

Need to restore vital signs? There's a manual for that

November 5 2013, by Sara Wykes



Sara Goldhaber-Fiebert, right, helped to develop a manual that serves as a cognitive aid in responding to emergencies in the operating room. Credit: Norbert von der Groeben

First-year anesthesia resident Jason Johns, MD, was pleased with the way his patient, a man in his early 70s, had maintained a steady set of vital signs during a four-hour surgical procedure at Stanford Hospital. "We were monitoring his blood loss and his numbers looked OK," Johns said. "But when we were sewing him up, his blood pressure dropped and he went into cardiac arrest."

In the minutes that followed, Johns and his colleagues did everything they knew should be done immediately. They turned the man on his back, began [chest compressions](#) and administered the standard

medications. Johns also did something else as soon as those basic procedures were under way. "I grabbed the emergency manual and started reading off things," he said. "We went through the manual to make sure we'd covered our bases and done everything."

Johns had trained briefly with the manual in simulation settings. He'd also read the emails reminding him and other Stanford medical personnel of its presence in the operating rooms. When the moment came that an unexpected [cardiac arrest](#) threatened the life of his patient, he reached for it.

That manual—with its laminated pages and brightly-colored graphic design, hung by a sturdy metal chain within easy reach of any member of a surgical team—represents medicine's next step in using cognitive aids to support practitioners in doing the best job possible in a profession where stress is a constant and knowledge is ever-expanding.

The value of such cognitive aids is detailed in a paper published in the November issue of *Anesthesia & Analgesia*. The paper describes the work of multiple Stanford teams that developed and implemented the emergency manual through a combination of research, training in simulated settings and feedback based on practical use. The emergency manual is now in use at Stanford and other hospitals.

It covers protocols for 24 conditions and circumstances. Some, like how to deal with a patient's bradycardia (a slow and unstable heartbeat), will be familiar only to medical professionals. Others, like how to handle a hospital-wide power failure, address what to do first, and thereafter, in such circumstances.

Sign of strength

In an editorial accompanying the Stanford paper and another paper on

the same topic, David Gaba, MD, professor of anesthesia and associate dean for immersive and simulation-based training at the School of Medicine, makes the connection between the value of cognitive aids and the spreading adoption of relevant crisis checklists in medicine. Their value, Gaba wrote, transcends the pejorative nicknames, like cheat sheets and crib sheets: "While in the past the use of these aids was viewed as a sign of weakness and stupidity, many of us strive to emphasize to students, trainees and experienced clinicians that their use is actually a sign of strength and wisdom and that failing to use them is a sign of weakness and perhaps hubris."

Sara Goldhaber-Fiebert, MD, lead author of the study and clinical assistant professor of anesthesia at Stanford who helped develop and implement the manual, said cognitive aids help medical teams efficiently and effectively deliver optimal care to their patients during critical events. "The emergency manual helps teams fill the gap between what they have done and what their patient needs," she said. "The goal is not to replace vital clinical actions, getting appropriate help or exercising good clinical judgment. Clinicians who have trained on why and how to use emergency manuals in teams can find helpful information quickly and adapt their actions to ensure the best care."

For Goldhaber-Fiebert and others studying manuals and checklists, the need is based on an easily understood reality: No one can be expected to remember everything correctly, especially when under pressure. In an emergency, the outcome can be altered when a checklist has been created with care and its practice rehearsed often. For decades, the aviation industry has done just this.

"Remembering nine out of 10 actions for a test is not good enough in real life for the patient who has the one in 10 problem," said the paper's senior author, Steven Howard, MD, associate professor of anesthesia. "Our memory is imperfect, more so under stress and that's the reason

why emergency manuals, cognitive aids and checklists are critical."

While some cognitive aids for a handful of medical situations are in common use, the emergency manual developed by the Stanford Anesthesia Cognitive Aid Group—whose core members, in addition to Goldhaber-Fiebert, Gaba and Howard, are Larry Chu, MD, associate professor of anesthesia, and Kyle Harrison, MD, clinical assistant professor of anesthesia—provides a comprehensive pass at building a reference of responses to perioperative critical events.

Testing the wording

The development group examined every aspect of the emergency manual, down to details whose importance might not seem immediately obvious, including the colors, typefaces, boldfacing of words, size of pages, binding and physical placement within a working space. Over and over, the implementation team tested the manual in simulation with a full medical team, refining elements based on feedback from its users. Both its wording and design went through many versions to reach the goal of allowing time-pressured teams to deliver optimal care efficiently. It will continue to evolve as feedback from clinical use is gathered, Goldhaber-Fiebert said.

"We learned from simulation testing that it is not enough just to put the manual in the OR," Goldhaber-Fiebert said. "We need to train people to use it. The 'what' is not enough. By training with these manuals, people reinforce their knowledge of both content and format. They learn how to efficiently access potentially lifesaving information and why using a manual like this can help."

The implementation team—which included anesthesiologists, nurses, surgeons, anesthesia technicians, hospital leadership and others—led accessibility and training efforts for operating room staff. Many were

involved in decisions, including where to place the emergency manuals for easy visibility without blocking workflow. Those simulations helped the team decide to hang the manual from a 6-foot beaded chain on a hook on the side of the anesthesia cart. Soon after, OR nurses requested a second copy be hung near the nursing phone. Computer and anesthesia technicians wanted copies where they work to help them anticipate equipment that might be needed during specific emergencies.

Beyond the knowledge that is reinforced, "just the act of training to use the manual promotes team building and communication, which is critical not just in emergencies, but all the time," said Bryan Bohman, MD, the former chief of staff at Stanford Hospital and an anesthesiologist who contributed to the implementation of the Stanford manual.

The *Anesthesia & Analgesia* paper also addresses other key elements in the best use of emergency manuals in combination with teamwork concepts such as leadership, roles and responsibilities, communication within the team, and planning. Such issues are not new: Stanford has had a simulation-based course in anesthesia-crisis resources for more than 20 years that included cognitive aids or emergency manuals. In recent years, the Anesthesia Department has incorporated an immersive training module in cognitive aids and emergency manuals. This type of training is gradually being expanded to include all personnel in Stanford's operating rooms. A 2006 study led by Harrison found teams that consulted a cognitive aid performed more of the critical actions and did so more quickly than teams working only from memory.

Joining forces

Stanford is not alone in its efforts to develop emergency manuals. In 2012, members of the Stanford Anesthesia Cognitive Aid Group joined with other clinician groups to form the Emergency Manual Implementation Collaborative at a national meeting of the American

Society of Anesthesiologists. Goldhaber-Fiebert is a member of that collaborative, as are Howard and Gaba, who was a key contributor in crafting and testing the manual. The collaborative is dedicated specifically to the adoption of crisis checklists in many acute care areas, focusing first on the operating room and related sites.

Several resources and references are on the collaborative's website at www.emergencymanuals.org, and the Stanford emergency manual can be downloaded for free at emergencymanual.stanford.edu. Since becoming available last spring, more than 3,500 people have downloaded a copy, including many hospital leaders and clinicians.

Johns, now a second-year resident, has grown in confidence, but still sees the manual as a key resource. "Having the manual is reassuring, especially when you're going through these catastrophic events," he said. "There's always a certain part of you that wonders, 'Have I thought of everything?'"

More information: emergencymanual.stanford.edu

Provided by Stanford University Medical Center

Citation: Need to restore vital signs? There's a manual for that (2013, November 5) retrieved 7 May 2024 from <https://medicalxpress.com/news/2013-11-vital-manual.html>

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