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Improvement from  
Front Office to Front Line

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*“To reduce the risk of harm and improve outcomes, hospitals would benefit both from a more sophisticated understanding of the organizational characteristics that support HRO [high reliability organization] practices and from knowledge about the steps necessary to achieve HRO status.”*

—Applying the High Reliability Health Care Maturity Model to Assess Hospital Performance: A VA Case Study (p. 389)



## Assessing Hospital Progress Toward High Reliability

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## In Search of Water: South Carolina Hospitals Apply High Reliability Thinking to Protect Patients in the Midst of Flooding

*J. Thornton Kirby*

“**W**ater, water every where, nor any drop to drink.”<sup>1</sup> In his poem *The Rime of the Ancient Mariner*, Samuel Taylor Coleridge used these famous words to describe the agony of thirst felt by desperate sailors who could not find fresh water. That agony echoed across time as South Carolina recovered from the recent floods.

In early October 2015, storm clouds brought a rain event to the Carolinas that was described by many as biblical in nature. Scientists endeavored to describe the deluge more empirically. For example, one meteorologist estimated the storm dropped *11 trillion gallons* on the Carolinas—enough water to fill 636 million swimming pools or end the drought in California.<sup>2</sup> In an irony reminiscent of Coleridge’s ancient mariner, the hospitals hit hardest by flooding would spend the next 10 days in search of clean water. The heavy rains caused flooding in many parts of South Carolina, but no city suffered more than the capital city of Columbia. Hundreds of homes and businesses were heavily damaged by flood waters, and the entire city’s water supply was interrupted when the swollen river breached a levee used to ensure adequate pressure for the city’s water treatment plant. That interruption in the municipal water supply spurred a frenzy among hospital executives and emergency managers that would span two full weeks and identify novel challenges. For example, our hospitals had never been required to answer the question, “How many gallons of water does your facility use in a 24-hour period?” They could quickly calculate the amount of water required for drinking, but they had a much more difficult time estimating how many gallons were required for boilers, sterilizers, and chillers. And even though they knew that their water was purchased from the city, they did not know which of the city’s two plants supplied their individual buildings. This information was critical as the city established boil-water advisories and worked to restore the water supply. Yet another novel challenge was presented by the extensive damage to infrastructure in certain parts of the state. Many hospitals experienced staffing challenges because employees had trouble driving to work, but at least one rural community was so isolated by bridge closures that their employees had to alternate 48-hour shifts until the

National Guard could bring in replacements by bus.

Fortunately for our patients, South Carolina’s hospital community has been on a three-year journey to make hospital care in the Palmetto State highly reliable. What does that mean? High reliability industries, such as commercial aviation, amusement parks, and nuclear power generation, demonstrate exemplary safety records even though they engage in hazardous activities. No hospitals anywhere in the world can boast safety records on par with these high reliability industries, but the South Carolina Hospital Association (SCHA) aims to change that. With the Joint Commission Center for Transforming Healthcare<sup>3</sup> as our primary partner, since 2013 we have helped hospital leaders at 31 hospitals within 12 health care systems in the state, through the South Carolina Safe Care Commitment,<sup>4</sup> learn new ways to guarantee safety for patients, employees, and visitors of hospitals. CEOs and other executives from participating South Carolina hospitals meet regularly to collaborate on strategies to move health care toward the same highly reliable performance seen in high reliability industries. These strategies have included the following:

- Establishment of daily safety huddles, which have uncovered countless opportunities to avert patient harm
- Adoption of a serious safety event classification system to identify and track undesirable events
- Use of a high reliability self-assessment tool, Oro™ 2.0, to develop a baseline against which culture change can be measured.<sup>5,6</sup>

In support of our members’ efforts, in 2013 the SCHA established a Certified Zero Harm Award program<sup>7</sup> (patterned after the High Reliability Certified Zero Award established by the Memorial Hermann Health System [Houston] in 2011<sup>8</sup>) to recognize hospitals that demonstrate at least 12 consecutive months without certain harm events. After only two years of work we have already seen downward trending in serious harm events, and by September 2015 we had awarded 148 Zero Harm Awards statewide. Moreover, we’ve received 123 applications for the third year, most of which are expected to survive the validation process.

The work that we’ve done paid substantial dividends during

the October 2015 flooding, and it was gratifying to watch hospital leaders apply high reliability thinking to disaster management and recovery. Weick and Sutcliffe identified five principles of high reliability organizations (HROs) that enable them to address unexpected situations: preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise.<sup>9</sup> All five principles were on display in the aftermath of the flooding in South Carolina.

*Preoccupation with failure* refers to a mind-set that never takes safety for granted. HROs do not assume that their processes will work as designed—they treat any small failure as a sign something may be wrong with their system. Such organizations are so preoccupied with failure they train every single employee to show up for work and ask themselves, “What could go wrong today?” This organizationwide surveillance, which Weick and Sutcliffe referred to as “collective mindfulness,”<sup>9</sup> was repeatedly demonstrated in our hospitals as they dealt with flood-related issues. In the course of daily conference calls with public health officials during the two-week crisis, I witnessed their preoccupation with failure as they looked for small discrepancies that could magnify the crisis in the days and weeks to come. “Do we have enough IVs and Cipro?” “If the city can’t supply water, will the local pharmacies be able to fill our patients’ prescriptions?” These questions and dozens like them were raised daily.

But the primary concern—where hospitals were most preoccupied with failure—was the restoration of a water supply. Over and over, hospital leaders rejected options that could not be relied on to ensure the safety of all patients and employees. For example, several hospitals had tested their water and found it pure, but the city had not yet lifted its boil-water advisory. It was tempting to use this clean water to sterilize instruments for patients in need of surgery, but hospitals could not guarantee that the water would remain free of contaminants, as additional water mains were still being repaired. Another proposed solution was to run nonpotable water through the hospital’s boilers, superheat\* it to remove contaminants, and then use it to sterilize instruments. However, even though the manufacturers contacted thought this approach workable, they would not certify its efficacy. As a result, these ideas were dismissed. Nothing was acceptable unless it could completely shield patients and staff from harm.

*Reluctance to simplify* means resisting shortcuts and working instead to create a more complete and nuanced picture of the challenges ahead. As soon as the water supply was interrupted, hospitals notified city and National Guard officials that

they needed water to avoid evacuating 1,600 patients from the downtown area. When the National Guard asked how much water was needed and why, hospitals realized that they had oversimplified the problem. From that moment forward, the hospitals outlined their water needs in terms of intended use, daily volume requirements, level of purity required, and delivery options. For example, a hospital might specify 50,000 gallons of potable water per day for chillers delivered to the south side of the building, 1,000 bottles of drinking water per day delivered to the loading dock on pallets, 5,000 gallons of nonpotable water required daily for flushing toilets, and so on. The hospitals increased the reliability of their operations by being more thorough in their understanding of water requirements. After a solution was discovered for drinking water, for example, the scale of the remaining problem was diminished. This process of tackling individual components of the challenge continued until all the various water requirements had been met.

*Sensitivity to operations* means attention to frontline operations where the real work gets done. When organizations build a culture that is sensitive to operations, anomalies are noticed while they are still easy to fix. Said another way, HROs pay attention to what people are *actually* doing, regardless of what they are *supposed* to be doing. Our hospitals demonstrated this principle with plumbers and surgeons alike. As hospital engineers worked alongside National Guardsmen to restore the water supply, their strategies were redirected frequently by plumbers. The plumbers were the professionals who knew how to move water most efficiently through the buildings; their encyclopedic knowledge of valves, supply zones, water mains, exterior water connections, and so on, made them the go-to experts as water was restored and systems were flushed.

Surgeons, on the other hand, needed detailed information about water quality so they could make patient care decisions. Was the water in the scrub sinks adequate to wash their hands before a procedure? Were the sterilizers supplied with water pure enough to remove all contaminants? In order to answer a long list of technical questions, one health system developed a Q&A document that was made available to all surgeons in an effort to alleviate any concerns about the hospital’s readiness to resume its operating room schedule.

Another hallmark of HROs’ sensitivity to operations is their skill at identifying and correcting unsafe conditions even when they are not looking for them. Several examples emerged during the flood response. As noted earlier, hospital leaders realized that they did not have sufficiently detailed information about their facilities’ water demands. They also realized that they needed the ability to provide their own water or purify

\* *Superheated water* is liquid water under pressure at temperatures between the usual boiling point, 212°F (100°C) and the critical temperature, 705°F (374°C).

nonpotable water. The city's largest health system explored the feasibility of drilling wells to guarantee at least enough water to address basic needs such as toileting and supplying chillers. Yet the advice from experts was that the local geologic conditions were unfavorable and the chances of success would be low. So the system is now exploring the feasibility of installing a water tank on the campus of its largest hospital, although with the hospital requiring 200,000 gallons a day, even a large water tank would provide only a short-term supply. At one hospital that was geographically isolated by damage to local bridges, it was discovered that accurate maps of the roads leading in and out of town were unavailable and that efforts to guide employees to the safest routes to work were thus hindered. This same hospital ran short on food supplies after several days, which led to the realization that the hospital's just-in-time supply chain could cause serious problems in the event of a disaster of any greater magnitude. On a statewide level, public health officials learned that our state does not have sufficient water purification resources; we avoided a mass evacuation only because the National Guard brought reverse-osmosis water purification units from other regions. To avoid disruptions that could occur from future events that have nothing to do with flooding, the SCHA and the state's Department of Health and Environmental Control are in discussions to purchase several reverse-osmosis units and stage them across the state in strategic locations.

*Commitment to resilience* describes a never-say-die attitude. *Resilience* is the organization's ability to regain its footing after a disruption and to continue functioning even under stress. In the first 24 hours after the water supply was interrupted, Columbia's downtown hospitals were forced to consider a city-wide evacuation of patients if a consistent water supply could not be established. Even as they began making preparations for evacuation, the hospitals turbocharged their efforts to locate adequate water supplies. For example, the fire department supplied water for chillers, the Coca-Cola Company donated three tractor-trailers of bottled water for drinking, and the National Guard supplied water purification systems that allowed for sterilization of surgical instruments. These on-the-spot solutions allowed our city's hospitals to narrowly avoid evacuation. One health system president summed up his system's commitment to resilience with this simple statement: "Our first priority, as always, is to deliver quality care to our patients. Our second priority is don't evacuate!"

Finally, *deference to expertise* is about leadership humility—resisting the temptation to make decisions on the basis of organizational hierarchy and delegating them instead to the people

most qualified to make them. For example, airline pilots have great authority to manage their planes, their crews, and their passengers. But they don't overrule mechanics when it comes to an airplane's readiness to fly. If a mechanic says that the plane isn't ready, the pilot doesn't argue.

I watched our hospital leaders defer to expertise throughout the flooding and recovery period. They deferred to infection control professionals on cleanliness of water; they deferred to engineers on the rerouting of water supply systems; they deferred to National Guardsmen on the process for purifying water; and they deferred to physicians on how best to meet the needs of their patients. Yet these hospital leaders were not passive—they led every meeting and conference call, they set high expectations for patient care and business recovery, and they marshaled resources for their teams. Simply put, these leaders made certain each critical decision was made by the person with the specific knowledge required for that particular problem.

The net result was a recovery without significant interruption and without harm to patients. Are South Carolina's hospitals HROs? Not yet—we have a long way to go. Are we well on our way? Absolutely. We've demonstrated in a real-world stress test that we're learning how to think like HROs.

Water, water everywhere, and we found a way to drink. ■

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