Performance Management Team Report

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Introduction

Although intensive care unit (ICU) beds comprise only 10% of inpatient hospital beds, they account for 30% of total hospital costs. As of 2006, the 5.7 million adults admitted annually to ICUs in the United States (US) generated $67 billion in charges and had an average mortality rate of 15-20%, equating to 540,000 deaths each year (Kirsten, et al., 2003; Angus et al., 2004; Angus et al., 2006). By 2010 total annual ICU charges had risen to $107 billion or 4.1% of the nation's total healthcare costs (New England Healthcare Institute, 2010). More than 50% of the ICU care in the US occurs in smaller hospitals, and the quality of ICU care can vary widely (Hartman & Angus, 2003). A seminal meta-analysis by Pronovost et al. (2002) concluded that a high-intensity staffing model where all ICU care was either directed exclusively by board-certified intensivists or required intensivist consultation could reduce relative ICU mortality by 30-40% and overall hospital mortality by 20-30% while also reducing ICU and hospital length of stay. Further analysis of this and other data led the Leapfrog Group, a nonprofit healthcare standards organization, to define an intensivist staffing standard which, if implemented in urban hospitals nationwide, could potentially avoid 53,000 deaths per year (Leapfrog Group, 2005; Berenson, et al., 2009).

Based on these studies, many hospitals have attempted to expand intensivist coverage in their ICUs to meet the Leapfrog Group standard of full-time intensivist presence during daytime hours, and intensivists answering pages within 5 minutes during off-hours and arranging for an FCCS certified physician or physician extender to reach ICU patients within 5 minutes during off-hours, both at least 95% of the time (Leapfrog Group, 2005). These efforts have been severely impeded by national shortage of properly trained intensivists, with supply falling so far behind demand that only 10-15% of U.S. Hospitals have full time intensivist coverage, with even fewer meeting the proposed standard (Berenson et al., 2009; Pronovost et al., 2001). One recent approach to addressing the workforce shortage while still obtaining the benefits of high-intensity ICU staffing has been the use of electronic medical records, audio and video equipment, special computer software packages, and telemedicine techniques to outsource advanced monitoring and management of intensive care patients to a central monitoring station, often located off-campus and staffed full-time with intensivists and critical care nurses (Berenson, et al., 2009).We will refer to this system as tele-ICU or by the brand name of its leading vendor, eICU.

Our organization serves a community of 50,000 people, managing a hospital currently functioning at a capacity of 150 beds. We are within 100 miles of a university hospital which has an excellent ICU and is a potential partner to provide eICU services. Our financial difficulties and budget deficits in the last two years are well known to this body. The Board of Directors has asked our team to evaluate the effect of outsourcing the monitoring of our ICU on hospital finances, quality, mission, and perception in the community, with special attention to whether this can serve as an appropriate cost cutting measure.

To obtain additional perspective on the functioning and staffing levels of intensive care units, we interviewed the medical director and the nursing manager of Yakima Valley Memorial Hospital, a similar size hospital in Washington State. An intensive care unit deals with the highest acuity patients in the hospital. For a150 bed hospital, the number of ICU beds can vary from a low of six to a high of twenty-five. Based on review of the ICU bed capacity at our local competitors and of applicable regional benchmarks, we conclude that our hospital needs 10-12 ICU beds to sustain a viable unit. As noted above, it has been shown that around-the-clock staffing by on-site board certified intensive care specialists significantly improves the quality of care and reduces-mortality; however, the Pronovost et al. (2002) study does not address whether similar results can be achieved with remote intensivist coverage.

Options

One option to decrease expenses would be to close our ICU and outsource that clinical service entirely to the university hospital. While managing expenses is important, this is not the only consideration. Currently our hospital beds are not full, but the ICU continues to run at capacity, and the need for ICU services will continue to grow as our population ages. In 2006, the Health Resources and Services Administration (HRSA) report to Congress began to focus more attention on the workforce that will be needed to care for the critically ill. HRSA (2006) concluded that the "graying" of America will significantly increase demand for adult intensivist services, particularly if it is desired to increase the proportion of intensive care unit (ICU) patients treated by intensivists. Closing the ICU will leave us without key services to meet a growing demand and result in frequent transfers of our sickest patients to the university hospital. This will likely cause dissatisfaction among our patients and our physicians, detract from our mission to provide the best, most up to date care to our citizens, and lower our standing in the community.

A second option would be to outsource the monitoring of our ICU to the university hospital while keeping the actual patient care at our institution. As we will explore below, this has the potential to improve quality, support mission, and improve satisfaction across multiple classes of stakeholders. However, the implementation of tele-ICU technology will present substantial challenges in financing, infrastructure improvement, personnel management, and community relations, so the ramifications must be fully and carefully explored.

Quality

Berenson et al. (2009) identified several characteristics which allow tele-ICU systems to improve hospital quality and patient safety. The extra monitoring provided by the system allows earlier detection of adverse trends in patient physiologic data and leads to earlier intervention to avoid complications. This is especially pertinent at night and on weekends when nurses may be reluctant to bother physicians at home until there are significant changes in patient condition and parameters. The board-certified intensivists at the central monitoring station may be able to better evaluate and respond to critical ICU events than less highly trained on-campus providers such as hospitalists. The central monitoring team can also provide great value in reinforcing and supporting the on-site physicians and nurses in their efforts to follow clinical pathways, implement evidence-based best practices, and participate in hospital quality improvement initiatives such as the prevention of ventilator associated pneumonia and reduction in the number of episodes of sepsis. Specialized eICU software allows central monitoring staff to sort patients into groups based on acuity, diagnosis and treatment, identify gaps in care, and provide more detailed outcomes measures to assess the value of different interventions. These factors are thought to constitute the mechanisms that produce the quality improvements seen in such metrics as decreased ICU mortality, decreased hospital mortality, decreased number of cardiorespiratory arrests, and decreased length of stay (Lilly & Thomas, 2010).

Two key studies in the peer reviewed literature are most often cited as evidence that the quality gains seen by Pronovost et al. (2002) with round-the-clock on-site intensivists could also be observed with the tele-ICU model. Rosenfeld et al. (2000) studied a single 10-bed surgery/trauma ICU and found a 45% reduction in severity-adjusted ICU mortality, 30% reduction in length of stay, and 16% reduction in costs when remote monitoring was implemented. A follow-up study of two Sentara Health Care System ICUs (Breslow et al., 2004) showed a 28% reduction in ICU mortality, a 16% reduction in ICU length of stay, and a 25% reduction in variable costs. Five other studies published in abstract form only have shown similar trends, although the magnitude of the effect varied from study to study (Lilly & Thomas, 2010). In a very extensive study of the University Of Massachusetts Memorial Medical Center and two of its associated community hospitals, the New England Healthcare Institute (2010) found that implementation of Tele-ICU produced a 20% reduction in ICU mortality, a 30% reduction in ICU length of stay, and an average cost savings of $2600 per patient.

On the other hand, there are also well-designed studies in the literature where the data shows that eICU interventions did not have a statistically significant effect on mortality, length of stay, or cost. Thomas et al. (2007 and 2009) studied 6 ICUs in 5 hospitals in a large U.S. healthcare system both before and after the initiation of tele-ICU monitoring, evaluating over 2000 ICU admissions during each time period. Although tele-ICU improved the mortality in the sickest patients, there was no improvement in overall ICU or hospital mortality or overall ICU or hospital length of stay. In a similarly designed study Morrison et al. (2010) evaluated 1300 admissions in the pre-eICU baseline and 1300 admissions each in two 4-month periods after eICU started in two large Chicago area community hospitals. This group also found no change in mortality, length of stay, or cost that could be clearly attributed to eICU.

It remains an important question for tele-ICU medicine research to explain why these programs show benefit in a majority of studies, but not in all. One reason may be that it is not possible to do a randomized prospective study of different units with and without the intervention. All of these studies are based on data collected from the same ICUs analyzed before and after the adoption of the telemedicine program. Because multiple different initiatives and work process changes are occurring concurrently in these units, it is difficult to isolate the specific impact of eICU technology (Berenson, et al., 2009). Also, the level of benefit shown may relate to the program's degree of acceptance by the on-site clinicians and its ability to produce durable changes in ICU work processes (Lilly & Thomas, 2010). Overall, since the majority of studies show improvement in outcomes when eICU technology is implemented, hospitals adopting these systems are perceived to have a higher commitment to quality, better ability to leverage their available intensivists to cover larger numbers of patients, and better ability to meet the Leapfrog Group standards for ICU physician staffing. This supports most hospitals' mission and vision and raises their standing in the community.

Staff Acceptance

The early adopters of tele-ICU systems were concerned that bedside clinical staff would fear these programs as competitors for jobs and recent them as a judgmental "big brother" constantly looking over their shoulder. Once it became clear that off-site monitoring actually increased overall staffing levels and that no on-site personnel were replaced, these fears were allayed. In a number of surveys, ICU nurses actually expressed increased satisfaction with the work environment after eICU implementation (Berenson, et al., 2009;Koppenheffer, 2009). One reason cited for this was an increased sense of security and confidence from knowing that an additional set of eyes supported by some very sophisticated software was monitoring the patients along with them. Nursing staff, especially recent graduates also liked the instant availability of experienced ICU physicians with full access to patient data to manage complex critical care situations where they were uncertain what to do. Most ICU nurses actually appreciated the eICU guidance to keep them on track with best practices and clinical pathways. The central monitoring station also represented a career progression opportunity where an experienced ICU nurse could apply his/her skill and experience.

In contrast to the nursing staff, physicians showed more resistance to the implementation of eICU systems. This has been attributed to concerns about their expertise being questioned, dislike of having other physicians care for their patients, and concerns about protecting their turf so as not to lose patients to other institutions and systems (Koppenheffer, 2009). The key to overcoming these barriers was to open better communication and collaboration channels. All involved clinical staff and administrators must work together to clearly define the level of care the central monitoring team will provide and the exact situations where the eICU intensivists will be permitted to intervene. In many organizations, the tele-ICU will only be contracted to monitor patients for part of the day. On site physicians will make rounds, develop care plans, and manage patients during normal working hours with the eICU coming on line at night. Lilly and Thomas (2010) pointed out that the availability of the central monitoring team to take sign-outs at a time convenient for the bedside team and the ability to provide software that helps the bedside team better document their care and capture previously missed charges go a long way to facilitate physician acceptance. Information system reliability and technical support are also absolutely vital with a target of 99.7% uptime capability, since physicians are notoriously intolerant of technical difficulties that interfere with workflow. The presence of physician leaders who are advocates for the program and of physicians who work in both bedside and central monitoring capacities can enhance adoption. Finally, physicians and administrators value a system that can collect and report performance, process, and outcomes metrics that are benchmarked at similar hospitals (Lilly & Thomas, 2010).

Work Processes

To properly operate an electronic ICU and benefit fully from its capabilities, the organization must pay close attention to how clinical data are captured, displayed, transmitted, and shared between bedside and central monitoring clinicians (Lilly & Thomas, 2010). Making the electronic data complete and accurate enough to support useful patient management consumes significant time and effort from bedside ICU staff, causing significant impact on ICU workflow. Three models of data acquisition have been implemented so far. In one, the bedside staff may document on paper with records faxed to the monitoring center. This requires extra staff at the monitoring center to translate data into electronic form, has a high potential for transcription errors, slows throughput, and created high risk that monitoring clinicians will not have sufficient data to assess and respond to critically ill patients. In a second, the bedside providers' document into an on-site electronic medical record (EMR), and a data interface handles transfer and translation into the telemedicine monitoring system. This dramatically improves the accuracy and completeness of the available data and leverages the power of the hospital's EMR, but may still be subject to errors in the data interface system. The third model is direct documentation into the tele-ICU system at the bedside. This provides the most complete, clear, accurate data possible direct to the monitoring staff, but may not be feasible if on-site providers have to document every piece of data in two places. These trade-offs must be carefully weighed when the ICU monitoring system is developed.

Costs

As pointed out above, the lack of an EMR creates substantial barriers to implementation and use of an eICU. Unfortunately, installing an EMR adds an enormous amount to overall costs. Relatively few studies that have examined the cost of implementing an EHR and computerized physician order entry system in hospitals (CBO Paper, 2008). However, the First Consulting Group determined that a hospital with “250 beds would incur initial costs of about $3 million and annual operating costs of approximately $700,000. On average, implementation costs for the health IT system amounted to about $14,500 per bed, and annual operating costs were about 19% of those one-time costs, or $2,700 per bed” (CBO Paper, 2008). This all occurs before the eICU project even begins, but is essential for that project to succeed.

The tele-ICU will require a separate independent system of technology. The monitoring center connects a to a patient's bed through "continuous, real-time audio, video, and electronic reports of vital signs." (New England Healthcare Institute, 2006). The tele-ICU system requires both hardware and software components to operate. According to the New England Healthcare Institute (NEHI), hardware components include:

- Computer systems to collect, assemble, and transmit information
- Communication lines
- Physiological monitors
- Therapeutic devices
- Medical records
- Video feed (with angle and zoom adjustments)
- Audio communications
- Video display panels
- Software

Software includes the programs that make the monitoring and information transmission hardware function properly. The NEHI pointed out “one challenge in developing tele-ICU software is to enable it to interface with and electronically accept data from other electronic information systems that serve the ICU (e.g., laboratory results, medications, nursing flow sheets, physicians' notes, etc.)" (New England Healthcare Institute, 2006). Having an EMR in place facilitates the creation of interfaces and connectivity between systems; however, it takes time and money. The most widely implemented and studied ICU telemedicine monitoring product is eICU, developed and distributed by VISICU, a division of Phillips Healthcare. The company estimates the infrastructure cost for eICU implementation at $30,000-$50,000 per ICU bed followed by annual operating and support costs of $6000-$10,000 per bed. Staffing costs differ depending on staff levels in the monitoring center and hours used per day, but may run $10,000-$20,000 per bed per year in a typical staffing scenario (Berenson, et al., 2009; Koppenheffer, 2009).

In addition to capital outlay, there are many other types of costs to consider in implementing new technology especially when moving from a paper based to an electronic environment. Examples include the time and energy required of technical and medical staff, training, workflow redesign, and interruption of services such as electricity or telecommunications while new facility infrastructure is constructed. Other costs associated with maintaining the new environment include regular ongoing costs to maintain the new infrastructure and the addition of clerical, administrative, and technical support staff.

Potential Cost Savings and Additional Revenue

Breslow et al. (2004), the NEHI, and others (see paragraph 2 in the Quality Section above) have argued that the decreased length of stay and reduced complication levels produced by eICU technology will reduce costs enough to fully amortize the initial program investments. However, the relatively few studies available in the literature have produced conflicting evidence concerning this claim (Thomas et al., 2009; Morrison et. al., 2010). The physician, nursing, and clerical staff of the eICU are a supplement to, not a replacement for clinical personnel on site. “Outsourcing ICU beds” does not literally mean having no intensive care unit. It simply means having fewer intensive care specialists on-site. The standard ratio of one ICU nurse to two beds must still be maintained for medication administration, patient positioning and multiple other nursing duties. On-campus physicians must still be available to make daily rounds, create care plans, and perform vital procedures such as endotracheal intubation and central line placement. It will be critical to have on-site hospitalists, internists, surgeons, and anesthesiologists trained in eICU technology and available for aspects of care that simply cannot be handled from 100 miles away. This may be why experience at multiple institutions so far has shown there will be no savings in personnel costs to offset eICU expenditures (Berenson, et al., 2009).

When an intensivist and nursing staff are in a remote monitoring center they can oversee more patients in one or many ICU facilities at one time. With the aid of electronic data and the ability to view the patient, see laboratory and physiologic data on monitors, speak with family members and the nurse on the floor, this new medical team can monitor and provide tremendous value to the patient as they provide round the clock care and eliminate the need to "transfer the patient to another facility saving payers approximately $10,000 per patient" (Garrett, 2011).

The HITECH provisions of the ARRA provide meaningful use incentives for implementation of an EMR, and the EMR itself will produce savings in the long run by improving efficiency and eliminating wasteful duplication. Both of these factors could provide some funds to offset the costs. Another source of revenue to offset the cost of telemedicine is reimbursement of billed charges by third party payers. Medicare first recognized the use of telemedicine in 1997 with the Balanced Budget Act (BBA) and increased their coverage with the Consolidated Appropriations Act of 2001 (CAA). On Oct 1,2001 H.R. 5661 amended BBA to allow for “Payment for Telehealth Services.” According to that bill, sites eligible for coverage included physician or practitioner’s offices, rural health clinics, critical access hospitals, rural hospitals, or federally qualified health center. Sites within census-defined metropolitan statistical areas were (and still are) excluded. Among the provisions passed were the following:

- Eliminated the provider "fee sharing" requirement;
- Eliminated the requirement for a Medicare participating "tele-presenter";
- Allowed Originating Sites to be paid a fee of $20 per visit to recover facility costs, with increases commencing in 2003;
- Expanded telemedicine services to include direct patient care, physician consultations, and office psychiatry services;
- Included payment for the physician or practitioner at the Distant Site at the rate applicable to services generally;
- Expanded the geographic regions in which Originating Sites are located to include rural health professional shortage areas, any county not located in a Metropolitan Statistical Area, and from any entity approved for a federal telemedicine demonstration project;
- Permitted use of store and forward applications in Alaska and Hawaii for federal demonstration projects(The Center for Telemedicine Law).

Our status as a rural hospital will allow access falls under these provisions. Medicaid also covers the use of remote care in 35 of the 50 states (Hall, et al., 2009), although geographic restrictions and levels of reimbursement vary greatly from state to state. Private insurance is also allowing the use of telemedicine with companies like Blue Cross/Blue Shield and others funding 38 programs in 25 states. (The Center for Telemedicine Law) A study by Whitten and Buis (2006) found that private insurers are regularly subject to reimbursement regulations established by state insurance regulators and that “Telemedicine programs were billing 130 private payers for 75 clinical specialties and 81% of the programs stated that there was no difference in reimbursement amount between telemedicine and in person services.” (Hall et al., 2009).

Community Impact

The utilization of telemedicine definitely supports our organization’s mission of providing quality health services and facilities for the community. However, it is unclear how the surrounding community will initially react. Today’s generation wants to be actively involved in their care and demands their input be taken into consideration. “This generation has a high awareness of technology and a desire to receive the best care available,” which a tele-ICU would achieve (Walter, 2004). However, since our organization is located in a rural environment, it is unclear how much technology our patients and families have encountered and whether they have used it enough to achieve a level of comfort.

If a telemedicine program were to be introduced into our organization, we would need to spend a substantial amount of time educating the community about the benefits to be gained and the changes to be expected. We anticipate the marketing department will play a large role in community outreach during this implementation and that physician advocates will spread a positive word to the patient community as well. With this marketing campaign and continued discussions of the quality gains provided by a tele-ICU system, we believe our organization can improve customer satisfaction and gain some competitive advantage compared to the surrounding organizations of equivalent size. Although the program will help us care for a significant number of severely ill patients who would otherwise have to be transferred to the university hospital, we do not think it will put us in a better competitive position compared to that organization. As a practical matter, our mission and the mission of the university are largely directed at different populations of patients.

Recommendations

As part of the effort to reduce our deficit in 2010 and eliminate it by 2011, the Performance Management Team (PMT) was asked to provide analysis and recommendations on the role outsourcing of ICU monitoring might play in that process. To accomplish this we extensively reviewed the literature on the costs and benefits of tele-ICU technology, interviewed staff of a comparable ICU at another hospital, and carefully considered the needs and priorities of all our major stakeholder groups. The data as a whole indicate that implementing a tele-ICU would raise the overall quality of our patient care, increase the performance and job satisfaction of most of our clinical staff members, advance our mission, increase patient satisfaction, and improve our standing in the community. However, based on the literature, the initial capital investment required would be in the range of $2.5 million for the EMR, assuming we size it for 150 beds, and $800,000 for the tele-ICU, both estimates including first year operating costs. Unfortunately, it seems very unlikely we can raise this amount of money, so the PMT must reluctantly recommend deferring further consideration of the eICU concept at this time.

However, our team does recommend creating a long-term strategic initiative to begin adopting health information technology at our organization wherever feasible. A logical place to start is with the implementation of at least a limited EMR. We could seek funding from government incentives for EMR use, grants from private foundations, fund raising in the community, and special programs for rural hospitals. We may also derive savings from outsourcing other clinical support services. As we gradually develop our information technology capabilities and improve our financial position, we will be better prepared to take on a more complex project like tele-ICU and provide those improved services to our patients.

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