IMPACT OF TECHNOLOGICAL INNOVATIONS IN HEALTHCARE SECTOR: AN ANALYSIS

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INTRODUCTION

The objective of this paper is to study the technological innovations leading to quality enhancement in healthcare sector. The scope is restricted to the influence of biomedical equipment, computer aided devices, cellular phones, internet and telemedicine on healthcare marketing. The conclusion is that technology and innovation must be cost effective and benefit the common man.

Healthcare in recent times has been revolutionized by technology. In a way, this process was inevitable because of several developments in medical science taking place in tandem with break-throughs in technology. It was Arthur Clarke, eminent science writer, who spoke about "bio-engineering" and the importance of genetics many years before anyone could dream about these. Modern healthcare relies heavily on a myriad number of electronic gadgets – right from instruments to take the blood count, take smears of the interior organs etc. to keeping patients alive through heart-lung machines. Recent developments include the application of laser technology in a variety of situations such as retino surgery for eyes, laparoscopy for gall bladder operations etc.

What Arthur Clarke prophesized ("Men will cease to commute, they will communicate") has again come true in modern healthcare practice as evidenced by the advent of telemedicine. Consultation with expert physicians and surgeons who examine the scan images of patients living thousands of miles away has been made possible through telemedicine. TIME magazine

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referred to telemedicine as "healing by wire". The concept may sound futuristic but is fast becoming a reality.

What this innovation accomplishes is the delivery of healthcare and exchange of information about it across vast distances by utilizing telecommunication technology. The following aspects are significant: It enables the transfer of basic patient information over computer networks (medical informatics), the transfer of images such as radiographs, computer tomography (CT) scans, magnetic resonance imaging (MRI) pictures, ultrasound studies, and pathology reports. In addition, transfer of video images of endoscopic or other procedures, patient interviews and examinations, consultations with medical specialists are all carried out in telemedicine.

As a medical researcher put it "the essence of telemedicine lies in transferring the expertise and not the patient – the goal of telemedicine is to eliminate the unnecessary traveling of patients (and their escorts)". Indeed, certain special features of telemedicine merit attention: the use of telecommunication technologies to enable communication and interaction between client and provider to improve clinical functions and making possible a division of labour and specialization among healthcare providers and staff through an underlying system.

It is but natural that marketing professionals in the healthcare sector are keen to adopt novel ways of reaching out to patients by making use of technology. In the last three yeas, online healthcare marketing efforts by Healthcare organizations (HCOs) have assumed importance. Initially, HCOs all over the world were "slow to jump on the internet marketing bandwagon" but a surge of interest is becoming clear more recently. Not surprisingly, developments in this area have been uneven and marketing-oriented web sites frequently come in for cutbacks when hospital budgets are tight.

Indeed, there has been a progression of HCOs through stages of internet marketing with a brochure site marking the first stage. This site indicates who they are and what they do. Many HCOs have crossed this stage but not much has been available in terms of interactivity and relationship building. "Some of the aura surrounding the Internet has been diminished by bad experience with dot-coms", according to a medical specialist.

However, several HCOs with web sites are now gradually moving beyond the first stage and providing valuable information online. These efforts in fact serve to promote their brands in an innovative fashion. Interactive web sites enable patients to locate physicians or sign up for health screening. "Once consumers are online, they are converting those browsers into prospects by capturing personal information in a customer data base and having them sign up for interactive health news and medical reminders". This allows the hospital to reach patients in a more personal way than just advertising on television or through print media.

Another development relates to making available information from a variety of sources and these usually are condition-specific. For example, a website offers newsletters relating to arthritis, diabetes and asthma. Possibilities for including senior citizens, children and teenagers are also there. Marketing strategies in healthcare take different dimensions. 'Ask the Expert' section on many websites showcases physicians who respond to questions on hormone replacement, mammograms, testing for prostate cancer etc.

Continuous quality improvement by hospitals is of vital importance in the healthcare sector. Technology has again helped here. Information systems assist physicians and surgeons by providing laboratory values, by calculating weight-based doses of medications. More sophisticated tools such as computerized algorithms and neural networks confer long-term benefits when they get integrated with provision of healthcare.

Possible diagnostic and treatment errors in numerous clinical settings including assessment of abdominal pain, chest pain and interpretation of radiological images and tissue specimens can be reduced with the help of such tools. It may sound far-fetched but all these innovations including storage of information about patients in computers (electronic medical records) serve to promote internal, external and interactive marketing efforts by healthcare organizations. Again, the ubiquitous mobile or cellular phones help in the process of collaboration and coordination among physicians, surgeons, and anaesthetists. These devices have not only improved process control and customer satisfaction but also enhanced servicescapes in hospitals.

There is a flurry of activity among the hospitals in Asia in the matter of getting accreditation from the Joint Commission international (JCI) of the United States. Indeed, this is supposed to be the gold seal of quality and it is much coveted by the corporate hospitals in India. The Apollo Group of hospitals, Wockhardt in Mumbai, Manipal Hospital in Bangalore and Sri Ramachandra Medical Centre in Chennai are now in the process of getting JCI accreditation. It is significant that 17 hospitals across Asia have already got the JCI seal during the last three years. This will serve to ensure that the hospitals equal the best in the U.S. when it comes to patient care and safety.

Considering innovation, a reference can be made to the first indigenous heart valve developed by Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum, an institute of national importance under the Union Government. The institute's Biomedical Technology (BMT) wing is today the first internationally accredited laboratory for the testing of biomedical devices in South Asia.

Ultimately, the objective must be to make medical care affordable for the common man and cost-effective for the healthcare organization. The idea of setting up a technology assessment cell for evaluating the cost effectiveness of every healthcare technology, which has been mooted by Dr K. Mohandas, former Director, SCTIMST, is significant in this context**.**

This research paper studies the technological innovations leading to quality enhancement in the healthcare sector. Healthcare marketing has also undergone changes as a result. A close look at the medical scene reveals an array of electronic gadgets and equipment getting pressed into service in hospitals in diverse situations. All these instruments are designed to assist the physician and the surgeon in the performance of their duties, and thus in the alleviation of human suffering. There can be no doubt that electronics plays a crucial part in the design and operation of these equipments.

Over the last few decades, the collaboration of engineers and technologists with biologists and medical personnel has been producing an astonishing variety of medical instruments. One of the earliest and widely known is the pacemaker, " a tiny, transistorized, battery powered radio

oscillator, permanently implanted in the abdominal walls of patients suffering from heart block and connected by two fine electrodes directly into the heart muscle to keep it beating regularly." Another ingenious device is the radio pill, which after swallowing by the patient, transmits a running account of conditions within the gastrointestinal tract to an outside receiver.

The range and diversity of equipment used in diagnosis and treatment is mind-boggling. It is all based on the science of electronics. The 'Life' magazine in an article published more than four decades ago pointed out: "As medical care grows in complexity and volume, the need builds up for ever more integrated and automatic instrumentation to handle the problems ------ the technology of medical electronics is exerting pressures of its own as it continues to develop in a dozen new directions, promising even broader applications in the future ….. The curious affinity of tiny electronic currents with those generated by living organisms themselves would seem to ensure that electronics will write one of the brightest pages in medical science."

It is not an exaggeration to say that healthcare in recent times has been revolutionized by technology. It was Arthur Clarke, eminent science writer, who spoke about "bio-engineering" and the importance of genetics many years before anyone could dream about these. Modern healthcare relies heavily on a myriad number of electronic gadgets-right from instruments to take the blood count, take smears of the interior organs etc., to keeping patients alive through heart-lung machines. Recent developments include the application of laser technology in a variety of situations such as retina surgery for the eyes, laparoscopy for gall bladder operations etc.,

Biomedical Equipments:

A host of instruments are considered indispensable in hospitals, whether large, medium or small. These include diagnostic devices such as equipments for taking x-ray, CT scan, ultrasound scan, magnetic resonance computer profile, echocardiogram (ECG), scintigraphy (nuclear medicine) etc., Equipments which aid surgical procedures-endoscope, laparoscope, laser devices, blood transfusion and oxygen supply units etc., also figure in this category. In addition, the following play a vital role in the treatment and care of patients:

(i) equipments used in intensive care unit (ICU) like the ventilator, nebuliser, heart beat, pulse rate and blood pressure monitors.

(ii) devices that offer cure or of therapeutic value such as dialysis machines for patients suffering from renal failure and linear accelerator/radio therapy unit for the cancer patients.

The above list is only a sample since there are scores of such biomedical equipments being pressed into service by corporate hospitals. Many of these are very costly but these have improved the confidence of patients in medical treatment offered by the hospitals. This is primarily because of the avoidance of human errors in diagnosis and treatment.

A significant development in recent years relates to the intense competition among the corporate hospitals to lure patients advertising their wares. In a way, this is understandable because they have invested large amounts in purchasing the equipments. In addition, the maintenance cost along with the operating expenses must be reckoned with. Thus it is not uncommon to find the print and electronic media bringing out advertisements highlighting salient features of treatment and the gadgets used for this. No doubt this forms part of healthcare marketing.

Technological developments have made possible the induction of several new machines and procedures. For example, in the realm of heart ailments, the entire range of non-invasive cardiac diagnostics includes: ultra-fast CT scan to help detect early blockages in coronary arteries. A pace maker like device called Implantable Cardioverter Defibrillator (ICD) implanted subcutaneously monitors continuously the heart rhythm and delivers a life saving shock if a dangerous heart rhythm is detected. This can significantly improve survival.

Computer and Computer-aided Devices:

Computers have already become ubiquitous in all business houses and industrial establishments. Hospitals and healthcare organizations (HCOs) are no exception. In fact, HCOs have been a sort of trigger for innovative technology directed towards improving the comfort level and safety of patients. In addition, the widespread use of computers has also resulted in getting proper feed back on performance. There has been increasing sophistication of software applications in hospitals and thus Information Technology (IT) is fueling several innovations in medical

instrumentation; this is happening in many areas of health care including cardiology, radiology,…….Laboratory investigations like measurement of creatinine, urea and uric acid, lipid profile, cholesterol, liver function test, hematology, lung investigation (pulmonary functions test) are all nowadays done efficiently by computer-aided devices.

It is to be expected that healthcare marketing makes good use of these developments by publicising the various facilities available. The public relations set up in hospitals comes under great pressure in this context. Almost all corporate hospitals offer packages at reduced rates for different types of health check up.

What is called " mass customization" namely the efficient and reliable production of goods and services according to the personalized needs of individual customer, has been taking place in several industries. Healthcare industries is obviously much more complex but computerized decision support has enabled a better deal to patient outcomes. Indeed, the risk of harm caused by medical care has to be tackled vigorously if the confidence of people in health care systems is not allowed to be eroded.

How can safety be ensured by Information Technology? According to medical experts, it is possible to reduce the rate of errors in three ways : "by preventing errors and adverse events, by facilitating a more rapid response after an adverse event has occurred, and by tracking and providing feedback about adverse events". Communication gap contributes frequently to the adverse events. A new generation of technology like computerized coverage systems for signing out, hand-held personal digital assistants and wireless access to electronic medical records is likely to bridge this gap. This will be more so when links between various applications and a common clinical database are already in place. Computerized order entry by physicians has been found to be effective in reducing the rate of errors. Similarly, bar-coded patient – identification bracelets serve to prevent accidents like performance of a procedure in one patient intended for another patient.

The task of monitoring is by its very nature inherently boring and is not done well by the humans. Also when a large amount of data gets piled up, it becomes difficult to sift through

them in order to detect problems. The silver lining in this situation is the computerization of monitoring with special applications software. As a result, clinicians can intervene before an adverse event takes place. 'smart' monitors will be able to look for and highlight signals which a human observer would often fail to detect. (David W.Bates and Atul A.Gawande, 2003). The screen of a 'smart' monitor in an intensive care unit will highlight physiological changes like a rapid pulse rate and decreasing blood pressure. The heart rate limit alert is triggered when the heart rate crosses a high or a low-limit, determined according to the patient's active medical conditions. According to one study, remote monitoring in a 10-bed intensive care unit brought about a considerable reduction in mortality. Also, the average length of stay in the I.C.U and related costs each decreased by about a third.

Technology and innovation have influenced matters relating to decision support. The latter depends very much on vital information about patients like laboratory values. It is not surprising to find medical experts extolling the benefits of sophisticated tools when it comes to decision-making. These allow many factors to be considered simultaneously before a specific outcome can be predicted. Clinical decisions based on these tools have made possible a decrease in the rate of complications associated with antibiotics. Other innovations with technological tools include the "bar coding of medications and the use of automated drug-delivery devices for both oral and intravenous medications." While all these developments appear to be rosy, financial and cultural carriers are also there impeding further progress. Further, the lack of standards for electronic data for key domains and clinical laboratory tests must be rectified according to medical experts. The absence of widely used standards has in fact made organizations reluctant to make large financial commitments. Information technology must be viewed by healthcare organizations as a strategic resource vitally important to the delivery of medical care.

Mobile Phones

Mobile or cellular phones may be considered as part of a technological marvel in telecommunications becoming popular during the last ten years or so. These instruments help in establishing quick contact between people, whatever their geographical separation maybe. They help in the process of collaboration and coordination among physicians, surgeons and

anaesthetists. These devices have improved process control and customer satisfaction in hospitals. Getting the help of medical experts in an emergency situation became a smooth process after the advent of mobile phones.

Internet Marketing

The advent of the World Wide Web and internet has made it possible for healthcare providers to publicize their offerings through this technological route. A number of posers were raised during a round table of discussion among healthcare marketing experts about online healthcare marketing efforts. These questions covered issues like the reason behind the slow adoption of internet marketing by healthcare organizations (HCOs), the factors that led to the acceptance of internet marketing among HCOs, the approaches to internet marketing that seem to be the most effective, and possible developments in healthcare online marketing.

In his article 'Healthcare Warms up to the Web' Richard K. Thomas (2003) succinctly presents the scenario. Some surprising insights came to light in the course of the discussion by experts. Healthcare organizations were "slow to jump on the internet bandwagon but recently there has been a surge of interest." However, the fact remains, progress in this area has remained uneven in many organizations. As in other aspects of marketing, websites oriented towards healthcare marketing are frequently targeted for cutbacks when budgets are tight.

The insights highlighted include in addition the following: there has been a progression of HCOs through different stages. The first stage involves a brochure site indicating who they are and what they do. Most HCOs have passed through this stage, but beyond that they are "all over the board in terms of information provision, interactivity, and relationship building. Some of the aura surrounding the internet has been diminished by bad experience with dot-coms. Yet the public interest in online healthcare information continues to grow. It remains to be seen if HCOs, especially provider organizations, will be the preferred source of health related information or whether these functions will be carried out by the Web MDs of the internet world."

That the industry experts failed in tracking the emerging healthcare internet revolution and getting that message came to light during the discussion. Several reasons were cited. Hospital

administrators and marketers are "not comfortable enough with internet technology to champion it within their organizations." Hence the strategies adopted by them lacked real depth. Second, many of this group looked at it as something to check off their list and then move on to the next item. The healthcare marketing professionals and the management of HCOs fix on other priorities, which they consider more important.

No doubt, healthcare is recognized as a regulated industry with many restrictions on account of product-labeling and consumer privacy issues. Hospital administrators in some cases want to stay in comfort zones by avoiding innovations such as internet marketing. But, it is interesting to find pharmaceutical companies "embracing the internet at a pace equal to their counterparts in other industries." Very few companies have leveraged the internet for disease management. This situation is gradually changing ever since the brands that are market leaders in DTC spending began scoring successes online. Although security considerations made the progress slow, these companies are now in the forefront of customer relationship building via the internet.

Several companies and HCOS now recognize the potential of the web in relation to information interactivity, decision support tools, transactions and care delivery. Healthcare marketers are successfully using offline technologies to draw consumers into their sites so that the latter can search for information or respond to specific offers. "Once the customers are online, they are converting those browsers into prospects by capturing personal information in a customer data base and having them sign up for interactive health news and medical reminders." The hospital hereafter markets to them in a more personal way than just advertising or television or through e-mail. Interestingly enough and not unexpectedly, the successful sites manage to convert the prospects into customers "by funneling them into their call center operators or specific service lines."

Information about healthcare can no doubt be gathered from a variety of sources. A website, Mylifepath.com offers newsletters on ailments like arthritis, diabetes and asthma. Different groups such as senior citizens, women, kids and teenagers can also be included. A very useful feature 'Ask the Expert' in many websites showcases physicians and responds to hot issues like hormone replacement, mammograms, or testing for prostate cancer. The websites enable

healthcare professionals and marketers to present information in adequate depth. As things stand at present, online marketing efforts are not very measurable. But they are fairly effective from the point of view of branding, customer satisfaction or goodwill created with the provider.

Telemedicine

What Arthur Clarke prophesized ("Men will cease to commute, they will communicate") has come true in modern healthcare practice as evidenced by the advent of telemedicine. Nowhere in the field of healthcare can one find a dramatic development like telemedicine. Derived from Greek and Latin roots, telemedicine brings together 'distance' and 'healing'. Consultation with expert physicians and surgeons who examine the scan images of patients living thousands of miles away has been made possible through this development. TIME magazine referred to telemedicine as "healing by wire." The concept may sound futuristic but is fast becoming a reality.

This innovation makes possible the delivery of healthcare and exchange of information about it across vast distances by utilizing telecommunication technology. The following features are significant: Telemedicine enables the transfer of basic patient information over computer networks (medical informatics), the transfer of images such as radiographs, computer tomography (CT) scans, magnetic resonance imaging (MRI) pictures, ultrasound studies, and pathology reports. Besides all these, transfer of video images of endoscopic or other procedures, patient interviews and examinations, consultations with medical specialists are also carried out in telemedicine.

As a medical researcher put it "the essence of telemedicine lies in transferring the expertise and not the patient- the goal of telemedicine is to eliminate the unnecessary traveling of patients (and their escorts)". Indeed, certain special features of telemedicine merit attention: the use of telecommunication technologies to enable communication and interaction between client and provider to improve clinical functions and enabling a division of labour and specialization among healthcare providers and staff through an underlying system.

In an article 'Integrated Healthcare and Telemedicine', Siriginidi Subba Rao (2001) points out that investment in Information Technology (IT) addressed financial, clinical and marketing issues. IT can improve aspects of both medical care and the underlying administrative infrastructure leading to greater patient satisfaction and increased revenues.

Telehealth has assumed importance as a subject area and practice of medicine. (K. Srinivasan, 2002). The key component is to place the appropriate tools and techniques of Information Technology in the hands of doctors and patients. Telehealth enables quality healthcare at reduced cost to the patient by delivering medical care in association with the doctors of local Primary or Secondary Healthcare Centres or the large number of clinics in the smaller towns. These small clinics are helped by linking with specialists / superspecialists in the leading hospitals and medical establishments of the big cities. There emerge two major outcomes:1. modernization of the primary healthcare services 2. IT facilitation of the medical profession including medical education. The Teleheath network allows the less experienced doctors in rural areas to gain immensely through association with leading specialists as well as access to online medical information systems.

Leading corporate hospitals in India have already established their own Telemedicine networks which is a boon to people living in inaccessible areas. For instance, the scattered islands of Lakshadweep have only primary healthcare centers (PHC) in the territory. The PHC doctor discusses the case of the patient with a specialist and treats the patient based on second opinion received using internet. Earlier, telephone and fax were used for teleconsultations. Now, teleconsultations are done through E-mail, Internet and Teleconferencing. Various combinations of media further extend the scope and application of Telemedicine. Technology innovation again has made ingenious utilization of medical care by people in several countries through telemedicine, benefiting ultimately patients in remote regions. The governments have also realized its importance and provided infrastructure facilities. The case of satellite connectivity given by Indian Space Research Organisation (ISRO) to Narayana Hrudayalaya in Bangalore for running a chain of Coronary Care Units in association with various state governments may be mentioned here.

Indigenous Medical Technology

It is not an exaggeration to state that medicine today is driven by technology. But few Indian industries have dared to tread the path of developing indigenous medical technology devices. A pioneering institution, Sree Chitra Institute for Medical Sciences and Technology (SCTIMST), Trivandrum (Kerala) has taken up the challenge of synergising medicine and technology. It has successfully developed and marketed medical instruments benefiting thousands of patients across the country. An institution of national importance, it has made products, which the medical fraternity could use on the clinical side for innovative solutions. In the view of Dr. M.S. Valiathan, the founder director, there is no point in research and development if it cannot deliver products that patients would directly benefit from.

The Director of SCTIMST, Dr. K. Mohandas, refers to the great work done in the Biomedical Technology (BMT) wing which has already secured some 98 patents out of which 33 have been converted to technologies. Of these, 15 have been transferred to industry partners for commercial production and this is an impressive achievement even by global standards. Today there are 15 companies profitably using Sree Chitra technologies. It all began with the commercial production of the country's first indigenous heart valve, TTK –Sree Chitra valve, the institute's most high profile medical device. A wide range of healthcare products including blood bags, membrane oxygenator, and hydrocephalous shunt are being produced. In addition, the centrifugal blood-pump, haemoconcentrator and oral insulin delivery system are in the pipeline. R& D work is also going on in the area of dentistry, opthalmics, and orthopaedics. The BMT wing of SCT is the first internationally accredited laboratory for the testing of biomedical devices in India and perhaps in South Asia.

The comprehensive care center for Movement Disorders launched a new initiative last year by taking part in an international drug trial for Parkinsons' disease. SCTIMST has also pioneered endoscopic surgeries thus bringing down the mortality rate of invasive alternatives. According to Dr. Mohandas, the institute is now in the process of setting up a National Testing Centre for medical devices. A center for Stem Cell and Tissue Engineering is also on the anvil. Ultimately, the objective must be to make medical care affordable for the common man and cost effective for the organization. The idea of setting up a technology assessment cell for evaluating

the cost effectiveness of every healthcare technology which has been mooted by Dr. Mohandas is significant in this context.

Sleep therapy devices

A research survey by the National Institute of Health in the United States has revealed that nearly 20 million Americans suffer from sleep apnea; yet 80% to 90% of patients afflicted remain undiagnosed. Also, the prevalence of obstructive sleep apnea (OSA), the most common form of sleep apnea – reveals that of asthma and diabetes. OSA has serious health consequences and can even be fatal, point out centers for disease control in the U.S. In fact, this problem is widely present in almost all countries but not much talked about since people tend to attach not much importance to sleep or lack of it. Innovation and technology in healthcare have in recent years tried to grapple with the problem of sleep disorder effectively. A simple tool for sleep disorder screening called Epworth Sleepiness Scale has been designed with a validated questionnaire that identifies excessive daytime sleepiness, a common symptom of OSA.

Since OSA is linked to other serious conditions, treating it may lead to improvement of other medical problems faced by patients. Identifying and treating OSA can be a simple process, according to sleep therapy experts. An Indo-U.S symposium 'Sleep Medicine 2006' held recently in Chennai and attended by doctors from all over India, and the U.S. discussed the theme "Understanding Sleep Disorders – A clinical approach." Sleep technologists conducted workshop in topics like "positive airway pressure titration, thermistors, oxymetry." Abbott, a pharmaceutical company of repute, came out with a tested drug called Zolfresh, internationally No.1 sleep restoring therapy as they claimed. Insomnia, an inability to obtain an adequate amount of sleep to feel restored and refreshed in the morning, afflicts over 30% of people worldwide. A company, Puritan Bennett which is a leader in "Breath Delivery" has designed and produced an interface or mask worn at night by patients. It has pioneered other interface technologies such as Nasal Pillows, which some patients prefer to traditional nasal masks. These interfaces provide a lot of comfort and the freedom to sleep in virtually any position for patients suffering from OSA. These sleep therapy devices have been developed through technology inputs. For example, Puritan Bennett's products called Good Knight is small, light weight, comfortable and ultra quiet. "But don't be fooled by their size-each device delivers a power

house of performance. A wide pressure range meets most prescriptions, and our patented technology is highly responsive to breathing changes, even with high respiratory rates." The clinical performance incorporates automatic altitude adjustment compensating for elevation changes to maintain prescribed pressure.

Medical Instruments and Innovation:

Medical instrumentation and devices have come a long way over the last two decades. Innovation and rapid progress taking place on the technology front have made medical devices industry one of the fastest growing in the world. According to an estimate, the global market during 2006 will exceed US $ 260 billion. The fact remains, however, that many developing countries do not have access to high quality devices and equipment to meet their specific epidemiological needs. This situation has led to the import of a large number of devices and in turn, opening the door to unscrupulous market influences putting the lives of patients at risk. Many examples for this can be cited: illegal reprocessing and repackaging of used syringes for sale, and market scarcity of equipment that fails minimum quality and safety standards. The paucity of vendor and product knowledge in the country makes the situation still worse.

There is an urgent need to harmonise national guidelines so that regulatory barriers may be reduced and access to new technologies improved. The existence and proliferation of several regulation models will not only increase healthcare costs but also jeopardize patients' safety. " The Indian market is characterized by extremes – at one end we have truly world-class certified products and on the other we have uncertified devices; both should be regulated in an appropriate way to ensure patient safety," points out a medical expert.

The Drug Controller General of India (DCGI) has formulated guidelines for the import and manufacture of medical devices effective from June 2006. Ten categories of sterile devices declared as 'drugs' under the Drugs and Cosmetics Act would be imported under the procedure for registration and import license prescribed for the same. This move will make for better discipline in health care sector even though the primary mode of action of a medical device is not metabolic, immunological or pharmacological, according to experts.

Interestingly, the volume of regulations and cost of health care are directly proportional to each other. Japan, the most regulated market in the world, has the highest cost of healthcare. A certified mechanical bi-leaflet heart valve sells in India for USD 1000, in Europe for USD 4000, in the U.S for USD 7000 and in Japan for USD 12,000 (Neesha Patel, 2006). The implication is clear. Not only are high costs passed down the value chain to patients but also the availability of devices gets restricted. It does not make business sense to import devices if minimum revenue to cover the costs cannot be ensured.

Accreditation:

There is a flurry of activity among the hospitals in Asia in the matter of getting accreditation from the Joint Commission International (JCI) of the United States. Indeed, this is supposed to be the gold seal of quality and it is naturally much coveted by the corporate hospitals in India. The Apollo Group of hospitals, Wockhardt in Mumbai, Manipal Hospital in Bangalore and Sri Ramachandra Medical Centre in Chennai are now in the process of getting JCI accreditation. The JCI seal would ensure that the hospitals measure up to the best in the U.S in terms of patient care and safety. A series of rigorous processes must be gone through by hospitals seeking accreditation. JCI has promulgated over 360 standards for different procedures and of these 65% are deemed 'core' and the rest 'non-core'. The hospitals must also improve the infrastructure for gaining this recognition.

Indeed, the execution of the JCI concept itself may be termed an innovation in health care. Seventeen hospitals in Asia have won the gold seal in the last three years and about 25 are in various stages of preparation for it. Actually, some 57 hospitals across 15 countries are accredited by JCI. It is in fact a business imperative for these hospitals.

CQI and TQM

Continuous quality improvement (CQI) by hospitals is of vital importance in the healthcare sector. Technology has helped here. Information systems assist physicians and surgeons by providing various inputs like provision of laboratory values, calculation of weight based doses of medications etc. More sophisticated tools such as computerized algorithms and neural networks confer long-term benefits when they get integrated with provision of healthcare.

Possible diagnostic and treatment errors in numerous clinical settings including assessment of abdominal pain, chest pain and interpretation of radiological images and tissue specimens can be reduced with the help of such tools. It may sound far-fetched but all these innovations including storage of information about patients in computers (electronic medical records) serve to promote internal, external and interactive marketing efforts by healthcare organizations. Historically, healthcare quality has been equated with clinical or professional quality, which bore little or no association with management activities. But, today, the importance of combining the two approaches is rated high on the agenda of all healthcare institutions. (Kay Ennis and Denis Harrington, 1999)

Hospitals and healthcare institutions are now clamouring to find ways to ensure that their organizations will become more efficient and cost-effective. With total quality management (TQM) defined as managing the entire organization to make it excel in all dimensions of the services that are important to its customers, it appears to be the solution to the problems that many hospitals are facing.

Cost Factor:

The induction of high tech equipments in hospitals has vastly improved service scapes but has also pushed up healthcare. The cost factor covers both the health care provider (hospital) and the customer or client (patient). For the hospital, the promoters and the administration/management have to ensure that the business/industry is profitable and no loss results. For the patient, the treatment and the medical care must be affordable; the patient must have the feeling that there is value for money and that he/she is not fleeced. The mesmerizing term "package" has nowadays come to occupy a pivotal place in healthcare marketing. Corporate hospitals compete with one another in offering a whole lot of services under the umbrella of package schemes. These includes apart from surgical procedures and treatment, components like room rent during stay in the hospital, visiting consultant's fees etc., Complete medical checkup (routine blood tests, oral and dental examination, X-ray of chest, ECG etc.,) is also offered for those who want to maintain a modicum of good health and well-being. Ultimately, the aim is to make patients lead an active life after getting cured. There is no doubt that all these efforts are laudable and competition promotes cost reduction. Again, the fact

remains that the general public is becoming increasingly health conscious, mainly due to the campaigns launched to create awareness about the serious after-effects of habits like smoking etc.,

The latest advancement in medical treatment have lengthened the life span of patients but only the affluent sections of society can afford the cost of treatment in a large number of corporate hospitals. In the absence of a viable social security scheme under the aegis of government, the majority of patients, especially those belonging to the middle class, are left high and dry. The 'Mediclaim' insurance policies from the general insurance companies impose several restrictions. The 'fine print' lists many diseases (pre-existing condition) that virtually disqualify thousands of patients from taking the mediclaim policies.

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