Commentary

Robotic telepresence in the intensive care unit

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Providing timely expertise in the care of critically ill patients is one of the main goals of critical care medicine [1]. This is a challenging goal, given the acknowledged shortage of intensive care specialists [2]. It requires the bedside nurse to have real-time access to senior level intensive care physicians, and conversely it requires the intensivist to have access to the intensive care unit (ICU). The strategic use of information technology (IT) has become one of the important features of modern critical care. IT applications offer the promise of improving patient care, physician efficiency, and patient outcomes [3,4].

Many IT applications and devices are presently in use, including handheld personal digital assistant (PDA) devices with wireless access, internet accessible electronic medical records systems, and digital teleconferencing. These various forms of IT serve one or more purposes for the intensivist. For example, PDAs are often used for database access, such as access to a digital drug database or a digital textbook. At last count, there were more than 527 Palm-based and 306 Windows CE-based medical programs for PDAs [4], with an estimated 60% of physicians using some type of PDA [5], and this number is expected to grow. Beyond the PDA, other IT solutions are needed for intensivists to help integrate data and develop treatment plans. An important need of intensivists is to interact frequently with real-time patient information and with the bedside nurses from a remote location. Thus, there is a need for a user friendly telemedicine solution for the ICU.

One of the best publicized telemedicine models is the eICU®, initially promoted by Breslow and colleagues [6]. The eICU concept is to create a centralized workstation of intensivists who supervise multiple patients in a variety of ICUs via high-speed internet connections. This model makes use of electronic medical record systems and real-time remote monitoring of patient monitors with proprietary smart alarms, which empower the intensivist to direct patient care. The details of this model have been published [7], and recently the use of eICU was validated in clinical practice [3]. Using eICU in adult academic ICUs across 2140 patients, Breslow and colleagues were able to demonstrate marked improvement in several features of patient care and patient outcome. Notably, there were statistically significant improvements in hospital mortality, ICU length of stay, and hospital financial profitability in patients treated using eICU. Thus, eICU has demonstrated that increased access to intensive care experts and more frequent interactions between the experts and bedside care givers results in improved outcomes.

In the UCLA neurologic ICU we have chosen an alternative telemedicine approach that is called robotic telepresence [8]. Telepresence is the concept that the physician is able to look and feel real to those in the ICU and to interact in a human way with the environment. This involves the use of a robot that projects the image of the physician in real-time onto a flat screen mounted at the head of the robot. The robot is mobile and under the control of the remotely located physician, and is able to move around the ICU in a manner similar to walking around the ICU on foot. The flat screen serves as the head and is able to move in 360 degrees and orient to face the person in the ICU directly. The telepresence method permits real-time, two-way, face-to-face communication between nursing staff, patients and families in the ICU. This interaction provides important visual information that cannot easily be conveyed by telephone, such as the actual appearance of the patient, graphical data from a monitor or flowsheet, and body language of the nurse or family. It is easy to understand that visual information such as the basic elements of the neurologic examination, appearance of the skin, appearance of the abdomen, and appearance of the patient's breathing are much easier to appreciate when they are seen directly by the physician rather than being conveyed by a third party.

Telepresence is unique in that nurses, patients, and families interact with the robot as if it is a person. This interaction occurs without orientation or coercion, and nurses take to the system 'like a fish into water'. It is not clear why this occurs,

ICU = intensive care unit; IT = information technology; PDA = personal digital assistant.

but this may reflect the mobility of the system. This acceptance is critical to the success of the overall process of remote physician involvement. In contrast to eICU, the robot is viewed as a trusted intrinsic member of the ICU rather than as an intrusive, external tele-expert, who is acting like 'Big Brother'.

Robotic telepresence started as a method for remote minimally invasive surgery [9-11]. This experience points to an untapped potential for performing manual tasks and invasive procedures in the ICU in future applications. In our preliminary assessment of robotic telepresence, we used the robot to make telepresence rounds, with the doctor located remotely. Doing so, we documented that robotic telepresence is associated with increased duration of direct, face-to-face supervision of patients by the senior level physician, and decreased response time to visual contact with a patient who has suffered a neurologic deterioration. Both of these elements have resulted in important changes in the care that is delivered to the patient, and in improved nursing satisfaction with physician responsiveness. Combined with an advanced data and image integration system, called Global Care Quest® (Los Angeles, CA), we are able to provide crucial data to both the doctor and the bedside nurse to facilitate a face-to-face discussion at the bedside [8]. This data–robot integration results in a mutual exchange and discussion of ICU data and provides a platform to formulate a multidisciplinary treatment plan at any time of day and from any location. Moreover, the face-to-face process builds trust and camaraderie, both of which are important features of critical care. Robotic telepresence could play a significant role in the delivery of intensive care to remote areas suffering from plague, war, or natural disaster [12]. Thus, IT applications such as robotic telepresence have great potential in filling the present gap in the delivery of critical care.

Competing interests

UCLA has financial interest in Global Care Quest. PV has Grant support to study Robotic Telepresence.

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