

The Center for Advanced Medical Simulation, Karolinska Institutet, Karolinska University Hospital, and Stockholm County Council

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OVERVIEW OF THE INSTITUTE

Purpose

The Center for Advanced Medical Simulation is an institution aimed at improving patient safety and reducing errors in health care. It was established by to meet the demands of systematic and evidence-based training in high-technological health care with a special focus on image-guided surgery and endoscopy as well as critical care management. The Center was inaugurated in 2002 by the head of the National Board of Health and Welfare in Sweden (Fig. 1) and was already described in 2001 by the Swedish Medical Journal (*Läkartidningen*) (Fig. 2).¹ The role of the Center is to increase patient safety by providing values and systematic training opportunities for improved patient safety in high-technological health care.

The Center offers systematic training of both technical and nontechnical skills integrating high-fidelity simulators. The target groups are students, physicians, nurses, and biomedical engineers. The vision is error-free health care based on improved patient safety and decreased risk of medical errors by human factors. There is also a strong commitment to introduce patient simulation as an ethical, rational, and cost-effective method to facilitate a change in culture leading to increased patient safety in health care.

The Center is a leading core facility for systematic training, evaluation, and research within the Stockholm County, Karolinska University Hospital and Karolinska Institutet. The Center has a leading position in systematic education, evaluation, and research in the field of advanced medical simulation.

Location

Geographic. The Center for Advanced Medical Simulation is located strategically in Stockholm, the capital of Sweden, in

modern facilities within 1 of the strongest university hospitals and medical schools in Sweden, in which multidisciplinary collaboration in an academic environment can be established, developed, and maintained.

Within the Institution. The Center is a core facility for systematic training within the Stockholm County, Karolinska University Hospital and Karolinska Institutet. Karolinska Institutet has the Nordic region's greatest range of educational programs within the medical field. The 20 different training programs enable students to enter professions that will improve patient quality of life by preventing, curing, treating, or alleviating disease. Across all programs, the aim is that all students will receive systematic training that is not only the best that the country has to offer but also tailored to the high technology of today's health care and to the needs of international medical research and development. Karolinska Institutet is in the forefront of devising innovative ways of training students with the aim of improving health care for all. The best and brightest young students are crucial to the Karolinska Institutet—and to get the “best and brightest,” the Karolinska Institutet programs must be second to none. Strengthening and enhancing the educational programs at the University is a key element in the vision of Karolinska Institutet.

Strengths

One important strength is that the Center for Advanced Medical Simulation has a multidisciplinary approach with active clinicians in general surgery; orthopedic surgery; urology; cardiology; gastroenterology; obstetrics and gynecology; ear, nose, and throat (ENT); and emergency medicine; as well as anesthesia and intensive care, serving as instructors and managers of the Center. Nurses and biomedical engineers also are engaged as instructors at the Center. The Center was the first to be established in Sweden. Another strength is that the Center is run jointly by the Karolinska University Hospital, Karolinska Institutet, and The Stockholm County Council.

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FIGURE 1. The Center for Advanced Medical Simulation was inaugurated in 2002 by the Head of the National Board of Health and Welfare in Sweden, Kerstin Wigzell (right).

LEARNERS TARGETED

Type of Learner Served—Practicing Surgeons, Individuals from Other Specialties and Disciplines, Residents, Students, Etc

The Center offers systematic training of technical and nontechnical skills in high-fidelity simulators for students, physicians, nurses, and biomedical engineers. The Center provides courses in high-fidelity human patient simulation in a broad range of fields ranging from procedural training (eg, induction of anesthesia) to full-scale multidisciplinary trauma team training applying Crew Resource Management (CRM) principles. Trainees range from medical and nursing students to clinical consultants and nurses.

On a graduate level, consultants and residents from multiple specialties are trained at the Center, to include anesthesiologists, surgeons, gastroenterologists, urologists, gynecologists, ENT surgeons, transplant surgeons, orthopedic surgeons, intensivists, pediatricians, emergency physicians, cardiologists, pulmonologists, general practitioners, and any physician on call in the emergency department.

Most students come from Karolinska Institutet. Medical students are also trained in several types of courses including the basic course in surgery, anesthesia, pediatrics, emergency medicine, and ENT. Nursing students in anesthesia and intensive care, scrub nurse students, and emergency care are also trained. Last, but not least, students in engineering from the Royal Institute of Technology train at the Center.

In image-guided surgery, courses are available for medical students, residents, and consultants in a range of specialties dealing with image-guided intervention. In 2003, a basic accreditation program in image-guided surgery was established and implemented in the courses given by the Center. Apart

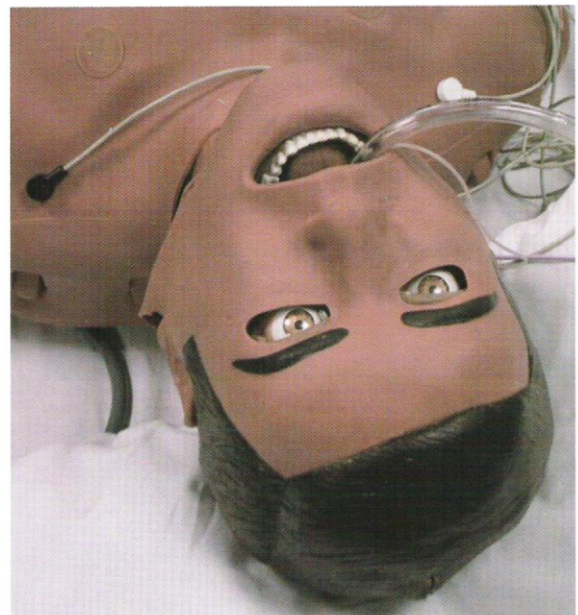
from theoretical knowledge, performance above predefined validated criterion levels in simulators is required. The coursework has been developed beyond a generic level to task-specific levels (eg, laparoscopy in general and gynecologic surgery, gastroscopy, and colonoscopy). A biomedical and technological curriculum has also been established, highlighting essential elements in a broad range of specialties in which invasive image-guided intervention is practiced frequently. Managing the challenges when agreeing on a multidisciplinary and measurable, highly generalizable basic curriculum format is a main challenge when changing the educational paradigm in modern skills training.

Description of Courses and How Often the Courses Are Offered

Most of the educational and training focus at the Center is in different fields of surgery and critical care. Attention is directed toward both procedural skills and CRM and team training. Practice is integrated in a multitude of courses that are widely available and also for multiple specialties (Table 1). All courses given at the section for Advanced Patient Simulation are mul-

Läkartidningen

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Simulatorcentrum på Huddinge – för bättre och säkrare träning

FIGURE 2. The Center for Advanced Medical Simulation was first described in a cover story in 2001 by the Swedish Medical Journal *Läkartidningen*.

TABLE 1. Systematic Team Training for Multiple Specialties Applying CRM Principles

CRM for the Trauma Team	General surgery, orthopedic surgery, anesthesia, radiology, emergency department staff
CRM for the Intensive Care Unit Team	Intensive care, infectious diseases, cardiology, pulmonology
CRM in difficult airway management	Anesthesia, ENT, operating theater staff
CRM for the Emergency Department Team	Emergency medicine, internal medicine, cardiology, anesthesia, emergency department staff
Training in donor management	Intensive care, transplant surgery

tiprofessional (physicians, nurses, and assistant nurses) presently with the exception for training of medical students.

Applications to the Center's programs are sent directly via the Center's website (<http://www.simulatorcentrum.se>). Practice with high-fidelity simulators in image guided surgery or human patient simulation integrated in established courses at Karolinska Institutet (eg, course in basic surgery and anesthesia, trauma electives, ENT electives, and emergency medicine in medical school or special courses for nurses specializing in anesthesia and intensive care, operating room (scrub nurses), and prehospital care in nursing school. High-fidelity human patient simulation of both skills and team training will now also be implemented in the basic course of pediatrics and electives in emergency pediatrics.

Courses are also given on request (eg, intensive care unit or emergency room team training in situ in the authentic clinical environment including pediatrics). Training in image-basic and advanced image-guided surgery for residents in surgical specialties is also provided.

The curriculum is focused on the cognitive process to complete a task. Systematic information sampling and assessment of the situation to achieve situational awareness is trained. The cognitive processes of dynamic decision making, action, and reevaluation are reviewed in a didactic seminar and are practiced repeatedly under the supervision of a trainer. One example is the course in "Rational anesthesia," which is applied to the procedure to safely induce, maintain, and exit general anesthesia.

In all CRM courses, the focus is training of nontechnical skills, such as relevant behaviors and attitudes in patient care and cooperation with others.

All training courses in the Center are developed using a 9-step constructive alignment method. Regarding image guided intervention, curriculum is available involving procedural skills, generic simulations for training basic skills, and 3-dimensional trekking, as well as full procedure simulations in gastroscopy, colonoscopy, endourology, endoscopic retrograde cholangiopancreatography, laparoscopic cholecystectomy, arthroscopy, endovascular intervention and gastric bypass proce-

dures, different laparoscopic gynecologic procedures, and laparoscopic suture.

Another important focus is the formal training of instructors where a 5-week formal university course for simulator instructors has been completed (Fig. 3). This activity of structured training of instructors at the Center for Advanced Medical Simulation has been identified as a key factor.²

Types of Learners Served from Outside the Institution

Apart from students from the Royal Institute of Technology, the Center hosts several national board certification courses in arthroscopy, surgical laparoscopy, emergency surgery, cardiology, and gynecologic laparoscopy.

SPECIAL FEATURES

Equipment—Simulators and Special Devices

At the Center, we have a large variety of hybrid mechanical and virtual reality (VR) trainers, including black boxes and virtual reality simulators. Several part- and full-procedure VR simulators with and without haptics for laparoscopic cholecystectomy, laparoscopic bypass, gynecologic laparoscopy, gastrointestinal endoscopy, bronchoscopy, endourology, endovascular procedures, arthroscopy, and laparoscopic suturing models are located in the facilities of the Center for advanced medical simulation. The simulators are portable within the Stockholm County area for local courses. The Center also has access to several low-fidelity models that are available in collaboration with the clinical training center. These models include airway models, different anatomical human body forms, bench models, breast models, pelvic models including prostate model, and so on. The Center also has several human patient simulators (adult and pediatric). All are portable to allow in situ simulation in the emergency room or intensive care unit in Karolinska University Hospital or other hospitals in the Stockholm County Council area.



FIGURE 3. An important focus is the formal training of instructors, who must complete a 5-week formal university course for simulator instructors.

Unique Teaching or Learning Methods Employed

The Center for Advanced Medical Simulation provides in situ simulation of high-fidelity human patient simulation in the intensive care unit and the emergency room in the whole Stockholm County Council area.

CONTACT INFORMATION

Director: The Director of the Center is Li Felländer-Tsai, MD, PhD, Professor and Senior Consultant in Orthopedic Surgery.

Administrative contact: Ann-Charlott Nordström is the Administrator of the Center.

Other key personnel: Ann Kjellin, MD, PhD, Senior Consultant in General Surgery is Manager of the Section for Image-Guided Surgery.

Petter Westfelt, MD and Cecilia Escher, both of whom are consultants in anesthesia and intensive care, are heading the section for Advanced Patient Simulation. Mats Hedsköld is Study Director.

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