

# 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,”<sup>1</sup> “Crossing the Quality Chasm,”<sup>2</sup> the 5 Million Lives Campaign,<sup>3</sup> and the Joint Commission’s National Patient Safety Goals,<sup>4</sup> 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,<sup>5, 6, 7, 8, 9, 10, 11, 12</sup> they are also appropriate frameworks for ambulatory care, and medical simulation with debriefing is an efficient, effective, and safe strategy to facilitating those skills.<sup>13, 14, 15, 16</sup>

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.

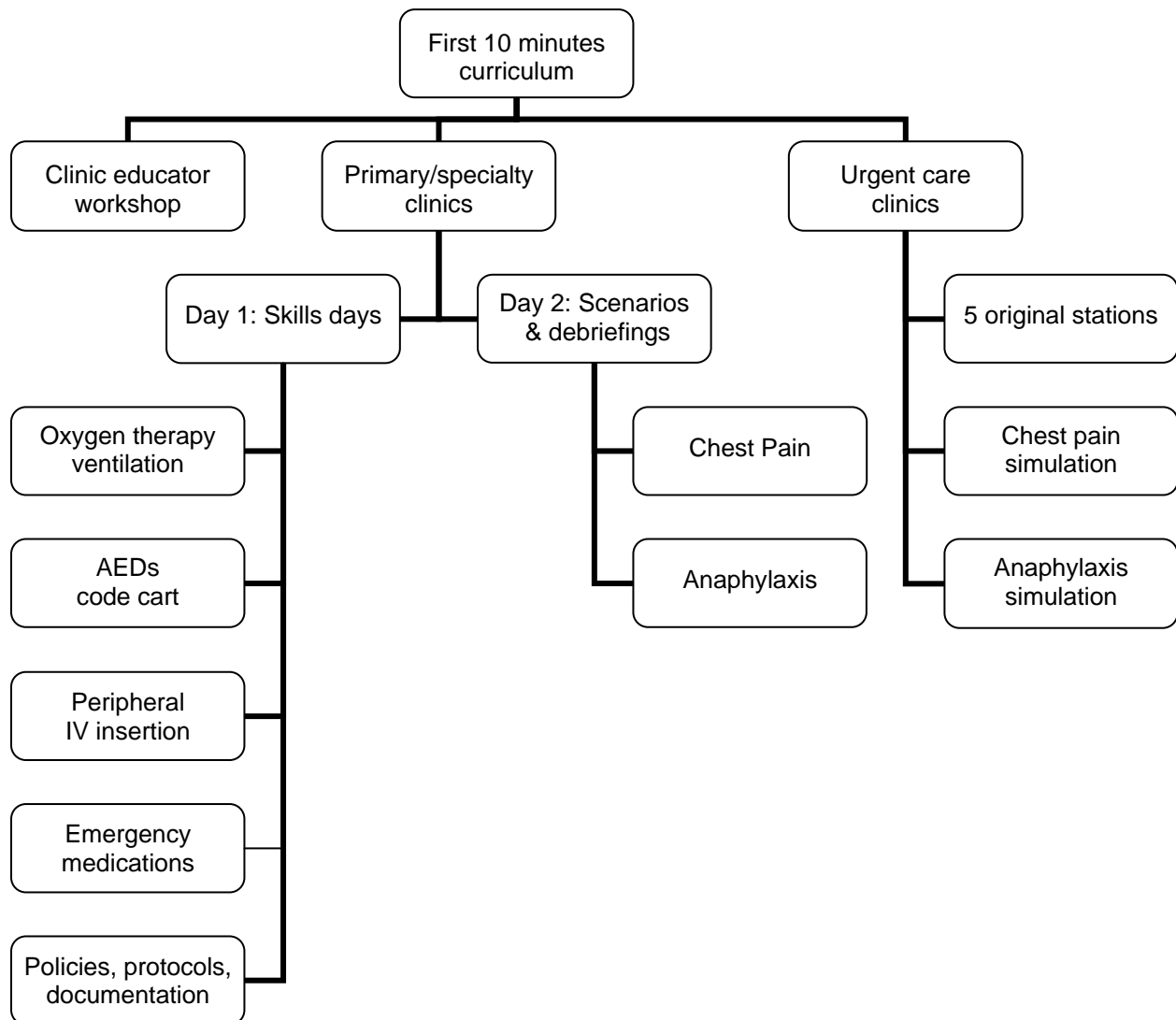
Clinic staff would rotate through the five stations as assigned according to their positions (RNs all stations; LPN/certified medical assistants [CMAs] airway, oxygenation, documentation; MDs/nurse practitioners drop-in). Simulated patient events would begin with the patient's arrival at the reception 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 occasionally 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.

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.

**Table 1. Preparation for workshops**

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**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.

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**Update**

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

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**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.

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**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).
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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 medications, 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<sub>2</sub> sat. Start O<sub>2</sub> 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<sub>2</sub> 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 oropharynx.
- Assess breathing.
- Place oral airway.
- Hook up O<sub>2</sub> 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<sub>2</sub> 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.























