four of us had gone through the training for *First Ten Minutes Response*. It was very valuable training, and that really proved true yesterday."
- "A man walked into the … clinic having a heart attack … [staff] promptly got him aspirin, oxygen, nitroglycerin, and an EKG and summoned me [the doctor]… Less than 15 minutes after walking through our door, he was leaving in an ambulance. Less than an hour after

> walking through our door, he was in the cath lab having the blocked artery opened and having the blood supply to that part of the heart restored. He is now stable in ICU. Your work had a profound effect on this man's life! I thank you for that. It is easy to see that effect when it happens so dramatically."

Over 40 patient safety concerns, primarily related to medications, were identified at the various clinics, and plans for corrective action were developed (Table 2). One year later, the Emergency Management Record and new revisions of the chest pain standing orders and chest pain worksheet continue to be used. Paramedic crews have noticed improvements in hand-offs from the clinics, many stating that transfers of care have been "flawless." Although there is still room for improvement, some clinics continue to have admirable chest-pain management with "door-to-EMS transport " times of less than 20 minutes.

### Comparing Clinic and Urgent Care Staff

The self-reported baseline level of comfort and post-workshop confidence for clinic staff and urgent care staff were surprisingly similar (Table 3). Since many urgent care facilities in Minnesota had been staffed in the past with ACLS-prepared physicians and RNs with extensive emergency department experience, one would expect that their baseline level of comfort in emergencies would be greater than that of primary/specialty clinic staff. Perhaps the recent trend towards urgent-care clinics being modeled on "after-hours" clinics and hiring staff with less critical care/emergency department experience has blurred the distinction between clinic and urgent care staff.

Although both staffs requested additional scenarios related to pediatrics, respiratory emergencies, and seizures, the urgent care staff also requested trauma scenarios (e.g., lacerations, fractures, head injuries, spinal cord injuries). Clinic and urgent care staff comments about the simulation experience followed the same themes: "More self-assured. Really reinforced learning with mock situation;" "Reinforcement is always helpful;" "The 'real' dummy was awesome to demo. Thanks!" "Made situations we don't see often very real – opportunity to think through and evaluate reactions."

## Discussion

Creating a culture of safety has been a focus for the leadership of the HealthPartners primary/specialty clinics and urgent care clinics. Similar to reports in the literature,[17, 18] HealthPartners system quality data indicated that the vast majority of our clinic incidents were related to prescriptions, but only a handful of reported incidents were associated with actual medication administration (primarily immunizations). The corrective action plan for pharmacy-physician prescription concerns had very limited involvement for the nursing staff, so the Nursing Education Committee focused on providing safe, effective care of two high-risk but relatively low-volume types of patients who receive emergency medications: those with chest pain and those experiencing anaphylaxis.

## Table 2. Patient safety concerns and corrective action plan

| Potential safety risk | Corrective action plan |
|---|---|
| **Airway/oxygenation safety risks** | |
| Intubation supplies on code cart; but few ACSL-trained staff; intubation not in clinic protocols; and supplies not on standardized list; leaders concerned about liability | Remove intubation supplies from code carts |
| Staff not sure which sizes of oral airways to use; some sizes missing | Demonstrate/return demonstration; containers with slots for each size airway |
| Infant oral airways in front of code cart drawer, but most oral airways are used for adults; displaced infant airway can obstruct adult airway | Label and place infant/pediatric oral airways in container in back of drawer |
| Four different oxygen regulators made it difficult for staff to remember how to attach; tanks run out of oxygen when valves are left open | Use Praxair Grab N' Go™ all-in-one portable medical oxygen system |
| Suction catheters too small; suction machines require electricity, but some clinic areas don't have outlets within reach | Add inexpensive turkey basters to quickly clear mouths; add second heavy-duty extension cord to code cart |
| **Medication safety risks** | |
| Dangerous to give oral nitroglycerin (NTG) if patient has taken Viagra® or Viagra-like medication within previous 24-36 hours | • Update chest pain protocols to include contraindications to oral NTG administration<br>• Discuss: 1) risk of dangerously low BP if NTG is given within 24-36 hours of Viagra-like med; 2) med names; 3) types of patients (male & female) who are prescribed these meds; 4) role play ways to solicit accurate information from patients |
| NTG expiration dates unclear | • Label with date expired, not date opened<br>• Clarify whether to use manufacturer's expiration date or 6 months from opening NTG bottle |
| Sound-alike meds: "Nitro spray" vs. "Nitro" (topical) in large silver canisters | • Nitrolingual® Pumpspray currently not available in clinics<br>• Providers request "nitroglycerin sublingual" |
| Difficulty injecting dextrose through small IVs | • Review needle-less systems<br>• Administration rate of meds related to IV catheter size |
| No filtered needles to draw up meds from ampoules | Add filtered needles to code carts and emergency drug boxes |
| No injectors (cartridge holders) to administer meds | Add injectors to code carts and emergency drug boxes |

## Table 2. Patient safety concerns and corrective action plan (continued)

| Potential safety risk | Corrective action plan |
|---|---|
| **Medication safety risks (continued)** | |
| Staff drew up meds through metal bottoms of cartridges | Review how to "seat" and twist to engage cartridge |
| Staff member accidentally triggered EpiPen® auto-injector into his/her own finger | • Review administration; demonstration/ return demonstration with trainer device<br>• Discuss emergency measures if EpiPen® accidentally discharges into healthcare provider |
| Look-alike meds:<br>• Diazepam, midazolam, and morphine in green-capped cartridges with purple-hued lettering<br>• Magnesium sulfate, furosemide, and midazolam all in small vials with orange caps | • Remove meds not on standardized list from code carts and emergency drug boxes<br>• Physically separate look-alike meds<br>• Alert staff to potential look-alike meds |
| Enteric-coated, low dose aspirin in code cart | • At least 4 *regular* low-dose tablets – *not enteric coated* – in aspirin bottle during code cart checks<br>• Review why it is not called "children's aspirin" |
| End-of-month, routine checks by pharmacy staff missed some outdates around holidays | • Reminders for pharmacists<br>• Consider best time of the month to check for outdates |
| Medications not on approved list (e.g., Depacon®, paraldehyde, lorazepam); only 6 meds on emergency drug box standardized list, but requests resulted in up to 4 tackle-box drawers filled with meds | Review and limit meds in emergency drug box to those on the standardized list |
| Staff and pharmacists unfamiliar with doses of emergency meds given infrequently | Add med chart to top of emergency drug box; include names (generic & brand; note version in box), format, usual dose, & admin instructions |
| • Variable med format and names (brand vs. generic) secondary to med cost and availability<br>• Unfamiliarity with meds delays administration | Indicate current format (e.g., cartridge, ampoule, vial) on the medication grid |
| Wrong concentrations &/or route on code cart:<br>• Epinephrine with intracardiac needle<br>• 1% lidocaine for joint injection vs. 2% for cardiac | Change to standard prepackaged emergency meds:<br>• Epinephrine (1 mg, Abboject®, needleless)<br>• Lidocaine (100 mg, Abboject®, needleless) |
| Right concentrations but too much available:<br>• Adenosine IV 60 mg/20 ml vials<br>• Diazepam IV 50 mg/10ml<br>• Outpatient pharmacists not always aware of usual emergency med doses | • Store only two doses of each med on code cart; obtain additional doses from pharmacy<br>• Add usual med dosages to standardization charts |
| Small, difficult-to-read fonts on med containers | • Tie magnifying glass and/or "cheaters" to code cart<br>• Large print instructions |

## Table 2. Patient safety concerns and corrective action plan (continued)

| Potential safety risk | Corrective action plan |
|---|---|
| **Equipment and supply risks** | |
| Code cart drawers not labeled | Standardize labels (e.g., medications in top drawer; then airway, breathing, circulation) |
| Staff unfamiliar with emergency documentation forms; tendency to jot notes on scrap paper | • New emergency med form piloted/revised<br>• New chest pain form follows standing orders – available in hard copy and computerized "Smart Text" |
| Difficult to find current ACLS protocols during an emergency | • Hang enlarged, laminated copies of current algorithms from IV pole on code cart<br>• LABEL and tab the most common protocols in spiral ACLS resource book |
| Wheelchairs unavailable (missing, locked up, on a different floor) | • Minimum of 1 wheelchair per floor<br>• 3-4 wheelchairs in reception area including an extra-wide wheelchair |
| Only regular size adult and pediatric BP cuffs on code cart | All code carts have a range of cuffs, including extra-large adult or thigh cuffs for bariatric patients |
| Monitor/defibrillators being replaced with AEDs in all clinics except those that use moderate sedation and urgent-care clinics; however, nurses and physician uncomfortable when unable to see cardiac rhythm | • Continue to have monitor/defibrillators in urgent-care clinics and areas where patients receive sedation<br>• Lab brings ECG machine if 12-lead ECG is needed or actual rhythm needs to be observed |
| **System and process risks** | |
| Unable to hear overhead pages in pharmacy, exam rooms, conference rooms | • Add audio speakers<br>• Adjust speakers in conference room so they can't be turned off during meetings |
| Missing "tasks": obtain information from family members, address family needs | Assign staff to attend to family: offer phone; gather information; escort to patient care area |
| EMS unable to find patients in large clinics | Assign staff to clear hallways, wait by entrance that EMS crews use, and escort them to patient room |
| Delayed pharmacist arrival in multilevel buildings | Receptionist holds elevator, escorts pharmacist to patient floor, returns immediately to ground floor to await ambulance crew, accompanies EMS to patient floor, holds elevator for EMS return with patient to ground floor |
| Staff unable to find patient location in new building | Identify floor, corridor, and room number during overhead page |
| Staff unaware of standing orders or did not know where to find them | • Place chest pain standing orders on code carts<br>• Keep "chest pain packets" at reception desk and hand to nurses responding to code blue |

**Table 2. Patient safety concerns and corrective action plan (continued)**

| Potential safety risk | Corrective Action Plan |
|---|---|
| **System and process risks (continued)** | |
| Staff reluctant to speak up when MDs order incorrect doses of medication or deviate from protocols | Discuss hierarchy, "assertion" communication, and responsibility of staff to speak up |
| Original documentation lost; unavailable for entry into charting system (tend to "go out door" with ambulance crews) | • Receptionist prints patient information (e.g., allergies, meds, insurance) to give to EMS crew<br>• Photocopy/print emergency management/chest pain flow sheets<br>• Worksheets in "Smart Text" |
| Roles unclear; staff hold back until they receive clear directions | • Clarify roles<br>• Educate about delegation; RNs practice directing, delegation, and SBAR hand-offs<br>• "Job cards" – individual roles during an emergency |
| Exam rooms small; unable to have ECG machine and code cart in room at the same time; crowded with staff responders | • Bring patients with chest pain or allergic reactions to larger procedure rooms<br>• Leave code cart in hallway outside exam room<br>• Crowd control: ancillary staff (pharmacist, lab, extra CMAs, nurses) stay outside of room until invited in |
| Staff uncomfortable with ECG rhythms | • Review dangerous rhythms for clinic RNs<br>• ACLS courses for urgent-care RNs and MDs |
| Some clinics do not have a pharmacy; controlled substances (e.g., morphine) must be locked up | • Lock emergency drug box in wall unit<br>• Consider if locked code cart drawer is secure |
| Inconsistent process/overhead page script to initiate emergency responses | • Standardize meaning and protocols across all clinics for "Code Blue," "Nurse," "STAT," "All available staff"<br>• Create standard script for staff |
| • Many staff haven't seen a smoothly managed patient emergency<br>• Not all staff could attend First Response workshops | • Create "gold standard," clinic-based video<br>• Periodic staff review of protocols<br>• Repeat clinical scenarios every 6 months |

**Table 3. Relationship between pre-workshop comfort level in emergency situations and post-workshop increases in confidence about ability to perform**

| Comfort level before skills day | Increase in confidence after skills session? [N (%)] | | | |
|---|---|---|---|---|
| **Primary/specialty clinic staff** (N = 399) | **No, not really** (N = 7) | **No, fine before** (N = 8) | **Some** (N = 181) | **Yes, very much** (N = 203) |
| Really hate ( N = 52) | 3 (0.8) | 1(0.3) | 29 (7.5) | 19 (4.5) |
| Uncomfortable (N = 180) | 4 (1.0) | 0 (0) | 90 (22.6) | 56 (14.0) |
| Very comfortable (N = 197) | 0 (0) | 7 (1.8) | 62 (15.5) | 128 (32.1) |
| **Urgent care clinic staff (N = 61)** | **No, not really** (N = 0) | **No, fine before** (N = 0) | **Some** (N = 27) | **Yes, very much** (N = 34) |
| Really hate (N = 7) | 0 (0) | 0 (0) | 4 (6.7) | 3 (4.9) |
| Uncomfortable (N = 22) | 0 (0) | 0 (0) | 13 (21.3) | 9 (14.8) |
| Very comfortable (N = 32) | 0 (0) | 0 (0) | 10 (16.4) | 22 (36.1) |

* Note: In-between scores were moved to a lower level. Pairwise deletion was used so that only respondents who answered both items would have his/her data included in the chi-square.

$\chi^2$ Primary/specialty clinics (6, 399) = 46.22, $P$ <0.01; $\chi^2$ urgent-care clinics (6, 61) = 4.63, $P$ = 0.59

## Drivers for Using Simulation

The primary drivers for using a simulation-based learning strategy to address emergent care were prior success in using simulation to improve patient safety, consistency with adult learning principles, and practicality. Patient safety concerns were identified through a review of the clinic quality incidents, observations by the clinical supervisors, the National Patient Safety Goals, and the ISMP Medication Safety Alerts.[19] The Simulation Center had already established that high-fidelity simulation with debriefing was a safe, effective, and efficient way to expose critical care staff to high-risk/low-volume situations, observe staff behavior under stress, and promote critical thinking. Our challenge was to adapt simulation to outpatient settings and to obtain a more easily transportable, moderate-fidelity manikin with heart/lung sounds and blood pressure.

The use of simulation with immediate debriefing was also supported by principles of adult education:

- Adults often learn most effectively when they can participate in interactive environments.
- Immediate feedback during debriefings is more valuable than delayed feedback.
- Consistent messages and standardized protocols reduce ambiguity and variation in practice.
- Concrete applications increase learner engagement and retention of information.
- People learn from their mistakes and, with simulation, mistakes can be allowed to lead to natural consequences without harming actual patients.

Finally, simulation was a practical approach. Since traditional skills days and learning packets had not been very effective or well-received by the clinic staff, the Nursing Education Committee was searching for an engaging strategy that could be used for efficiently teaching large numbers of staff. The Simulation Center not only had expertise in creating emergent scenarios, but it had secured grant funding to support the project. Providing education at the clinics made staff participation easier and less expensive than if staff had to travel off-site to the Simulation Center. On-site education also supported the discovery of clinic- and system-based issues and the implementation of corrective action plans. We concluded that simulation-based learning at the clinics would be an effective, efficient, and safe way to meet our educational goals.

## Curriculum

The basic curriculum for the *First Response: The First Ten Minutes* program was effective. Each of the five learning stations was rated "most valuable" by a large number of the participants. Faculty were also well-received. The moderate-fidelity manikin was sufficient for the scenarios. The sessions were praised as being "nonthreatening," and additional scenarios were enthusiastically requested. Adjustments to the program included:

- It was more effective for managers to observe a workshop prior to it coming to their site than to attend an instructor class off-site; therefore, the second instructor class was canceled.
- Only a paramedic, an infusion specialist (for 2 hours over lunch), and an educator from each clinic were in the original staffing plan for implementation. When few educators could be freed up from patient care duties and it became apparent that a high level of expertise was needed at the emergency medication station, the simulation coordinator supplemented the team, taught most of the medication stations, and evaluated the code carts and pharmacy drug boxes.
- The format for the medication station was changed from a self-study module with quiz to a half-hour discussion based on the quiz, demonstration/return demonstration, and analysis of code cart and pharmacy drug box contents.
- New documentation forms and standing orders were piloted during scenarios.
- Because some staff avoided participation when physicians were present, the paramedic was selective about which clinics allowed their physicians to take part in the scenarios.
- Additional skills days and scenario sessions were needed to accommodate the number of staff in the larger clinics.

## Lessons Learned

Most of our "lessons learned" were associated with implementation rather than planning. First, the supplies, equipment, and manikins that filled the back of a stationwagon were heavy, and because they were not dedicated solely to this project, had to be transported from the Simulation Center to each clinic and back again. A dedicated manikin and supplies would reduce that time and labor.

Second, clinic staff were not experienced in patient simulations, so they were not sure what they should do compared to what they should verbalize. They had a tendency to want to fabricate the

lab results and change the flow of the scenarios. Increased exposure to simulation and this particular manikin would help clarify faculty expectations and increase staff comfort.

We also realized that the advantages of doing the scenarios on-site definitely outweighed the disadvantages. We would not have identified the majority of the safety concerns noted in Table 2 had we offered the program off-site. Although on-site education provides an opportunity to involve the staff physicians and nurse pracitioners, most providers were booked with patients and only expressed an interest in participating "after the fact." Earlier involvement and enagement of providers in the learning stations and scenarios would help encourage high-performing team behaviors, particularly role clarity and communication.

Medication "lessons learned" included:

- Since most pharmacists and nurses are outpatient-based and unfamiliar with the administration of emergency medications, the corrective action plan must have "hard stops" to reduce the risk of medication errors.
- Despite overall excellent relationships with the physicians, nurses sometimes did not question them when they requested an incorrect medication or dose during scenarios. Whether this reluctance was due to the clinic hierarchy or nurses' insecurity, several actions (e.g., "pause for the cause," practice "assertion language") and an understanding of the responsibilities involved in being on a high-performance team are needed.
- Vigilance is critical, even when medications and supplies have been "standardized." The variability that occurs naturally when large numbers of staff are spread over multiple sites should trigger frequent, routine examinations of code carts and pharmacy drug boxes by clinical experts who can quickly spot potential problems. Except for purchasing additional wheelchairs and reinstalling overhead speakers in some clinics, most of the suggested corrective actions were both inexpensive and relatively easy to implement.

## Safety Concerns

Since the clinics' supplies, equipment, emergency medications, and protocols had been previously standardized, the large degree of variation among the clinics came as a surprise to everyone. The 40 safety concerns fell into four broad categories: airway/oxygenation, medications, equipment/supplies, and system/processes (Table 2). Of particular concern were the emergency medications in the pharmacy drug boxes. Although only six medications were on the standardized list, some clinics had up to four tackle-box drawers filled with additional medications, such as Depacon®. The most distressing example was related to the stocking of adenosine. A pharmacist had stocked adenosine 2 mg/mL as directed by the standardized list, but each of the 6 vials contained 60 mg. The initial adult dose is 6 mg IV. How easy it would have been for a nurse inexperienced in giving adenosine to hear "60" instead of "6" and administer the entire vial.

Sound-alike medications were not an issue, but some pharmacy drug boxes had look-alike medications in near proximity, such as midazolam, magnesium sulfate, and furosemide in small vials with orange caps, and midazolam cartridges labeled with pink-purple print, much like nearby meperidine and morphine sulfate. In addition, medications on the code carts were not

always the appropriate dosage, concentration, or formulation, and some carts were missing the injectors or filtered needles needed for medication administration.

### Next Steps

The *First Response: The First 10 Minutes* simulation-based strategy can be modified to address multiple safety concerns and patient situations. For HealthPartners, the focus of Season 1 was the emergent identification, management, and seamless transfer of patients with chest pain or anaphylaxis. Season 2 focused on first response to alterations in levels of glucose, particularly hypoglycemia. Standing protocols for adult and pediatric hypoglycemia were revised, and corresponding worksheets were created. The clinical scenarios included the management of a young woman with hypoglycemia and a man with diabetes who was experiencing chest discomfort but had a normal blood glucose. It is anticipated that subsequent seasons will address management of pediatric respiratory distress and seizures. The success of the *First 10 Minutes* program has stimulated interest in adapting the curriculum for the staff of the HealthPartners dental clinics and the outpatient pharmacies.

## Conclusion

Simulation-based education was a well-received, effective strategy to enhance patient safety in ambulatory care. Implementing *First Response: The First 10 Minutes* at each primary/specialty clinic and urgent care clinic resulted in identification of multiple safety concerns that would not have been discovered had the training occurred off-site. Increased staff knowledge, competence, confidence, and teamwork skills improved their ability to manage chest pain and anaphylaxis in real-life patient situations. Key components of the program included careful planning, revisions of standing orders, easy-to-use documentation tools, on-site education via interactive learning stations and simulated patient scenarios with immediate debriefings, faculty who were expert teacher-clinicians, team training, and a firm commitment by nursing leadership to make the safe delivery of care in emergencies a priority. The program format can be readily adapted to address other patient safety concerns.

Finally, and perhaps most significantly, is the enhanced awareness that even well-run, standardized ambulatory care environments can benefit from careful, *in-situ* scrutiny of their medications, supplies, equipment, and processes.

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