Alternate Modes of Financing Health Care Technology†

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Alternative financing of health care delivery is one of the most vexing problems facing medicine today. Intensive care in many ways is a perfect example of the core problems facing policymakers responsible for financing health care. Intensive care is very expensive, its delivery is variable across and within countries, it is an arena into which new technologies are introduced regularly, often at further increase in cost, and these costs are only likely to continue growing as the human race ages.[1]

Inextricably linked to the financing and cost of health care is the need to consider quality. Some have argued that by improving the quality of care, costs will fall. Whether true or not, others have pointed out that to look only at costs could result in favouring policies that are very deleterious for the patient.[2] In this presentation, I will discuss some pertinent issues fueling the current financing crisis in health care, including the concurrent problem of poor quality and errors in health care delivery, and review various techniques designed to deliver higher quality health care yet more efficiently while utilising available resources.

The Costs of Health Care

In the developed nations, health has improved dramatically during the past century. But in the most recent 50 years, mortality per 100,000 population in the US has only decreased from approximately 1,000 to 800. That is a very modest improvement compared to the massive increase in cost which has escalated from 4% of the gross national product in 1950 to over 14% in the year 2000. Thus, the mortality has decreased approximately 20% while these expenses have tripled in terms of percent of the gross national product and many more times if the expenses are counted in dollars spent on health care. The soaring cost of health care has been particularly steep in the 1990s, increasing from US$752 billion in 1991 to an estimated $1,600 billion in the year 2000. In 1997, the United States spent $3,724 per capita for health care, making this country the greatest spender in the world. In spite of this, the US performed poorly in terms of the quality of health care for its population, ranking number 37 among the world's nations with France number one and Singapore number six.

Intensive care is frequently referred to as expensive care and in the US consumes about 20% of all hospital costs. This corresponds to approximately one percent of the gross domestic product and is considered far too much. Critical care medicine has been difficult to define. We sometimes turn to the Chinese expression for crisis, using two characters, the first one standing for danger and the second for opportunity. We know the danger well as the mortality among our critically ill patients is very high. I would like to more extensively consider the opportunities in this presentation.

In his best selling book, *The Eagle's Secret*, the author McNally[3] discusses the economic earthquake as he calls it. He presents the dominant forces as: technology expanding at warp speed; international competition demanding higher product quality with better service at lower cost; and communication taking place around the clock worldwide. Computers have facilitated this instant worldwide communication. Through computerisation in the ICU, we have seen improvement of data acquisition, statistical analysis and quality control. While patient safety should never be compromised, in intensive care the goal is to maximise the positive aspects of health, function and satisfaction while minimising the negative aspects, i.e., morbidity, mortality and expense. Curtailing health care expenses is on the mind of all governments in every nation. During the 1990s, cost containment was the primary goal. A higher ideal would be cost reduction but this remains utopia as we enter the new millennium.

Medical Errors

In recent years, it has become obvious that the number

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and cost of errors made in medicine is disturbingly high. One study by Thomas et al,[4] published last year, indicates that in 1992, there were 459 adverse events at 28 studied hospitals in Colorado and Utah. This analysis permitted an estimation of the nation-wide US cost of adverse events to be $37.6 billion and, of these events, the preventable ones were calculated to have cost the nation $17 billion that year.

In 2000, the renowned Institute of Medicine published a report entitled "To Err is Human".[5] The Institute estimated that medical errors leading to death would place this category somewhere between numbers 5 and 8 amongst the medical problems leading to death. It is quite an eye opener that medical errors result in death of more people than those due to traffic accidents which kill approximately 40,000 humans each year in the United States. The types of errors can be categorised as diagnostic, therapeutic, preventive and other types such as communication, equipment and system failure. The problem relating to morbidity and mortality caused by drugs[6] has been thoroughly studied in the ambulatory setting in the United States with an estimated cost in 1994 of $76.6 billion due to errors with physician prescriptions, pharmacy dispensing or patient non-adherence.

Potential Solutions to Improve Quality of Care

The Institute of Medicine in its report makes four recommendations: to establish a national focus; identify and learn from errors performed; raise national standards to improve safety; and create safety systems.

Protocolised Care

Protocols and algorithms have been entered into the management of ICU patients. These tools help us increase the speed of action and decrease the occurrence of complications. They improve outcome and have the potential to reduce cost as well. In addition, standardised protocols may help us discover the truth.

Regionalisation of Care

Regionalisation with delegation of expensive management to special centres improves outcome and efficiency with the potential of reducing cost as well. Typical examples are neonatal critical care, trauma and burns and transplantation surgery. Since the first successful transplantation of a solid organ was performed in 1954, there have now been approximately 700,000 transplants worldwide. The majority of these are kidneys but there have also been over 70,000 liver transplants and some 50,000 hearts grafted. In other words, this is no longer experimental surgery. The results of transplantation have been spectacular with more than 75% of kidney transplant patients surviving 10 years although graft survival is not equally prominent.[7] However, the point is that kidney transplantation has been demonstrated to be more cost effective than chronic chemodialysis which is more expensive and ties the patient to a machine several times per week.

Simulation Training in Medical Education

One issue mentioned repeatedly in the Institute of Medicine report is to use computerised simulators for "hands on" learning experiences of conditions and problems not readily available for educational purposes in clinical work.[8] Currently, there are some 155 simulation centres identified worldwide. More than half of these are in the United States but there are also several such centres identified in Asia with one in Singapore and another in Malaysia.

Alternative Staffing Models

Cost reduction can be indirect by improved outcome or direct through decreased expenses. For instance, we can substitute nurses, physician assistants and technicians for physicians to save money as physician salaries are significantly higher than those for nurses and technicians.

We also have the possibility of using systems which are automatic and do not require directly involved manpower. An example is the cart transport system at Huddinge Hospital in Stockholm, Sweden. All eight floors of the hospital are served by 250 carts which via 11 elevators transport food, laundry and supplies to and from the different wards. The salaries for people operating the computer centre regulating this system is only $220,000 per year and the maintenance cost is approximately $45,000 per year. This has been a very cost-effective operation. However, it has not been duplicated elsewhere because it necessitates installation at the time a new hospital is built.

Micro-Invasive and Non-Invasive Monitoring and Interventions

In recent years there has been a trend to increasingly utilise non-invasive monitoring in ICUs and operating rooms. Such surface monitoring is essentially free of complications and there are virtually no infections. Therefore, the morbidity and mortality caused by monitoring has been reduced to almost zero with such a technique.

In surgey, minimally invasive techniques, utilising endoscopy with appropriate training, lead to fewer complications. The cosmetic outcome is improved which is much appreciated by the patients. The hospital length of stay is shortened and the patient returns to normal life sooner. Visibility of the operating field is available to the entire operating room (OR) team via TV monitors displaying the procedure. The surgeon no longer looks through the

endoscope. Instead, a camera does and the surgeon can see and direct his manipulations by viewing the surgical field on the TV screen.

Leasing Capital Equipment

Leasing equipment rather than directly purchasing may also have significant advantages. The leasing agreement may be continuous with stationary equipment or intermittent with mobile equipment. In Pittsburgh we lease or rent temporarily large trailers housing equipment for lithotripsy, CT scanning or MRI scanning. Occasional use of such expensive equipment can reduce peaks in demand and waiting time for patients, thus increasing the efficiency of the Hospital by avoiding bottlenecks of this sort.

The Royal Victoria Hospital in Belfast, North Ireland, has reached a contractual agreement with Agilent Technologies, a subsidiary of Hewlett & Packard. The current five-year lease covers 24 operating rooms and 26 ICU beds. The equipment includes OR tables, monitors, computers, infusion pumps, anaesthesia machines, ventilators, etc. Obsolete equipment is replaced with new equipment maintained by Agilent. Disposables are not included in the agreement. Equipment is provided as needed and sold if not needed. The many benefits of leasing equipment include significant reduction of the initial capital outlay; preservation of other credit lines; improvement of the financial statements; and an increase of the tax benefits over the term of the lease. At the end of the leasing period, the equipment can be returned at market value or purchased with the lease expenses deducted. Furthermore, obsolescence and disposal problems are eliminated with this technique.

Reducing Equipment Idling Time

While ICUs and emergency departments operate 24 hours per day seven days per week, we usually find that very expensive operating rooms and x-ray equipment at night and during weekends are used only for emergencies, i.e., not used at all for large portions of the time. These facilities are too expensive for idling as they become obsolete quickly. Our Pittsburgh administrators indicate that they can mobilise nurses and technicians willing to work on shifts around the clock but so far our physicians have refused. The question therefore is whether shift-working physicians would solve that problem.

Minimising Unwanted or Futile Care

Reduction of ICU cost can also be accomplished by rapid and early diagnosis of futility such that treatment can be withdrawn as soon as the prognosis clearly is hopeless and the family agrees to such an approach with a more dignified death for the dying patient.[9] Examples include cases of persistent vegetative state and multiple organ failure, where continued intensive care becomes wasteful and frequently not desired by the patient and/or family.

Alternative Locations for Short-Term Acute Care

A new trend in the United States is to use short-term ICUs in the emergency departments.[10] These are for rapid diagnosis and treatment with lower frequency of complications such as infections compared to conventional hospitalisation which is a relatively slow process. An advantage in the United States is that the patient is not considered admitted to the hospital with the additional cost involved, if the stay is less than 24 hours in the emergency department ICU. Examples of cases suitable for this type of care are drug overdose patients, those with a combination of head trauma and alcohol consumption, and patients who are being ruled out for acute myocardial infarction. Automobile accidents caused by an alcohol-intoxicated driver are a common occurrence in the United States. We frequently have great problems determining whether such a patient's coma is due to his head trauma or to the high blood alcohol level. These patients may wake up within 10 to 20 hours and if not seriously injured, often demand immediate discharge from the hospital.

Technologies That Can Reduce Costs

Since its introduction by Laennec 200 years ago, the stethoscope has been a symbol for medicine. However, there are now available small portable ultrasound devices which provide much more information not only about the heart but other organs in the chest and abdomen as well. These tools are likely to become so small that they will fit into the pocket of a lab coat, making them readily available to provide an earlier bedside diagnosis of various problems and complications, likely to reduce morbidity and mortality and perhaps cost as well.

Modern technology has also made possible remote communication with sound, images and data through telemedicine which can be used for treatment of patients, conferences and teaching.[11] A group of innovative physicians at Johns Hopkins University School of Medicine recently published their experiences, using telemedicine in intensive care. In an affiliated hospital where intensivists were not available around the clock, the provision of critical care medicine specialists was via telemedicine. Their pilot study indicated very significant reductions in mortality, frequency of complications, ICU length of stay and ICU costs. They concluded that remote care programmes may provide a means of improving quality of care and reducing costs when onsite intensivist coverage is not available.[12]

In Pittsburgh we utilise teleradiology with PACS, i.e., the Picture Archiving Communications System. This is

extremely expensive at approximately $85,000 per station, but our faculty member, Dr Paul Chang has recently designed a Dynamic Transfer Syntax (DTS) which provides access to one central PACS and displays images on remote personal computers programmed with the DTS software at a fraction of the PACS cost.

The latest development is the building of intelligent operating rooms at our University of Pittsburgh Medical Center (UPMC) as well as a few other prominent hospitals. The construction cost for this is very high but hopefully it is an investment into the future. At UPMC, there are three important components. HERMES is the OR control centre which provides voice command of endoscopic cameras, light sources, video recorders, printers, gas insufflation devices, etc. In addition, there is an automated endoscopic system of positioning called AESOP. The third component is Zeus, the robotic surgical system with remote control via joysticks. This increases precision during the procedure in the patient's body cavity. There is reduction of risks, operating time, hospital and healing time, and the potential for decreased cost. A fascinating future aspect is the possibility for worldwide telesurgery.

There are many advantages of utilising robotics. The machine is tireless and can continue without breaks. Precision is outstanding with access to major surgery through minimal incisions. Already, several surgical specialties are using robot techniques including neurosurgery, cardiothoracic surgery, abdominal surgery, orthopaedics, etc. However, so far our robots must be directed by a surgeon. It is not automatic as is the case in automobile manufacturing industries.

Conclusion

Finally, it should be mentioned that the principles for use of expensive technology must be based on the national resources of each country. Expensive care should be justified by outcome data and patient benefit. The indications must be clear in that regard and not governed by political decisions. However, affluent patients throughout the world may pay their own way which is acceptable as long as conventional care of other patients is still provided adequately.

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