CHALLENGE

To investigate the use of in situ simulation as an evaluation and educational tool to measure (1) Personal Protective Equipment (PPE) adherence of staff during simulated pediatric cardiopulmonary arrest for suspected 2009 H1N1 patients, (2) confidence in PPE use, (3) elapsed time to specific resuscitation maneuvers, and (4) deviation from American Heart Association guidelines.

STANDARDS

- IC.01.06.01
- IC.02.03.01

ORGANIZATION

Johns Hopkins Hospital, Baltimore, MD; 1,000 beds, includes 180-bed Children's Medical and Surgical Center

PROCESS

In each inpatient setting, the scenario began when a bedside "code button" triggered an alarm to first responders, who, on arrival, were read a vignette and instructed to proceed as if the scenario were a real emergency call. Each scenario started with profound hypoxia that indicated immediate bag-valve-mask ventilation, then progressed to a pulseless electrical activity cardiopulmonary arrest at 3 minutes after the first responder's entry, and ended at 10 minutes.

After each simulation, participants completed anonymous surveys. Each session was videotaped and reviewed by three reviewers, who watched the videotapes and independently assessed the use of PPE and elapsed time to specific resuscitation maneuvers. Discussion occurred until consensus was achieved.

EXAMPLE

**Working Toward Systematic Quality Improvement**

Translating the study's findings into systematic improvements occurred at several levels. After each scenario, participants were debriefed on donning of PPE, maintenance of a rapid isolation cart, use of a gatekeeper (a more-experienced clinician or support staff who restricts nonessential or nonprotected providers during high-risk procedures) to increase PPE adherence, and management of a deteriorating patient before arrival of the pediatric medical emergency team, with emphasis on how this response would differ for a child on "enhanced droplet precautions"
The results were also shared with the nurse manager and nurse educator responsible for the inpatient units and outpatient clinic in the study. This empowered local providers to do the following:

- review their capacities and capabilities to respond to pediatric emergency scenarios during a highly infectious outbreak
- provide feedback to their staff on self-protective behaviors and resuscitation protocols
- implement local measures, such as provider-specific training measures, to improve PPE adherence and optimize resuscitation

Emergency bedside equipment also was subsequently standardized throughout the Children's Medical and Surgical Center. The study’s results and recommendations (see Table 5) also were provided to the Johns Hopkins Hospital Incident Command Center and Epidemiology and Infection Control Department, which provide administrative investment and oversight during an outbreak.

### Table 5. Key Findings and Recommendations

#### Key Findings

- Pediatric staff inconsistently and improperly use personal protective equipment (PPE) during simulated resuscitation, placing themselves and other patients at greater risk of health care-associated infection.
- Simulation using PPE may increase personal confidence in proper PPE use.
- Enhanced precautions may lead to delayed room entry in the emergency setting.
- Identification of a "gatekeeper" leads to more consistent and proper use of PPE.
- Deployment of rapid isolation carts may facilitate distribution of PPE during emergency resuscitation scenarios.
- In situ simulation offers a mobile and highly reproducible mechanism for systemic implementation of PPE training during an outbreak.
- Pediatric staff infrequently meet resuscitation maneuver goals according to American Heart Association pediatric basic life support algorithms during the first 5 minutes of resuscitation.

#### Recommendations

- Resuscitation simulation should be included as part of health care enterprise-wide training packages during highly infectious outbreaks as a means to train, test, and reinforce self-protective behaviors.
- During a highly infectious outbreak, gatekeepers and rapid isolation carts represent low-cost, high-impact strategies for potentially optimizing self-protective behaviors among staff.
- First responders to a pediatric emergency call should always follow standard precautions, although initial delay of enhanced precautions may allow for rapid and life-saving intervention without significant added risk.
- Pediatric resuscitation simulation needs to be continually utilized as a quality-control and educational measure to improve the first 5 minutes of resuscitation, particularly in the setting of an outbreak requiring modification of standard personal protective behaviors.

### From the Source

"Simulation technologies offer a highly appealing, practical, and scalable mechanism for the rapid identification of knowledge gaps and integration of training initiatives into a health care setting during a highly infectious outbreak such as pandemic influenza."

### Outcome

During this study, observed adherence with PPE use was 61% for eye shields, 81% for filtering facepiece respirators or powered air-purifying respirators, and 87% for gown/gloves. Use of a "gatekeeper" to control access and facilitate donning of PPE was associated with 100% adherence with gown and respirator precautions and improved respirator adherence.

Simulation using a pediatric patient with 2009 H1N1 suggests that significant gaps remain in the knowledge and use of self-protective behaviors during resuscitation. Intervention opportunities include use of rapid isolation measures, use of gatekeepers, reinforcement of first responder roles, and further simulation training with PPE.