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News

STS Press Release

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Heart Surgery Residents Ready to Save Real Lives After ‘Out of Body’ Training Experience

Largest, Most Comprehensive Study of Simulated Surgery Shows Practice May Help Improve Patient Outcomes

CHICAGO (August 25, 2016) — Simulation training for surgery residents builds confidence and could have a life-saving impact on patients undergoing cardiac surgery, according to two studies published online today in *The Annals of Thoracic Surgery*.

“Simulation training should create better surgeons who are trained much more efficiently,” said Richard H. Feins, MD, from the University of North Carolina at Chapel Hill, who led one of the studies. “This type of learning allows surgery residents to develop their knowledge, skills, and confidence, before going into the operating room, thus protecting patients from unnecessary risks.”

Dr. Feins, Nahush A. Mokadam, MD, from the University of Washington in Seattle, and James I. Fann, MD, from Stanford University in California, were among leaders from eight major cardiothoracic surgery residency programs in the United States who formed the Cardiac Surgery Simulation Consortium.*

In what is believed to be the largest, most comprehensive study of simulation-based cardiac surgery training ever conducted, the Consortium developed a rigorous, 39-session curriculum that included simulation training modules for three commonly performed cardiac surgery procedures (cardiopulmonary bypass, coronary artery bypass grafting, and aortic valve replacement) and three adverse events (unexpected and undesirable experiences, such as a sudden deterioration in heart function).

“The first three modules laid out the basics of cardiac surgery,” said Dr. Mokadam. “We had 27 residents who were taught in a deliberate, detailed, progressive manner that ensured they understood the basics. Over the course of several weeks, the residents went from novices to truly being experts in doing routine procedures such as aortic valve replacement.” The second half of the curriculum delved into adverse events. Residents were instructed in a non-threatening classroom environment on how to address catastrophes during surgery, and then practiced their protocols in a fully immersive simulated environment.

Key Points

- Some cardiac surgery training can be completed efficiently and more safely by using simulation technology.
- Cardiothoracic surgery residents who received simulation training improved in all surgical skills that were evaluated, with perfect or near perfect performance.
- Simulation training has the potential to decrease the number of and improve responses to adverse outcomes that occur, resulting in lower costs and better outcomes for patients.

The simulation technology ranged from low fidelity plastic models to real tissue and pig hearts that realistically duplicated actual patients undergoing surgery. Repetition, practice, coaching, and review were incorporated into each module and resulted in a significant improvement in surgical skills, communication, and decision-making. The study showed that cardiothoracic surgery residents improved in all surgical skills that were evaluated, with perfect or near perfect performance after about 110 hours of total simulation training per resident.

Traditionally, surgery residents are taught to perform surgery via the apprenticeship model, which depends on learning almost exclusively in the operating room. According to Dr. Feins, the modern operating room is too fast-paced and has too many competing priorities to be the only place to train residents. A simulation-based curriculum can enhance and facilitate training by circumventing the limitations of the operating room, thus providing a model to complement the traditional apprentice learning in medicine.

“In the simulation environment, the essentials of producing masters—deliberate practice and component task training—can be employed,” said Dr. Feins. “One would never expect to produce an outstanding basketball team if the players could only develop their skills during a game. But that is essentially what the apprentice model in surgery does. We have shown there is a better way.”

Unlike the operating room, the simulated surgery environment allows learning and re-learning skills as often as required to correct mistakes. This provides the opportunity for residents to fine-tune skills and gain confidence, in an effort to optimize clinical outcomes. The per-repetition analyses from the study showed a clear relationship between repetition of a task and improvement in performance.

“Simulation-based training in adverse events could well prove life-saving,” explained Dr. Feins. “This training has the ability to decrease the number of adverse outcomes that occur and to minimize the ramifications of those events. This should result in better outcomes for patients, as well as lower costs and improved efficiency.”

Dr. Fann agreed. “We have created a curriculum that allows crisis management training to be conducted during cardiac surgery residency. Until this study, we have not had well-defined steps for simulation-based crisis management of important rare events. This approach leads directly to improved patient safety.”

Residents More Confident After Simulation Training

A companion study, also published online today in *The Annals*, analyzed the experiences of residents and faculty members who participated in the simulation training.

The analysis found that, after completing simulation training, the vast majority of residents (85%) and the entire faculty (100%) reported feeling more comfortable and confident with the resident skillset and performance in the operating room. The experience also helped residents and faculty develop an improved rapport and confidence in each other.

“The rapport I had with the residents was exponentially improved,” said Dr. Mokadam. “I had practiced with the residents in the simulation lab and they had proved to me time and again that they knew the steps and that they

understood the principles of the operation. So when we were in the operating room, my confidence level in those residents was extremely high because they had already proved to me that they could do it.”

Simulation Curriculum Available Online

At the completion of the study, the curriculum was reworked into 29 sessions, rather than 39 sessions. The revised curriculum is now available via the Thoracic Surgery Directors Association (www.tsda.org), which, along with other organizations, provides leadership in cardiothoracic surgery residency education in the US. In addition, the Consortium trains faculty members at other residency programs on how to use the curriculum.

“The simulation-based training curriculum will continue to evolve and expand,” said Dr. Feins. “This model for training is also being adopted for training in other parts of cardiothoracic surgery such as robotic lobectomy. We hope that it will be an integral part of every resident’s experience in the not so distant future.”

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*The Cardiac Surgery Simulation Consortium also included Jennifer D. Walker, MD, from Massachusetts General Hospital, John V. Conte, MD, from Johns Hopkins University, Jonathan C. Nesbitt, MD, from Vanderbilt University, George L. Hicks, MD, from the University of Rochester, and Harold M. Burkhart, MD, from the Mayo Clinic, and K. Robert Shen, MD, from the Mayo Clinic.

Feins R, Burkhart H, Conte J, Coore D, Fann J, Hicks G, Nesbitt J, Ramphal P, Schiro S, Shen R, Sridhar A, Stewart P, Walker J, and Mokadam N. Simulation-Based Training in Cardiac Surgery. *Ann Thoracic Surg* 2016; DOI: 10.1016/j.athoracsur.2016.06.062.

Mokadam N, Fann J, Hicks G, Nesbitt J, Burkhart H, Conte J, Coore D, Ramphal P, Shen R, Walker J, and Feins R. Experience with the Cardiac Surgery Simulation Curriculum: Results of the Resident and Faculty Survey. *Ann Thoracic Surg* 2016; DOI: 10.1016/j.athoracsur.2016.06.074.

Note: Dr. Mokadam discloses a financial relationship with St. Jude Medical, HeartWare, and SynCardia Systems, Inc.; Dr. Fann with Twelve, Inc.; Dr. Conte with LivaNova, Medtronic, Inc., and Boston Scientific; Drs. Coore, Ramphal, and Feins with KindHeart, Inc.

Find comprehensive medical information presented for patients by leading experts in cardiothoracic surgery at the [STS Patient Website](http://ctsurgerypatients.org) (ctsurgerypatients.org). For a copy of *The Annals* article, contact Jennifer Bagley at 312-202-5865 or jbagley@sts.org.

Founded in 1964, The Society of Thoracic Surgeons is a not-for-profit organization representing more than 7,300 cardiothoracic surgeons, researchers, and allied health care professionals worldwide who are dedicated to ensuring the best possible outcomes for surgeries of the heart, lung, and esophagus, as well as other surgical procedures within the chest. The Society’s mission is to enhance the ability of cardiothoracic surgeons to provide the highest quality patient care through education, research, and advocacy.

The Annals of Thoracic Surgery is the official journal of STS and the Southern Thoracic Surgical Association. It has a 5-year impact factor of 3.433.