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AGA KHAN VS. UMASS: A FIRST WORLD - THIRD WORLD COMPARATIVE ANALYSIS OF THE USE OF MEDICAL TECHNOLOGY

An Interactive Qualifying Project Report

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by

Zareen A. Mushtaque
Zareen A. Mushtaque

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Approved:

Professor K. Saeed
Advisor

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Abstract

This project is a comparative study of the implementation and effects of medical technology at two medical institutions in Pakistan and the United States. I present an analysis of the latest technologies at these institutions, Aga Khan and UMass, to see if medical technology exists in a third world country, and how it affects health care. However, because one of the hospitals is not a representative sample of its region, I can only make conclusions on medical technology alone, and not on health care delivery of these institutions.

Executive Summary

This IQP begins with an introduction listing the objectives of this project. The main goals are to see if medical technology existing in a first world country is also available in a third world country. Another aspect I want to study are the ways medical technology has altered or enhanced health care delivery, due to its strong integration into many medical institutions today. However, since one of my institutions is not a representative sample of its region, my limited research does not allow me to compare the health care delivery aspect of this project.

The second section of the IQP is the background of the two medical institutions studied and why they are chosen in particular for this project. This information gives the reader an idea of the history and size of the hospitals studied.

The literature review section deals with the impact of medical technology on both the physicians' and patients' attitudes and outlook on their treatment. Though medical technology has many advantages, there are also some profound setbacks if it is not understood and used properly. The way to make physicians and patients aware of the technology should be by education. A new aspect of "medical art" should be taught along with "medical science" to give the best treatment possible, with the best of both worlds of technology and one-to-one personalized care.

The methodology section gives the background on the latest technologies studied at these hospitals. This section also describes the survey methodology and how the surveys were handed out to the physicians, patients, and technicians who deal with and

are in contact with these technologies. These surveys allow me to get the firsthand opinions about the technology from the essential members of a health care system.

The respondents' surveys are then used for the analysis section on the comparison between these two institutions. The results are split into two sections: the technological aspect and the personal aspect. The technological aspect deals with the mechanical and technical parts of the technology. This section also contains the physicians' and technicians' opinions on the benefits and harms of each technology. The personal aspect is broken down into physician, patient, and physician to patient comparisons at both UMass and Aga Khan. This allows me to conclude whether or not technology is available at each institution and what its effects are on health service and delivery of care.

The next section deals with the health care delivery comparison between Pakistan and United States. Since, both countries are quite different economically, health care is just not comparable. Aga Khan is a rare institution found in Pakistan, whereas UMass is a common average institution found throughout the United States. Since both samples are not similar, it is not feasible to rise to conclusions on health care delivery.

Thus, my IQP concludes with the fact that the latest medical technology found here in the US does exist in Pakistan also, though it is not as readily available. Since Aga Khan is not a representative sample of a health care system found in Pakistan, I can make no further conclusions on health care delivery available in both these nations.

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Introduction

The Interactive Qualifying Project (IQP) is a degree requirement at Worcester Polytechnic Institute (WPI) which focuses on the study of the affect of technology on society. For my IQP, I carried out a comparative analysis of the medical technology and health care delivery in studied institutions in two different parts of the world: the United States, a first world country, and Pakistan, a third world country.

Medical technology "... which results from basic and applied biomedical research is a scientific body of knowledge underlying the techniques, procedures, or programs needed for effective medical diagnosis, therapy, or prevention."[i] As we enter the new millenium, we are witnessing a rise of medical technology, which has undoubtedly impacted health care delivery. With this rapid progression of technology and enhanced methods of treatment in the medical field, health care providers have been more readily able to detect, diagnose, and prevent many illnesses.

However, the recent rise of machinery in our society has caused an increase in skepticism as to whether or not the benefits of medical technology are worth both its social and fiscal expenses. As a result, there is a misguided reliance on medical technology which can lead to impersonal medical care. This blind faith may also give rise to high expectations of both the physician and of the overall capability of health care. Another setback of medical technology is its high financing. Indeed, "...new technology is accused of raising the cost of providing health care."[ii] With total dependency and increased costs, medical technology is seen as a major cause of problems in these areas.

The objective of my study was to compare my findings from both the US and Pakistan and to see if medical technology has spread globally, and if and how it has affected health care delivery in different economic settings.

My specific objectives of this project were:

1. To see if medical technology used in a first world country is also available in a third world country
2. To study in which ways medical technology has altered or enhanced health care delivery in both first and third world countries

I achieved these project objectives through conducting surveys for physicians, technicians, and patients who deal and work with the specific technologies studied. This created personal insight on the technology and further collected opinions on health care in general and specific to the studied hospitals. The surveys also enabled me to conclude firsthand if a specific technology is available and how it impacts health care delivery from different perspectives. I also researched literature on these topics to further help me analyze the impact of technology on society as we enter the 21st century.

My fieldwork involved comparing two university-based medical institutions in the US and Pakistan, with the objective to see if the latest technologies in major departments in an esteemed hospital in the US are also available at the institution studied in Pakistan. This comparison allowed me to recognize the existence of comparable technologies in the two institutions, although I could make only limited generalizations for the two countries for this comparison.

In this project, I have addressed both the positive and negative affects of medical technology and how it can be used to either benefit our society or harm it in the long run.

The surveys done at both institutions also showed that both physicians and patients felt positively about medical technology and its affect on health care delivery, although some doubts were raised by both segments of each population. There is no doubt that medical technology has impacted health care in many ways. However, it does not mean all effects have been beneficial. Critics felt that medical technology has alienated the human element in the diagnosis and treatment of patients.

Another aspect of this project was to compare health care delivery in the first and third world countries. Due to different economic and social backgrounds, both countries have great differences in their service and the availability of health care. Since my samples of study did not fully represent their respective regions, my research alone could not accurately compare the overall health care provided in the home countries of the studied institutions.

Medical technology has undoubtedly impacted health care delivery in numerous ways in all parts of the world. It is not clear, however, what are the specific effects of medical technology on health care and whether or not more technology means better health care.

Background

I. Overview of institutions studied

To get similar samples for my study, I chose two top-notch institutions, both located in metropolitan areas and affiliated with medical colleges. They each have all the major departments and serve the general public. One big difference between the hospitals is that at the time of my research, UMass was funded by the state, while Aga Khan was supported by private funding. However, both these institutions are highly reputed and well known in their respective settings. These hospitals were chosen for this study primarily due to my accessibility to these institutions. It just so happened they both had reputable statuses: Aga Khan with one of the best medical facilities available in Pakistan, and UMass, affiliated with a well known medical school in the nation, ranking 41 in the top 50 medical schools in the US in 1999.[iii]

UMass Memorial Health Care, a non-profit health care system, is located in the small city of Worcester, Massachusetts. It is a university based academic health science campus and was founded in 1962. The hospital is affiliated with the medical school, teaching clinics, and two graduate schools of biomedical sciences and nursing. UMass has a total bed capacity of 388 beds, with 45 contracted beds at Worcester State Hospital and has a workforce of more than 6,000 employees. UMass is a public hospital which is also awarded $72 million annually in research funding.[iv] UMass serves the patients throughout New England and its "...prominence stems from both its international reputation in specialized patient care and research."[v]

Aga Khan Hospital, along with its affiliated medical college, is a "...modern medical, research, and teaching facility..."[vi] and is located in Karachi, one of the largest and most populated cities in Pakistan. It has a total bed capacity of 721 beds, a community clinic capable of treating 1,500 outpatients daily, a medical school, a nursing school, student housing, and a physical plant and services building, all situated on an 80-acre site in Karachi.[vii] It was founded in 1984 by the Aga Khan Foundation, a world wide philanthropic organization dedicated to helping those with no access to health care.[viii] It is relatively a modern institution and has a well designed campus reflecting traditional Islamic architecture. According to the Aga Khan University homepage online, Aga Khan Hospital is the "...largest philanthropic project sponsored by the private sector in Pakistan to play a pioneering role as the training and support center for a network of over 100 primary health care units in rural areas – an issue of growing importance in developing countries."[ix] The hospital aspires to serve all patients, regardless of race, nationality, or religion. The founders have said that this hospital is "...a commitment to the betterment of the condition of life in people in Pakistan and represents an intimate collaboration between the East and the West."[x] See Appendix A for pictures of both hospitals.

Both institutions are highly distinguished and respectable in their respective areas. However, whereas UMass Memorial is a more uniform representation of the hospitals throughout the United States thus blending in with other state hospitals, Aga Khan is one of the few well-funded and developed hospitals of Pakistan, and is known throughout the whole country. As a result, I will discuss later in my IQP why health care delivery in the

United States and Pakistan is not fully comparable due to the differences between both countries' health care systems and due to the limitations of my study.

II. Literature Review

With the profound effects and intense penetration of medical technology into the health care delivery today, there is rising controversy as to the benefits and use of this technology. Undoubtedly, as the surveys will show, patients and their physicians both believe medical technology positively affects recovery time, early diagnosis, and in some cases, easier and quicker treatments. There is no denial that medical technology has many beneficial results to the overall community. However, there are also many shortcomings in the uses of the same technology. Many now wonder if more technology necessarily and actually means better health care of patients.

As we are about to enter a new millenium, modern technology has a dominant presence in health care delivery. Many people have this "blind faith" that more technology means better quality care, especially the providers of the care. "...Physicians and especially physicians in teaching hospital settings, have been trained in the ideology of 'more is better,' that more technological innovation, and more widespread use of technology, will enhance the quality of care."[xi] What is so attractive about technology that draws both patients and physicians to its use? Kenneth E. Warner states in his article, *Hospital Cost Containment and Medical Technology*:

> Possession of modern, sophisticated technology confers prestige on physicians, and it often contributes to their economic well-being. As a result, hospital administrators want to acquire sophisticated equipment and facilities, both for their own prestige and to attract and hold high caliber physicians on their staffs. Finally, the public's growing faith in the power of science in general and of curative medicine in particular accelerates the demand for technologically advanced methods of care. In short, technological sophistication is viewed by many – patients, physicians, and administrators – as a surrogate for high-quality care.[xii]

Patients also often believe that more technology means better treatment. "The development of many marvelous products in science and technology has led to public

awareness of technology and to increased public expectations of the benefits to be received from technology… The public is also partly mystified by modern medicine and partly dissatisfied with the inability of many medical practices and practitioners to improve patient outcomes."[xiii] As a result, they believe that increasing application of technology to health care will bring many significant benefits. With this utopian view, they end up assuming that technology is free of flaws and errors. They put their full trust into what machines say, usually without any doubt. What people tend to forget is that machines are "…influenced by the human hand that operates them and the human mind that evaluates the results. Furthermore, the machines are denied complete access to a whole range of nonmeasurable facts about a human being that a physician can obtain only through his own sense – questioning, observing, making judgements."[xiv] As a result, it is obvious that more technology does not necessarily mean better health care. As we will see below, better health care involves more than just the "technological" aspect.

Technology has an impact not only on care of patients, but also on attitudes of both physicians and patients. Modern technology and newer "techniques influence the relationship of the patient with the physician; they influence the doctor's image of himself as a decision maker; they influence the association of physicians with each other, and thus the manner in which the institutions of medical practice are organized."[xv] It is essential to view this technology and its affects in all aspects: the most important one being the patient and satisfying his or her needs and wants.

What the public wants and fulfilling those wants is part of what makes a good and beneficial health care system. It is crucial in seeing that what the public "…wants first is quality care, and that means to them personalization and one-to-one care."[xvi] It should

then be the goal of every physician to provide this personalization. Although many are happy and grateful for the positive results of the technology, there are a lot of people who believe that increasing technology reduces personalization and the "human element":

> Although we certainly appreciate [technologies'] benefits – longer life, reduced morbidity, lower risks of adverse effects from surgery, reductions in the time spent recovering from illness, safer and more precise diagnostic techniques, and even the disappearance of some forms of disease – technical innovation has often been coupled with increased economic and societal costs. Many patients feel that the system has become inhumane. They are overwhelmed by the complexity of the technologies that are being used to help them and often feel that they are treated as products processed in a hospital assembly line.[xvii]

Listening to the patient and putting the patient first, ahead of machines and technology, is a crucial element in health care delivery. According to a British physician James Mackenzie, there are two factors of medicine that need to be distinguished from one another: medical science and medical art. He argued that "…illness could be better understood and detected earlier if doctors listened to what patients said…[and] that attentive listening could illuminate the emotional and social components of their patients' complaints, and thereby improve the effectiveness with which illness was managed."[xviii] Basically, he wanted to emphasize that "…the art of medicine was a talent for understanding the human needs of the patient and using this knowledge to manage his illness better."[xix] The problem with modern technology is that most often, physicians turn to it for help in diagnosis instead of the patient himself:

> Machines inexorably direct the attention of both doctor and patient to the measurable aspects of illness, but away from the 'human' factors that are at least equally important…So, without realizing what has happened, the physician in the last two centuries has gradually relinquished his unsatisfactory attachment to subjective evidence – what the patient says – only to substitute a devotion to technological evidence – what the machine says…As the physician makes greater use of the technology of diagnosis, he perceives his patient more and more indirectly through a screen of machines and specialist; he also relinquishes his control over more and more of the diagnostic process, [which] tends to estrange him from his patient and from his own judgement.[xx]

As a result, this separation between the patient and the physician due to reliance on technology has been a cause for great concern in both the medical and general society. Many feel that "...the healing of illness requires more than healing parts of the body; it also requires intensive efforts to communicate with the patients – to gain their trust and to understand their needs and hopes."[xxi] Only by doing this can we have a successful health care system.

As we move into a newer modern era, one can wonder why technology is criticized so often? The only answer here can be because it is often misused, and thus, misunderstood. "Technology is not just gadgets and bits and pieces of innovation. Unless technological components are used as part of a system..., the overall effect of technology could be harmful,"[xxii] and "without the proper understanding of the systems to be utilized, the benefits cannot be realized."[xxiii] How can it be incorporated into the system? The key is by education. As William B. Walsh states in his proposal, *The Reform of Medical Education*, "The education of new doctors has not prepared them for management roles.... The rapid advancement of medical technology has dramatically altered patient care patterns...."[xxiv] He and other reformers believe that "...medical education...needs to prepare health professionals as much for the exercise of social responsibility as for the exercise of expert decision making."[xxv] Another reform proposal, *Physicians for the Twenty-First Century*, by the Project on the General Professional Education of the Physician (GPEP) of the Association of American Medical Colleges, states that "...medical education should emphasize skills, values, and attitudes as much as the acquisition of knowledge; [and] that future physicians should be prepared to deal with changes occurring in the health care system...."[xxvi] Basically, "health and medical care

training, beginning with undergraduate education, should include a broad and full exposure to technology and its proper use."[xxvii] By doing this, physicians will be more readily able to understand and use the latest technologies and implement them in such a way as to benefit themselves, the patients, and the entire health care system.

A question then arises as to how can we bring about this reform in medical education? Many say a reform can be brought about by the addition of humanities courses to the medical education curriculum. One who believes this is essential is J. David Newell, who similarly to William B. Walsh, states, "...[There is] an ancient and fundamental conviction that medicine is much, much more than a science; it is at the same time and art....[And] it is an art firmly grounded [both] in the sciences [and in] a fundamental focus on the *human*."[xxviii] Eric Cassell agrees by stating, "The humanities have always had a place in medicine, and ... they will play an increasingly important, necessary, and specific role as medicine evolves beyond its present romance with technology toward a more balanced view of the origin and treatment of illness."[xxix] By integrating humanities and "medical art" to medical education, we can train physicians to combine both the human element with the technological factors in order to better health care delivery.

So the problem we must try to solve now is how do we blend in technology into health care in such a way that its benefits are advantageous and the patient is still treated as a human being? Without any doubt,

> technologies that improve accuracy, and centralized organizations that enhance efficiency and provide security, are essential factors in modern medicine. Yet accuracy, efficiency, and security are purchased at a high price when that price is impersonal medical care and undermining the physician's belief in his own medical powers.[xxx]

Physicians must learn to accept the patient as a human being and use his or her own better judgment in the patient's treatment. They should deal with the patient firsthand, instead of hiding behind the technology, and use the technology only to further their own diagnosis. "Physicians who have used technology now know that its reason for use is to increase the desired one-to-one relationship in health care delivery, while maintaining or increasing the quality delivered."[xxxi] By learning and implementing about the importance of the human element, physicians will be able to integrate the benefits of technology into their personal health care delivery, thus bettering the quality of care. Technology is a very powerful tool and "...should be introduced into the practice of health care [in such a way that]... its benefits to society outweigh its cost."[xxxii]

Methodology

I. Research

There are two main parts I would like to discuss in detail in my IQP. First, I would like to analyze the effects of technology on healthcare by surveying different physicians, technicians, and patients in various departments of a hospital. This will show firsthand what the essential members of the health community feel about technology and its role in health care delivery. By comparing their answers with the points made in the literature I read, I will attempt to assess if technology is impacting health care delivery, and if its benefits are really worth the costs.

With these surveys, I will also attempt to analyze the second part of my discussion on whether the effects of technology on health care are different around the world. By comparing my surveys done in Worcester to the ones done in Karachi, I will attempt to see if and how technology is affecting health care quality and delivery globally.

Background of medical technologies researched:

All the major departments in hospitals are developing modern and newer technologies to facilitate early diagnosis and better treatment. For my IQP, I chose the most commonly used and efficient technologies being used daily in hospital environments. The major departments I decided to focus my study on are surgery, cardiology, urology, anesthesiology, and radiology. These are vital departments which serve the greater society in healthcare delivery. Within each of these departments, I

chose a few technologies which are imminent in the healthcare of the patients in these specific areas. All these technologies can be divided into two aspects of health care: diagnostic and treatment-related.

Diagnostic:

Radiology

Fluoroscopy

A fluoroscope is "…an x-ray device that provides images of internal body parts as they move."[xxxiii] In this procedure, x-rays strike a screen that is coated with a fluorescent material. As a result, a dark shadow of bones show up on the television screen against a light background. Fluoroscopy gives direct images and helps guide invasive medical procedures, where the physician can see where the catheter is going by the images observed with fluoroscopy. It can also help patients regain lost functions and can improve the safety of other medical procedures.[xxxiv] It is especially helpful in diagnosing problems of the digestive tract, kidneys, and gallbladder. The exam can usually last 30 to 40 minutes.[xxxv]

Magnetic Resonance Imaging

This technology, developed in the early 1980's, uses "…a strong magnetic field, radio waves, and computers to look inside the patient's body. This can be done as a non-invasive procedure and without any ionizing radiation exposure to the patient."[xxxvi] It produces images by "…determining the distribution and behavior of the patient's atoms and molecules while they are exposed to a strong magnetic field and radio frequency signal."[xxxvii] This allows the computer to produce an anatomic image of the body in any desired plane and an image of blood vessels within the body.

Ultrasound

Ultrasound or sonogram tests use "...sound waves to obtain pictures of [a patient's] abdominal or pelvic organs. There are no known risks to [one's] health from the sound waves, and no after effects following the procedure. The test is ordered by the doctor to rule out any abnormality of the abdominal or pelvic organs (stomach, liver, bladder, ovaries, etc.)"[xxxviii] The sound waves can also image any type of soft tissue structure or organ, as well as blood flow studies, and are most often used for pregnancies.

Computerized Axial Tomography (CAT Scan)

This diagnostic tool, developed in 1973, is "...an advanced scanning x-ray and computer system that makes detailed pictures of horizontal cross-sections of the body."[xxxix] More specifically, it can produce pictures and reveal radiographic densities of areas protected or surrounded by bone and can also show ducts, blood vessels, tumors, or any other organs. Because it is 100 times clearer than a regular x-ray, the CAT scan can diagnose some diseases at an early stage.[xl]

Anesthesiology

Swan Ganz Catheterization

This technology is the "passage of a catheter (a thin flexible tube) into the right side of the heart to obtain diagnostic information about the heart and for continuous monitoring of heart function in critically ill patients."[xli] This test is performed to "...evaluate heart valve function and circulatory volume, monitor for complications of acute myocardial infarction, and monitor effects of certain cardiovascular drugs."[xlii] It is a tool used both in the Anesthesia department and in the ICU. The estimated cost for this procedure is $650.

Pulse Oximetry

Pulse oximetry is a "...non-invasive method to determine a patient's percent oxygen saturation without having to obtain an arterial blood specimen."[xliii] It also measures "...the percentage of haemoglobin (Hb) which is saturated with oxygen."[xliv]By using highly sophisticated light sensors, the pulse oximeter can measure the absorption of red and infrared light passed through a patient's finger. Basically, it measures the "...changes in the intensity of transmitted light as blood pulsates through a patient's finger or earlobe."[xlv] The machine then does mathematical calculations to determine the percent oxygen saturation of the blood. This method has many benefits as it most importantly eliminates the necessity of drawing arterial blood from the patient. It also reduces transportation time to the hospital, as this can be done at bedside. Physicians can also review trend of the oxygen saturation as up to 60 hours of trended data can be displayed.

<u>Treatment-related</u>:

Patient Controlled Analgesia (Anesthesiology)

This technology is based on the idea that "...patients are the best judge of how much pain they are feeling and how much medication they need to control it."[xlvi] In Patient Controlled Analgesia (PCA), a special computer-controlled pump is attached to the patient's intravenous (IV) line. When the patient is in pain, he or she pushes the button connected to the pump and a dose of medicine is sent to them. The pump is set to give a specific steady amount of medication, so the patient cannot overdose. This allows for faster relief and ability for patients to control their own pain.

Surgery

Laparoscopy

Under the surgery department, laparoscopy is a new technology which "...uses a small video camera and a few customized instruments to perform surgery with minimal tissue injury."[xlvii] Here, instead of making large cuts into the skin and muscle, the camera and instruments are inserted through "...small skin cuts allowing the surgeon to explore the whole cavity..."[xlviii] with little exposure. Through the use of high-resolution video cameras, surgeons are allowed to use this technology, which in turn "...reduces the recovery time due to its minimal tissue damage permitting the patient to return to normal activity in a shorter period of time."[xlix]

Urology

Extracorporeal Shock Wave Lithotripsy

In urology, one very important and efficient technique is Extracorporeal Shock Wave Lithotripsy (ESWL). This is a new alternative method to surgery to people with kidney stones. In this procedure, ESWL disintegrates the stones in the kidney by shock waves "...into sand-like particles that can be excreted with little or no pain." "The shock waves are a form of high energy pressure...that pass through the tissues of the body without damaging them, [and in turn] can pulverize a stone inside the kidney." This is a very fast and efficient process for an average of 1500 shock waves are needed to disintegrate the stones; each shock wave taking "...less than a thousandth of a second."[l]

II. Surveys

Respondents:

To begin my research in obtaining information about the specific technologies, I decided to give out surveys to the people who were in intimate contact with these technologies and would provide firsthand input. All three members of a defined health care system (physicians, technicians, and patients) participated in this study at both UMass and Aga Khan. The surveys were handed out for each technology and were organized under three different headings relating to specific information about the technology, about the doctor/patient relationship, and about personal opinions of technology assessment at that hospital. There were 24 respondents at Aga Khan and 27 respondents at UMass, since UMass carries one extra technology that Aga Khan does not. All of the participants in this study were essential members of health care delivery, and I wanted to observe the people who maintain the technologies, use the technologies, and receive the technologies.

Sampling Design:

There was no objective sampling design for this IQP. The two hospitals were chosen based on convenience and accessibility, due to my limited resources. However, to my luck, both these institutions happened to be of respectable status, with Aga Khan as a leading hospital in Pakistan, and UMass, also a reputable hospital in USA.

To conduct my research at both these hospitals, my sampling frame for this study was dictated by the specific number of people who directly work with the technologies. For physician surveys, I went to the heads of the department for their authority and

information for whom to contact for my surveys. In some cases, they answered my questionnaires, whereas a few gave me names of other physicians who dealt with the same technology. As a result, the surveys for the physicians at each hospital were given at random to any physician who worked with that technology. There was no specific position of the physician in that department that had to fill out the survey. For technicians, there were usually only one or two people whose main job was to work with those machines directly, so they were contacted to participate in my survey. In regards to the patient surveys, I was unable to directly hand out the surveys due to my inaccessibility. Instead, the physicians had the patients undergoing those technologies filled them out.

The sample size for these surveys was determined mostly by my time limitations and accessibility of the physicians, technicians, and patients. I also believed that surveys from a physician, a patient, and a technician for each technology at both hospitals would be sufficient for this particular study. As a result, my sampling size is quite small and I am unable to provide reliable statistical inferences from my data.

Questionnaire Design:

The same three types of surveys were given out at both UMass and Aga Khan hospitals to give a similar sample study and to allow me to cross compare the answers. Each physician, patient, and technician was also given the same survey for each technology for the same reason.

For the physician survey, there were 12 questions on the components, mechanism, benefits, and harms of the technology that they specifically deal with. In addition, there were 8 questions about the physician's opinion on the importance of the doctor/patient

relationship and how he or she believe it has affected by the use of this technology. At the end, there are 4 questions on the physician's personal view of the status of their hospital in relation to the technology available and its standing in that country. This three-fold organization for the physicians allows for easier cross comparison in three different, but important, aspects of this study. See Appendix B for physician questionnaire.

To keep a similar background, almost the exact same survey was given to a patient who had undergone this technology. This allowed for a cross comparison between the different perspectives of the key players in a health care system. However, in these surveys, the technical aspect in regards to the questions about the specificity of the technology was removed, since patients would not have much background information in this area. See Appendix C for patient questionnaire.

Instead, this technological perspective of the survey relating to the mechanical aspect of technology that was given to physicians, but not to patients, was also given to the technicians who work with and maintain those technologies. Their answers would be used to specifically view both the advantages and disadvantages of the technology that they are familiar with. See Appendix D for technician questionnaire.

Procedure:

To undergo this study, I employed mail type surveys that I gave out directly. I thought the mail surveys would not be sufficient in Pakistan, as I was there for only a limited period of time and could not really rely on the Pakistan postal service. Also, many times the respondents are too busy to mail back the surveys. For the same reason, I did not administer the face-to-face survey, as these require a substantial amount of time

in making appointments with already quite busy physicians and technicians. As a result, I thought dropping off the surveys would be the best method to administer at Aga Khan and UMass. This way, I could explain the purpose of this study in person, and then allow the respondents to fill out the surveys in their own time. After a few weeks, I would directly pick up the surveys and thus, save the respondents valuable time.

The surveys at Aga Khan were administered in the summer of 1998, while the surveys at UMass were given in the fall of 1998. To ensure and increase the response rates of the surveys, I had a contact at Aga Khan who frequently made checks around the hospitals to remind the respondents to fill out the surveys. At UMass, I also called frequently to ask if the surveys had been completed. If they were not, I often gave them more time to return the completed questionnaires.

According to *Introduction to Survey Design and Methodology,* a paper by James Doyle, an Assistant Professor in the Department of Social Sciences and Policy Studies at WPI, "the response rate of a survey is simply the number of completed, usable surveys obtained divided by the number of people who were asked to complete a survey."[li] Thus, at Aga Khan, the response rate was about 79%, with 19 surveys completed out of 24, and at UMass, the response rate was about 74%, with 20 surveys completed out of 27. The response rate at Aga Khan may be lower than it should be because in the Radiology department, a physician filled out one entire survey for the three technologies under that department. Thus, two surveys were lost. Also, at UMass, for one technology, the nursing department deals with the equipment, so the anesthesiologists were unable to answer questions pertaining to that technology.

Limitations:

There were quite a few limitations in this survey methodology. For example, since any physician in that department could fill out the survey, the effect of rank and experience of a physician was informal in the cross comparison. Had each head of the department or all residents filled out the surveys, I would have had a more accurate and representative sample for cross comparison. Also, often times, the surveys were handed out to one person in the department, who was to spread the surveys on to the respondents in this study. This could bring error in my response rate, as these people might not be as persistent or efficient in handing out the surveys as I would have been. If I had handed out the surveys to each individual myself, I could have explained the purpose of my research more clearly and could have persuaded them to take a great interest and more active role in my research. As a result, I could have gotten a greater response rate from my surveys. Also, since I administered a mail type survey, I was not present when the respondents were filling out the survey. Thus, I did not have much control over the accuracy of the responses or whether the surveys were filled out completely and conscientiously. This would also apply to the patient surveys, since I was not able to contact any of them directly either.

Another limitation that may exist is in my questionnaires in the section about the personal opinions on the status of the hospital. These questions might have arisen more biases than the others, as people may want their hospital to look "good," even if they do not believe it. Upon obtaining my results, I also noticed that one of my questions pertaining to the cost of the technology was quite misleading. While I meant the cost of the actual equipment, others thought I meant the fee of getting this procedure done. This

was clearly a manifestation of inappropriate wording of the question. Any of these limitations may affect my results in the cross comparison between the two hospitals by either giving inaccurate data or not giving a similar sampling framework for an accurate comparison.

Survey Results

After collecting all my data from both UMass and Aga Khan hospitals, I recorded the results into one database. From there, I observed the answers and drew conclusions regarding the information I received. In this section, I will discuss two main aspects of my surveys: the technical aspect and the personal aspect, by listing and explaining the results. The technician surveys and first part of the physician surveys were used for the technical aspect, while both the physician and patient surveys were used for the personal aspect. Both these perspectives will help in answering the technological and health care delivery parts of my IQP.

I began by comparing the technological standings of both hospitals to each other. I noted if each hospital carried the technology, how old the technologies were, and how many units the hospitals carried. This comparison gives an idea on where both hospitals stand with each other. More specifically, it helps us to see if Aga Khan, an institution in a third world country, offers and has available the latest technology in comparison to an institution in a first world country. And if these technologies are in use at Aga Khan, are they also up-to-date and reliable in performance? Here, we are comparing on the assumption that UMass, because it is in a first world country, has this technology which functions reliably.

I. Technological aspect

Table 1 below shows the number of technology units and the ratio of technology units per hospital bed at each hospital. Some exact numbers were unavailable for which I put an N/A. Out of all the technologies chosen for this project, all are present except for the PCA at Aga Khan, which has not yet been introduced there. Other than this major difference, all the other technologies do exist and are relatively equal in amount at each hospital as seen in Figure 1. Except for the Anesthesiology technologies, UMass is only ahead by one extra unit.

Table 1

Technology	Units at UMass	Units/Bed at UMass	Units at Aga Khan	Units/Bed at Aga Khan
Laparoscopy	N/A	N/A	5	0.0069
Fluoroscopy	3	0.0077	3	0.0042
MRI	2	0.0052	1	0.0014
CAT scan	2	0.0052	1	0.0014
Ultrasound	6	0.0155	5	0.0069
Pulse Oximetry	20	0.0515	12	0.0166
Swan Ganz	12	0.0309	4	0.0055
PCA	N/A	N/A	0	0
Lithotripsy	1	0.0026	1	0.0014

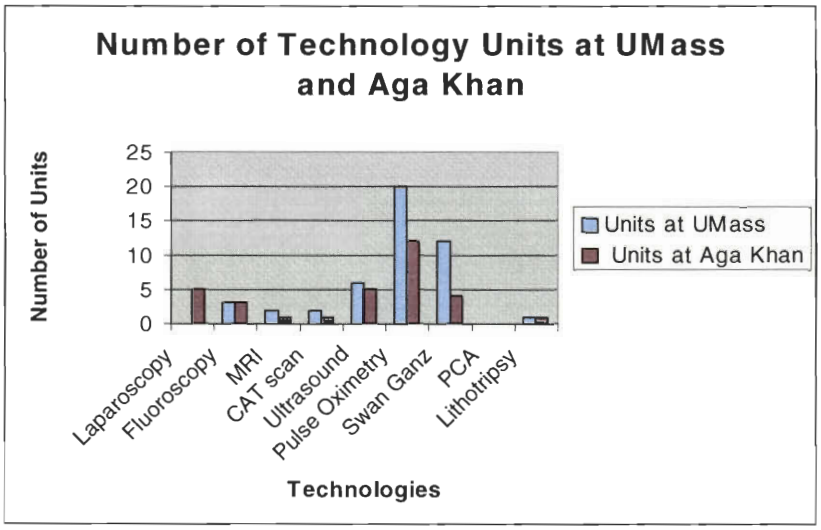

Figure 1

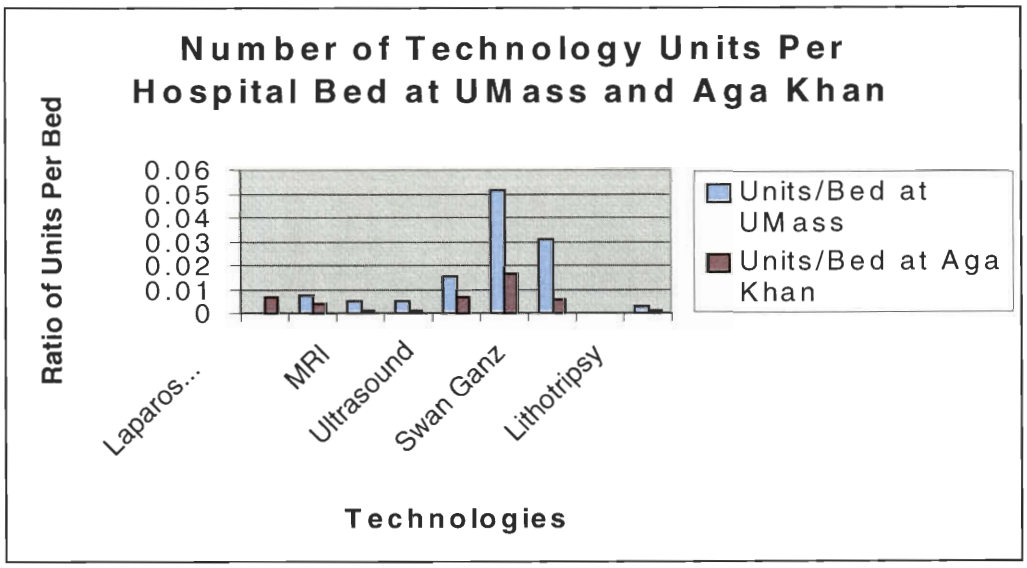

Figure 2

However, looking at the above Figure 2, we can see that according to the hospital bed capacities, UMass has a higher ratio of technology units as compared to Aga Khan. Thus, we can conclude that though both hospitals have approximately the same amount of technologies, UMass has a higher ratio of technology in relation to the hospital bed capacities of the hospitals. Thus, UMass is more likely to satisfy the demand of technology for the patients than Aga Khan.

The next point I wanted to observe was the age of these machines to see if each hospital was up-to-date with the newest equipment. The ages are listed and graphed below in Table 2 and Figure 3. By observing the graph, we can see that in most areas, Aga Khan has older equipment and in some areas, UMass does. The age varies in the different departments; thus it is hard to say which hospital has newer and latest equipment. However, the majority of the technologies in each hospital are under 10 years old, suggesting that both hospitals have relatively new and up-to-date technologies.

Table 2

Technology	Average Age at UMass	Average Age at Aga Khan
Laparoscopy	N/A	3
Fluoroscopy	10	6
MRI	3	2
CAT scan	2	12
Ultrasound	3	10
Pulse Oximetry	6	7
Swan Ganz	2	2
PCA	N/A	0
Lithotripsy	N/A	10

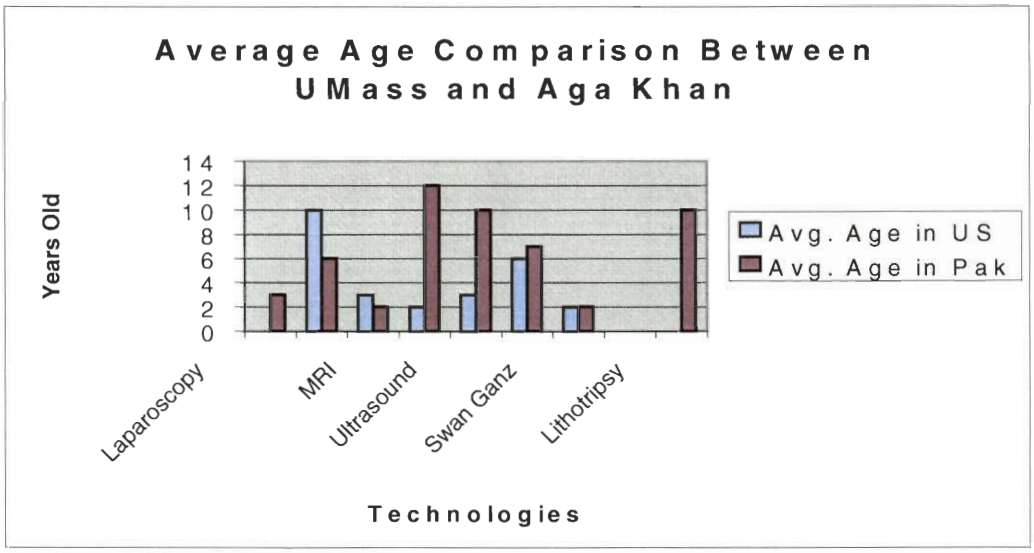

Figure 3

Next, I looked at the price of the equipment at each hospital. Though I had wanted to research the cost of the procedures the patients had to pay for the use of each technology, many respondents misunderstood my question and gave me the price of the equipment instead. Thus, I took those figures and compared this technical cost aspect instead of the original intended health delivery aspect. Each was an approximate estimate made by the physicians and the technicians. The prices estimated at Aga Khan were given in rupees, the currency at Pakistan. The exchange rate fluctuates daily, but currently, the exchange rate compared to the dollar is approximately 52 rupees to a dollar.

Thus, the Aga Khan equipment will be converted to estimated dollar amounts. Table 3 on the next page lists the cost figures for each technology at both hospitals.

Table 3

Technology	Approximate cost at UMass	Approximate cost at Aga Khan
Laparoscopy	$50,000	$25,000
Fluoroscopy	$150,000	N/A
MRI	$2,500,000	N/A
CAT scan	$2,200,000	$1,000,000
Ultrasound	$500,000	$48,000
Pulse Oximetry	$2,500	$1,900
Swan Ganz	$500	$190
PCA	N/A	N/A
Lithotripsy	$1,000,000	N/A

This above table shows that UMass has paid a higher cost for its equipment than Aga Khan. Some prices are twice as much as what Aga Khan pays. A possible explanation for these differences can be that the actual machines at Aga Khan are more basic and less elaborate than those at UMass. Also, most of the equipment at Aga Khan is imported from Europe and the Far East, which are far less cheaper than the United States. These figures are also rough estimates made by the physicians and the technicians. Another setback is that it is hard to be accurate in the conversion rates since the dollar rate fluctuates on a daily basis. In the past few years, the rupee has jumped from 25 rupees to a dollar, up to 65 rupees to a dollar, and has currently settled at 50 rupees to a dollar. We do not know what the exchange rate was for the equipment at the time of the purchase. Only that conversion price would give us accurate estimates to compare with UMass. In general for both hospitals, it is hard to say whether these prices are expensive for the equipment, as I do not have a general cost with which to compare them with. However, the prices do seem reasonable as they include the scanners, monitors, and other essential components required.

Overall, it is difficult to compare Aga Khan and UMass technically and come to a distinct conclusion about its standings in technology. Both hospitals carry and use each technology to its full purpose to serve the general public. UMass is a bit ahead in the technical aspect since it has more elaborate units, while Aga Khan has all the essential equipment.

Pros and Cons of Each Technology:

Next, I attempted to compare both the physicians' and technicians' answers from the questionnaires on what they believe were the benefits and potential harms of the technology that they were familiar with. This enabled me to see what these technologies do and whether the physicians and technicians believe that they are really worthwhile in their use. Also, it showed whether the two hospitals agreed with one another on the advantages and disadvantages of a technology. For each technology, I will also discuss how often the technology is used, what other factors are necessary for its use, and whether the physicians are up-to-date on the latest developments in their departments. Again, the technologies are divided into diagnostic and treatment related categories.

Diagnostic:

Fluoroscopy

- **Benefits and Harms**

	UMass	Aga Khan
Benefits	allow real-time x-ray diagnostic imaging of patients	detect infilamentaryy conditions; detect level of obstruction in dysphagia
Harms	ionizing radiation	number of radiation dangers

This technology allows physicians to detect and observe objects inside the body by imaging. As a result, there is more rapid and accurate diagnosis and treatment. The risks associated with this procedure are relatively the harms of exposure to radiation.

- **Use of technology and decision maker**

Fluoroscopy is used daily for both diagnostic and interventional procedures, with an average of 10-12 cases per day at Aga Khan. At both hospitals, the clinical physicians in care of the patient order the procedure.

- **Other factors**

The technician at Aga Khan stated that processing machines and equipment and the cooperation of the patient are essential factors in the use of this technology. The physician at UMass believed there are no other necessary factors.

- **Physician's Awareness**

Both surveys given at each hospital suggested that the physicians are up-to-date with the newest technology in radiology.

- **Time Efficiency**

The physician at UMass believed this technology is very time efficient, whereas the technician at Aga Khan said there is a variability, since it depends upon the specific procedure used.

Magnetic Resonance Imaging

- **Benefits and Harms**

	UMass	Aga Khan
Benefits	no ionizing radiation; best resolution of Central Nervous System diseases	non-invasive procedure
Harms	RF energy hazards - burns to skin	none

This is a non-invasive procedure which allows images of the body without any exposure to radiation. With this technology, there is better prognosis and better application of medical or surgical treatment. It has, thus, increased the survival rates of trauma, cancer, and other illnesses. Some potential harms can be burns to the skin as mentioned above.

- **Use of technology and decision maker**

This procedure is used very frequently, with over 1100 performed each month at UMass. The radiologist and the referring physician, which is often the clinician, are the deciders of this technology.

- **Other factors**

Cost is an important factor in the availability of this technology.

- **Physician's Awareness**

Here, again, both people believed the physicians are up-to-date with the latest technology available in their department.

- **Time Efficiency**

The physicians at UMass believed this procedure is fairly time efficient and the technician at Aga Khan believes that it varies from patient to patient and procedure to procedure.

CAT Scan

- **Benefits and Harms**

	UMass	Aga Khan
Benefits	cross sectional imaging and tissue characterization	early treatment and correct diagnosis
Harms	radiation exposure	radiation

The benefits are again imaging of the body which allows for earlier and more accurate treatment. However, the main risk that exists here if of great radiation exposure.

- **Use of technology and decision maker**

This technology is used in most of the cases, particularly any abdomen, head, bone, and chest pathology. It usually runs 24 hours per day every day and is decided upon by the referring physician.

- **Other factors**

Both hospitals agreed that cost is a very important factor, as this procedure can be extremely expensive.

- **Physician's Awareness**

Again, the physicians were up-to-date with the latest procedures and technologies in this department.

- **Time Efficiency**

Both the physician and technician agreed that this procedure is very time efficient.

Ultrasound

- **Benefits and Harms**

	UMass	Aga Khan
Physician Benefits	cross sectional imaging without radiation	easily accessible and no ionizing radiation
Physician Harms	none	not known as of yet
Technician Benefits	non-invasive imaging, no contrast use, no sedation, no radiation, dynamic real-time imaging	cheap, easy, non-invasive, no radiation easily available
Technician Harms	no documented biophysical hazards	operator dependent

Both hospitals agreed that there were many benefits to this technology; the main one being that it is non-invasive imaging, without radiation. It is cheap and easily accessible. As a result, there is early diagnosis and early recognition of complications. This is the only technology so far that has no known or potential harm. It may just cause stress to pregnant patients. Also, some compartments are poorly visualized, giving some difficulty in diagnosis and treatment.

- **Use of technology and decision maker**

This technology is used 24 hours a day in the majority of cases and is decided upon by the patient's clinician and a radiologist consult.

- **Other factors**

The many factors that affect the availability and use of this technology are cost, choice of physicians, availability of trained radiologists and technologists, and health managed care.

- **Physician's Awareness**

Both the physicians and the technicians agreed that they are up-to-date with the newest technologies and their use.

- **Time Efficiency**

Both hospitals agreed that this technology is very efficient if used properly.

Pulse Oximetry

- **Benefits and Harms**

	UMass	Aga Khan
Benefits	to be aware quickly of a person desaturating; to monitor O_2 saturation	knowledge of saturation important during surgery
Harms	relying on O_2 saturation of monitor only without using other assessments	very safe unless failure or malfunction of equipment

The main benefit of this technology is to monitor and observe the percentage of oxygen saturation in a patient. It provides valuable and efficient information of the cardio/pulmonary systems. The only potential harm of this technology is too much reliance on digital monitor readings. The physicians have pointed out that they must not ignore the patient and must look at their patient's blood gas, color, temperature, etc., along with the monitor readings to keep the patient's oxygen saturation at a reasonable level.

- **Use of technology and decision maker**

This technology is given in all cases. Every patient is monitored with a pulse oximeter during and after surgery, which is an ASA standard. It is given most often by anesthesiologists and by practitioners in charge of the patient.

- **Other factors**

Availability of this technology and patient cooperation are important factors. The patient's condition is also essential, since different types of patients need various types of monitoring. Cost, once again, is another factor.

- **Physician's Awareness**

All the technicians and physicians at each hospital agreed that all the physicians are up-to-date with the latest technology in their department.

- **Time Efficiency**

Both hospitals agreed that this technology is very time efficient.

Swan Ganz Catheter

- **Benefits and Harms**

	UMass	Aga Khan
Benefits	vital assessment and valuable information of cardio-pulmonary function; hemodynamic monitoring of the heart	hemodynamic monitoring which helps to make management
Harms	danger of perforating a vessel, coiling/knotting of catheter, infection, carotid and artery complications, pulmonary artery rupture, arrhythmia	pulmonary artery rupture, arrhythmia, damage to heart vessel

This catheter gives helpful information of the heart and lungs, thus allows for better care. The potential dangers are injuries that can occur with the tube inside the body, resulting in serious consequences.

- **Use of technology and decision maker**

The swan ganz catheter is used in all cardiac cases, such as open heart and major vascular cases, except in left ventricle function, approximately four or five times at Aga Khan. It is also used in liver transplants and cardio/pulmonary diseases. It is ordered by

a cardiologist and an anesthesiologist. Also, sometimes it can be given by a surgeon at the beginning of surgery.

- **Other factors**

Patient consent, doctor's orders, cost, and patient safety are the main factors which play into the good use of this technology.

- **Physician's Awareness**

Both the physician and technician at Aga Khan believed that the physicians are up-to-date with the latest technology in this department. The same goes for UMass, especially if the technology is relevant to their practice.

- **Time Efficiency**

All physicians and technicians believed this technology is quite time efficient.

Treatment-Related:

Laparoscopy

- **Benefits and Harms**

	UMass	Aga Khan
Physicians' View of Benefits	decreased post-operative pain decreased length of hospitalization	short hospital stay decreased morbidity and reduced pain
Physicians' View of Harms	injury to surrounding structure; slight increase in complications initially	little margin for intraoperative error with serious consequences if it should occur
Technicians' View of Benefits	N/A	early discharge, decreased expense, decreased stay
Technicians' View of Harms	N/A	have not seen any

Both hospitals agreed that there is definitely a decreased hospital stay and reduced pain for the patient. The patient can now return to family and work at an earlier date.

There are no immediate potential risks of harm. However, there may be possible increased long-term complication.

- **Use of technology and decision maker**

This technology is used frequently and is decided by the attending consulting surgeon and the patient's physician.

- **Other factors**

As to the other factors that play into the availability and use of this technology, the physician at UMass said both training and money are necessary. The physician at Aga Khan also agreed that the training of support staff, assistants, and new users is essential. The cost of the equipment is also an important factor.

- **Physician's Awareness**

Both the technician and physician at Aga Khan stated that though the physicians were aware of the new technology, many may not be aware of its use.

- **Time Efficiency**

Both physicians agreed that there is no significant time efficiency in this procedure.

Patient Control Analgesia

- **Benefits and Harms**

	UMass
Benefits	Patients give themselves pain medication so: 1. no wait for nurses to administer medication 2. can take medicine immediately when needed 3. not fearful of being in pain 4. no use of needles
Harms	None for patient. However, error in setting up medication amount and malfunction of machine can result in overdose

There are many benefits to the Patient Control Analgesia. Because patients have the control of giving themselves the medication, thus having less fear of being in pain, they often result in taking less medication. Also, much time is saved for a patient in pain by administering his or her own medication, instead of wasting time waiting for a nurse. There are no immediate potential harms. However, a malfunction in equipment can have serious consequences with an overdose of pain medication.

- **Use of technology and decision maker**

This technology is used routinely and for overnight patients who have just undergone major surgery. It is decided upon both by the anesthesiologist and surgeon when to give the PCA. Most often the nurses are the ones who administer it.

- **Other factors**

Most importantly, the training of the nurses on how to administer this technology is important, so they can then teach the patients how to use it.

- **Physician's Awareness**

Yes, UMass physicians and technicians agreed that they are up-to-date with the latest procedures in this department.

- **Time Efficiency**

They also agreed that the PCA is very time efficient because there is no need for the nurses to repeatedly administer the pain medication. As a result, the patient does not have to be in pain for long periods of time.

Lithotripsy

- **Benefits and Harms**

	UMass	Aga Khan
Benefits	saves people from major surgery	no surgical procedure, painless reduces hospital bed occupancy rate cost-effective treatment
Harms	very safe, occasional bleeding around kidney	none to patient; occupational hazard – can affect the ear drums of the operator; due to excessive trauma, patient can go into acute renal failure

This procedure is very beneficial as it eliminates need for surgery by disintegration of stones by the sound waves. This reduces the cost, pain, and time greatly, as in case of surgery, the patients would have to stay 5-7 days in the hospital and 6-8 weeks out from work. As a result, more people undergo this treatment that would not have previously done so, because they have a feeling of well being and quicker discharge from the hospital. Also, chances of procedure and hospital infections are also reduced. There are no immediate potential harms to the patient. However, there may be a long-term harm to the operator of the machine.

- **Use of technology and decision maker**

This procedure is done routinely and is administered by the consultant surgeons. It is given to young, mobile patients and to those patients not opting for surgery. More specifically, it is given to kidney stone patients.

- **Other factors**

The essential factors for the use of this technology are the patient's consent and general condition, and the degree of co-morbidity. Also, at UMass, another factor is the expense of equipment as it requires shared use by many other hospitals.

- **Physician's Awareness**

Both hospitals again agreed that yes, the physicians and technicians involved in this procedure are up-to-date with the newest developments in this technology.

- **Time Efficiency**

This procedure is very time efficient as it reduces the recovery and operating time that would take place in case of surgery.

II. Personal Aspect

After recording the results from the technical part of the questionnaires handed out, I wanted to examine the more personal and opinionated section of the surveys. To view and analyze these aspects, I broke down the answers into numerous categories from which to compare different perspectives from the various people who filled out the surveys. Within each category, I will discuss both the similarities and differences among the answers and the possible reasons for the results. In the next section, after analyzing all categories, I will compare the general answers with the topics discussed in the literature review, to see where the people in my study stand in relation to technology and health care delivery.

The main categories are:

- Physician comparisons at UMass and Aga Khan
- Patient comparisons at UMass and Aga Khan
- Comparisons of physician and patient opinions at UMass and Aga Khan

Physician comparisons at UMass and Aga Khan

Health service and technology:

I. How important is the patient/doctor relationship?

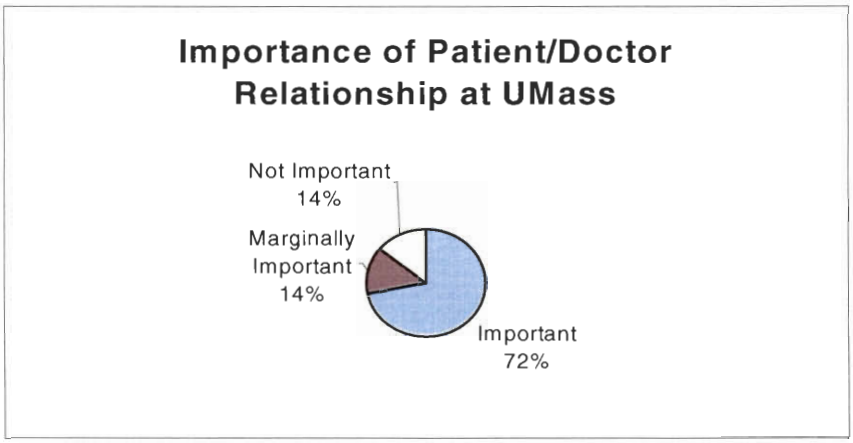

Figure 4

For UMass, Figure 4 above shows that out of the seven physicians, five believed that this relationship is very important. An assistant professor in surgery stated that this relationship is necessary for achieving all goals of diagnosis and treatment. From the other two, one believed it is marginally important, where the other believed it is not important at all. Thus, the majority of the physicians believed this relationship is quite important in the treatment of patients.

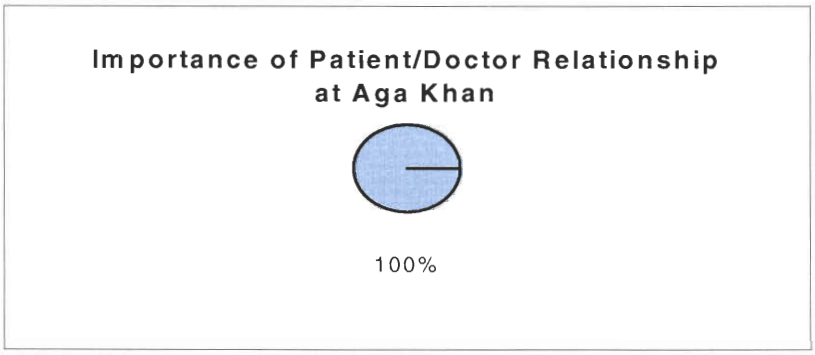

Figure 5

Figure 5 above shows how at Aga Khan, out of the six physicians, all of them thought that this relationship is extremely important. It is vital to the treatment of the patient and always important for an understanding to develop between the clinician and the patient. From both figures, we can see that there is a variation among the hospitals, as there are some at UMass who believed this relationship is not as vital to the treatment as others there and all surveyed at Aga Khan believed it is.

Physicians at both these hospitals who do not believe this relationship is that important may not be in a field that has direct contact or is one-to-one with the patients. However, the general majority at both hospitals believe it is quite essential to the treatment and health service of patients.

III. Are patients comfortable with their doctors?

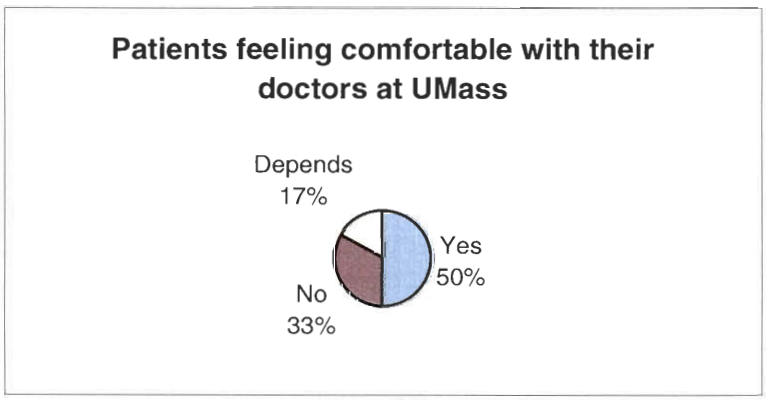

Figure 6

As Figure 6 shows above at UMass, three physicians say no, while the other two say yes. One physician says that some are, depending on the field. For example, radiologists many times do not physically see the patients, thus they have no direct contact and no need to be intimate with the patients.

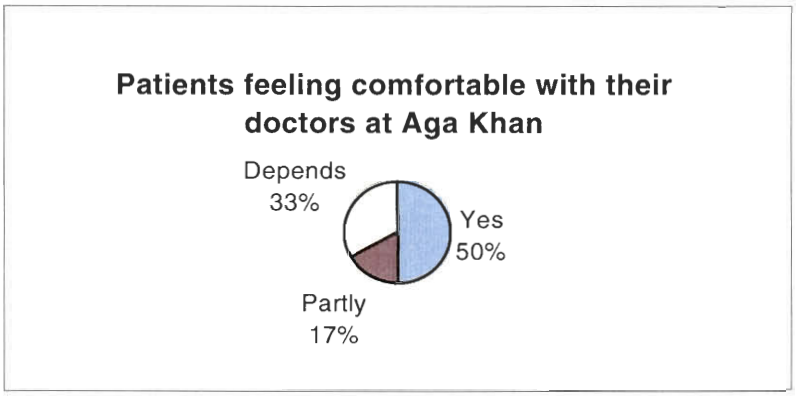

Figure 7

Figure 7 above shows that three physicians at Aga Khan said yes that doctors usually do bring comfort while one said that they sometimes do. Also, like UMass, the physicians who work with fluoroscopy both agreed that it can depend on the field, and here particularly, it is not essential to have closeness with the patient in order to enhance the treatment. This figure is very similar to the one for UMass for 50% of physicians at UMass and Aga Khan said doctors usually bring comfort. However, 33% at UMass said doctors are not close with patients, whereas 17% of Aga Khan physicians said some physicians are partly close. 33% of Aga Khan physicians believed the relationship depends on the field and treatment, and only 17% at UMass said a similar thing. No physicians at Aga Khan believed that patients are not comfortable with their doctors.

III. *What is necessary and important in this relationship?*

At UMass, the physicians believed trust, listening to patients, and giving careful attention to details of each case are essential in building and maintaining this relationship.

At Aga Khan, there were many different factors that are necessary in this relationship which physicians should provide to their patients. These were the

main ones: confidence, honesty, caring, availability, feedback from clinicians, patient satisfaction, motivation, and reassurance, good patient/doctor communication, and moral support. The patient should trust the doctor and also show cooperation during procedures to enable doctors to give the best of treatment possible. There was quite a variation for this question among the physicians within each hospital and between both hospitals, though there was some overlapping. It was hard to pin down what is most necessary for this relationship, though trust was relevant through most answers.

IV. What factors might prevent this relationship?

Physicians at UMass answered that time constraints is the most common factor. Also, poor communication (language barriers) and patient and doctor's personal biases can be additional factors hindering this relationship. Similar answers were seen at Aga Khan where all also agreed that time is the main factor that hinders this relationship. The hospital environment is also an inappropriate environment, where there is no privacy and time to become intimate and close to the patient. There is also great pressure to increase volume handled by a service. All factors at both hospitals are summarized below in Table 4.

Table 4

UMass	Aga Khan
Time constraints	Time
Poor communication	Hospital environment – Lack of Privacy
Personal biases	Pressure

As shown above, each hospital had different responses. However, time was a common factor for both hospitals, shared by many of the respondent physicians.

V. *Is a personal relationship vital in the treatment of patients?*

At UMass, the majority of the questionnaires said yes, that most often it can be vital in diagnosis and treatment of a patient as seen in Figure 8. Next to it, Figure 9 shows that at Aga Khan, four of the physicians answered yes, they believed it is vital to the treatment of patients. On the other hand, two of the physicians believed that it is not so vital. By looking at both figures, the results seem to be quite similar, varying by a small amount. Thus, a relatively equal amount agree this relationship is important and not as important at both hospitals.

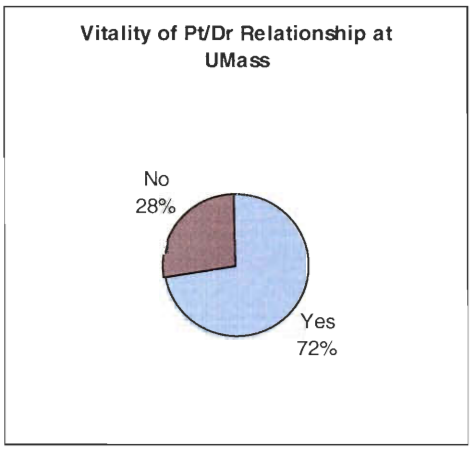

Figure 8

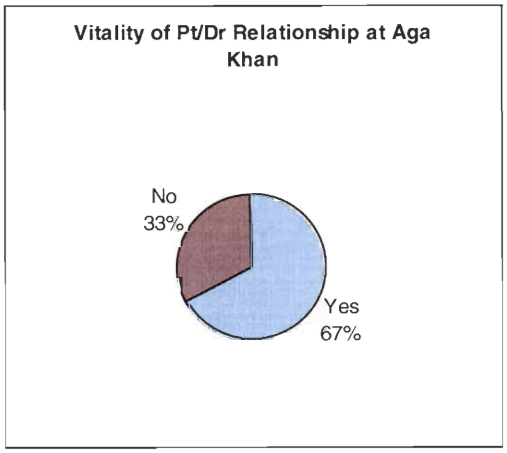

Figure 9

V. *Has medical technology altered the patient/doctor relationship?*

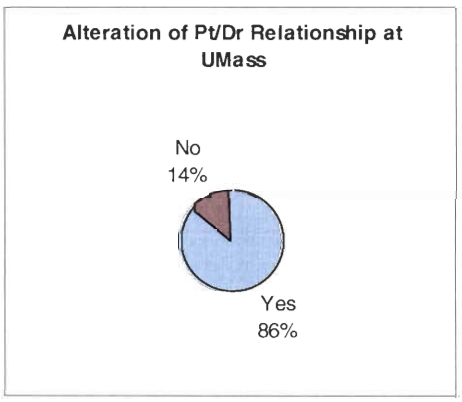

Figure 10

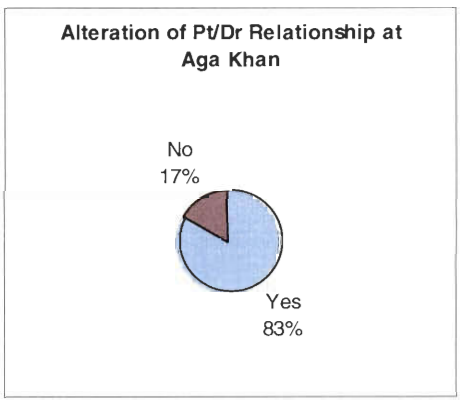

Figure 11

As Figure 10 above shows, all except one physician at UMass stated that yes, medical technology has affected the patient doctor relationship. One physician stated that it has allowed them to treat patients more effectively. However, there were some negative aspects too. One doctor said that sometimes they tried new technologies that were unfamiliar. This evidently carries some risks. These risks can be difficult to explain to the patients. Also, sometimes, technology does not deliver on its promises. Another physician stated that physicians relied more on diagnostic technology than on information from a patient. An Associate Professor of Radiology and Director of Neuroradiology at UMass said how some referring physicians were known to order hi-tech tests without fully listening or closely questioning the patient. All these positive and negative aspects are summarized below in Table 5.

Table 5: Positive and Negative Aspects of Medical Technology at UMass

Positive Aspects	Negative Aspects
More effective treatment	Unfamiliar technology with uncertain benefits
	Technology did not fully deliver on its promises
	Physicians relied on technology for info, not patient
	Ordering tests without listening to patient

Figure 11 at Aga Khan shows very similar results to UMass where again, all except for one physician believe that medical technology in some way has altered patient/doctor relationship. They say that it has alienated the patient in certain ways. Interaction has become less between the doctor and the physician. The physicians are more dependent on the diagnostic facilities than relying on the clinical approach. The patient also may demand more. In order to fix this, we can increase the number of facilities and alter funding to allow a more relaxed pace. We can also change the way individuals are selected for medical college to

allow more able people to enter the medical field. In order to help the patients, they should be given more confidence before conduction various diagnostic tests. Also, an explanation of the needs for these tests can also help the patient better understand what is going on. More immediate, a realistic evaluation of the effort of therapy and procedure must take effect to better the health service delivery. Table 6 below summarizes both the negative aspects and how to better these aspects in a health care system.

Table 6:Negative Aspects and how to change these aspects at Aga Khan

Negative Aspects	How to change these aspects
Alienation of patients - much less interaction	Increase facilities and alter funding
Physicians dependent on diagnostic facilities than clinical approach	Change selection for medical school
Increase in patient demands	Patients given more confidence
	Explanation of technology and tests
	Evaluation of effort of therapy and procedure

For this question, there was a similarity between the hospitals on those who agreed medical technology has altered the patient/doctor relationship and those who believed it has not. There were some variations as to how it has altered the relationship. Both hospitals were again similar in having more negative aspects than positive on how it has affected the relationship, with UMass only having one positive aspect and Aga Khan listing none. There were different responses to the negative aspects, but both hospitals agreed that physicians have become more dependent and rely too heavily on the diagnostic technological facilities, as opposed to the clinical approach of listening to and asking the patient. As a result, there has been alienation among the patient and the physician, thus greatly hindering the patient/doctor relationship. Both hospitals strongly agree that understanding and attentively listening to the patient can rebuild that bond.

Analysis of Health Service and Technology:

By looking at the above figures and responses to the surveys, most of the physicians at both UMass and Aga Khan agreed that an intimate doctor/patient relationship is essential. It is obvious that in such a profession, there is definite human contact and interaction. The majority of physicians at both institutions agreed that to best serve the general public, there has to be a trustful bond between both the physician and patient. Once the patients are aware that the physician honestly care about their well being and morally and physically support them, they are more confident in their recovery process.

But how comfortable are patients with their physicians? Do physicians bring enough ease into this relationship? The physicians at both hospitals were almost equally split with this question. Six out of the ten surveyed physicians believed that doctors do bring ease, while four say they are not. Bringing comfort to a patient obviously varies from physician to physician and it is a relief to hear that there were relatively quite a few who are close to their patient. This enhances trust and confidence between patient and physician, which are obvious factor needed. By looking at the questionnaire answers, it is quite clear that both UMass and Aga Khan believed that along with trust, good communication and attentiveness are also important in the health service provided by the doctor. The patient should feel comfortable and at ease with the physician. The patient are trusting their lives and bodies to these physicians, and the physicians should show that they care as much for their health and well being as the patients do. With proper communication and attentive listening, the patient will feel that this is the case.

With the penetration of medical technology into the hospital environment, the majority of doctors at UMass and Aga Khan believed that it has affected this essential doctor/patient relationship in a major way. Most importantly, it has alienated the patient from the physician, causing a break in their relationship. Patients are demanding more and hoping more from technology and their doctor, and physicians are relying more on and emphasizing the technical approach, rather than the clinical. They are more or less straying from the direct interaction needed for patient treatment. As a result, patients are estranged, and a large essential component of a well-maintained health care system is lost.

By observing all answers, I saw many similarities between the physicians at UMass and Aga Khan in their opinions of health service in relation to medical technology. There was not a great difference between the responses in many of the survey questions from both hospitals. Variations generally arose in questions that could have a wide range of answers. These surveys showed that culture and language differences do not affect how physicians feel about medical technology and the importance of a good doctor/patient relationship. Despite the great distance gap between these two hospitals, the similar responses at UMass and Aga Khan showed that many believed the bond between the physician and patient is essential and necessary in any health care system around the world, though it may not always exist.

Delivery of care and technology:

I. Has medical technology affected the delivery of patient care?

At UMass, all the physicians believed that yes, it has affected health care delivery by optimizing it and making it more accurate. However, it is also more

time consuming and results in more unnecessary examinations. A very similar response is seen also at Aga Khan where again, all surveyed physicians agreed that medical technology has affected patient health care delivery. One specifically believes that it has improved it by its advancement in the medical field. It is obvious by these responses that medical technology, whether positively or negatively, has impacted the delivery of patient care wherever it exists.

II. *Has it affected how quickly the patients are attended to?*

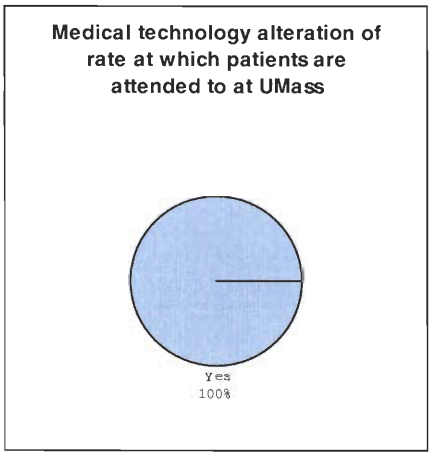

Figure 12

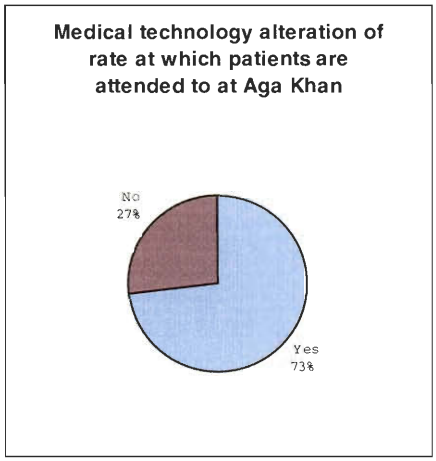

Figure 13

Figure 12 displays how all the physicians at UMass agreed that medical technology definitely hastens the diagnosis process, since the diagnostic information is now more readily available. However, Figure 13 shows how at Aga Khan, there were a difference of opinions. About 73% of the physicians believed that it has affected how quickly patients are attended to, since time duration has decreased due to the speed of technology. On the contrary, about 27% of the physicians at Aga Khan believed that medical technology has no affect on the time factor of treatment of patients.

III. Has it affected the recovery time and period of stay at the hospital?

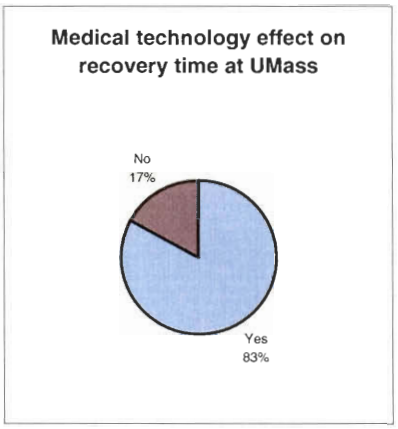

Figure 14

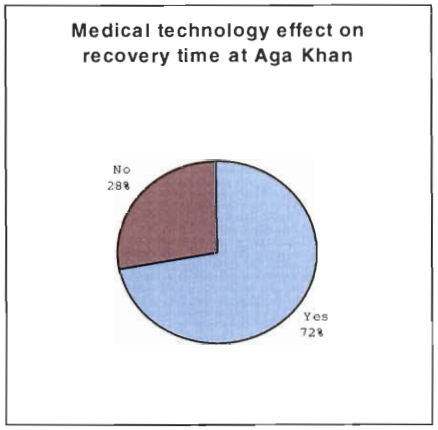

Figure 15

All except one at UMass said that medical technology has affected both the recovery and overnight stay time in the hospital, as seen in Figure 14. It definitely helps by facilitating identification of complications, which can reduce both the above factors. Technology has generally yielded faster diagnosis and treatment and lessens pain, suffering, and recovery time.

Most of the physicians agreed that medical technology has reduced both the recovery time and period of stay at the hospital at Aga Khan, as displayed in Figure 15. However, this can vary upon procedure and illness. Some said that it has not greatly affected the overall time needed to recover for a patient. Again, we see similar results among both hospitals with slight variances.

Analysis of Delivery of Care and Technology:

Both hospitals have practically the same answers for this section. It is quite obvious that in each of these hospitals, the physicians believed whole-heartedly that medical technology has impacted delivery of patient care. Though many have different

opinions on how it has, they all agreed that to some extent it has undoubtedly reduced the patient's recovery time, along with the length of stay in the hospital as seen in Figures 14 and 15. There is some difference in how quickly the patients are attended to as a result of medical technology between the hospitals. However, both institutions have similar responses in believing that technology can alienate the patient personally from the physician, but it also does reduce the amount of pain, suffering, and recovery time of the patient. What is debatable is whether it is worthwhile losing the doctor/patient relationship, a great part of health care delivery, or instead gaining more rapid and accurate methods of patient diagnosis and treatment.

Opinions on First World and Third World Status at UMass and Aga Khan:

I. What is the status of medical technology at each hospital?

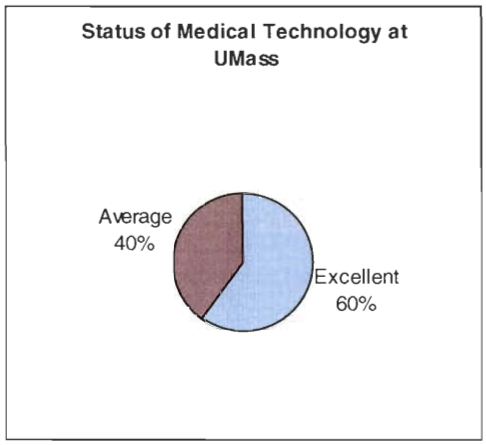

Figure 16

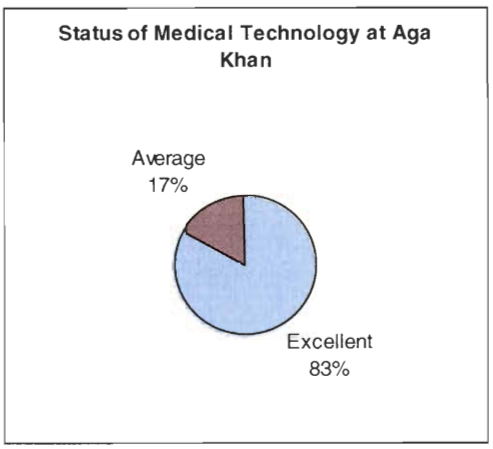

Figure 17

Figure 16 shows the difference in opinions on the status of medical technology at UMass. Three physicians said that it is excellent, at top 25% of the hospitals, and high rated in 90th percentile. One physician said that in some areas, UMass is in the forefront, and in some areas, it is average in technology

availability. More specifically, one physician wrote that UMass has state of the art CAT scan and ultrasound technology, but poor fluoroscopy.

Figure 17 displays how most of the opinions are similar in saying that Aga Khan is advanced and up-to-date in comparison to the other institutions in Pakistan. One physician believed it is the best available in the country at present. In Radiology, the physician believed it is quite good and more advanced when compared to the other radiology departments in Pakistan. Only one thought that the status at Aga Khan is reasonable.

A great variation is seen here between the two institutions. At UMass, there was a relatively close split between those who said the status was excellent and those who said it was just average. However, at Aga Khan, there was quite a wide difference between those who said its status was excellent and those who said it was average. We can conclude by these figures and results that UMass was seen as a typical average institution in the United States, whereas Aga Khan was a relative outlier in the Pakistani data. As compared to the other hospitals in Pakistan, Aga Khan is rated as one of the best by its own physicians. This shows Aga Khan may not represent a typical common hospital found throughout Pakistan, whereas UMass does.

II. *How can we improve the use and availability of technology at each hospital?*

All the answers from the UMass surveys agree that the biggest obstacle is the cost, since most of the limitations of technology at this point are relative to this factor. They could increase accessibility by purchase of more scanners and

the newest fastest scanners. With more money, it would be possible to try new ideas. In the diagnostic field, a third CAT scan would help decrease backlog.

At Aga Khan, there are various ideas on how to improve the use of technology. A urologist suggests that proper marketing and cost minimization to a certain extent might work. A consultant surgeon also agrees that if capital costs could be reduced, it would permit replacement of equipment. Two others suggested installing newer and latest machines and bringing in more qualified personnel, who have specialized training. Listening to patient and a good and efficient application of the technology can be other ways to improve its use. A summary of ways to improve the use and availability of technology is listed below in Table 7.

Table 7: Ways to improve use and availability of technology

UMass	Aga Khan
Receive more money	Proper marketing
Purchase of newer scanners to facilitate accessibility	Cost minimization
Trying new ideas	Installing newer latest machines
	Bringing in more trained personnel
	Efficient application of technology
	Listening to patient

There are again various opinions on methods and ways to improve the use of technology. Observing the table, there are no similarities between the two institutions on how to do this. UMass physicians' responses dealt with cost and the purchase of newer equipment, whereas Aga Khan physicians' responses dealt with marketing, patient's importance in treatment, and trained personnel. Both hospitals varied greatly in their opinions, and no distinct similarity was seen between both.

III. Do you think technology is an essential factor in treatment of patients?

All agreed at UMass that yes, it is absolutely important in the treatment of patients. Similarly, all the physicians at Aga Khan also agreed that technology is an essential factor in a patient's treatment. There were no differences in any answers to this question.

IV. What other factors are essential in health care delivery?

The most important factors listed by physicians at UMass were trust on the part of the patients on their physicians, and compassion and intelligence on the part of the physicians. On another aspect, commitment to care on the part of the government and a decreased penetration of managed care.

All the physicians at Aga Khan had a variety of opinions on what they believe important factors are. A resident in radiology said that both patient diagnosis and preventive treatment are essential. Another physician said that health education, the doctor/patient relationship, compliance, proper follow-up advice/visits, and proper clinical approaches could all help better the health care system. A consultant surgeon agreed that health education and awareness for *both* patient and physician is essential. There should also be the ease of availability of the technology and equipment and expertise in using the technology and training of the support staff. A cardiac anesthesiologist believed that giving incentives to people, avoiding lethargic attitudes of the administration, and giving sufficient salaries to people are also vital in health care delivery. Table 8 summarizes all factors listed by physicians at both hospitals.

Table 8: Essential factors in health care delivery

UMass	Aga Khan
Trust	Sufficient salaries
Compassion	Preventive treatment/ Follow-ups
Intelligence	Health education and awareness
Government's commitment to care	Patient/doctor relationship
Decreased penetration of managed care	Availability of technology
	Expertise in technology
	Avoiding lethargic attitudes

As listed above in Table 8, there was quite a variety in factors between both institutions. The factors listed by UMass are more on a personal level, as to what qualities are needed among the health care givers and the health care receivers for better care delivery. Aga Khan, on the other hand, lists more technical aspects that could improve health care delivery, such as health care awareness and education, availability and expertise in technology, etc. These factors lie on a much greater scope of health care delivery, whereas UMass, with the exception of two factors, emphasizes specifically factors relating to just the patients and the physicians.

I believe the reason for this difference is because UMass and other such hospitals in the United States are already fortunate enough to have most of the factors listed by Aga Khan, such as the availability of technology when required and proper follow-ups when needed. Thus, what is essential to health care delivery to them now are better personal qualities to help administer the technological aspect they already have. Aga Khan, on the other hand, because latest technology in Pakistan is not that common, first believes having the bare essentials in a good health care system are more important and necessary in health care delivery than the actual manners in which they are presented. To them, just having the technology is a luxury that means immediate better health care, whereas to UMass, other personal factors are necessary along with the technology.

Analysis of Hospital Statuses:

Each hospital is relatively happy with the status of technology in their hospital. UMass is equipped with the latest technology and is in the high percentile of hospitals nationwide. However, there were some physicians who believed UMass was just average among some of the fields. Aga Khan, on the other hand, is considered one of the best hospitals in Pakistan, equipped with the newest technology. Each physician believed that their hospital is doing reasonably well in their technology standings. Many also agreed that with more money, they could improve the availability of technology at their hospital with more improved equipment. Good training is also essential, because there is no benefit to technology if it is not properly used. Not only does the machinery have to be efficient and updated, but also the staff must be trained and taught well in order to get the best out of each technology.

Overall, as expected, there were not many great differences between the physician questionnaire responses among UMass and Aga Khan. They basically had relatively similar responses, with few variations on their opinions of medical technology and its effect on the health care system. Despite the different worlds the physicians live and practice in, they are still physicians. No matter where in the world, physicians have the same goals of maximizing the best of service they can provide to their patients. In addition, both hospitals had similar technological backgrounds also, thus they both knew the impact of technology and how it has affected health care delivery. As a result, many undergo the same experiences and have similar opinions as to the importance of the essential factors in a health care system.

Patient Comparisons at UMass and Aga Khan

Health service and technology:

I. *How important is patient/doctor relationship?*

Without a doubt, all patients at both hospitals believed that this relationship is very important in a beneficial health care system for the assistance and treatment of all patients.

II. *Are patients comfortable with their doctors?*

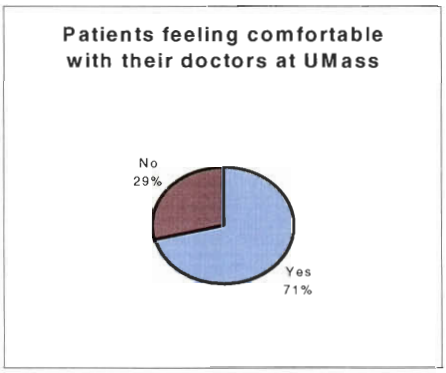

Figure 18

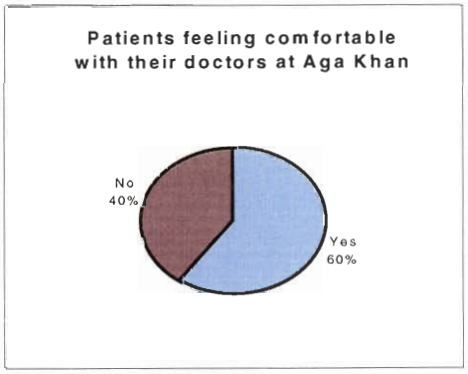

Figure 19

There were mixed opinions at each hospital. About 71% at UMass and 60% at Aga Khan believed that doctors usually are somewhat close with their patients and concerned about their well being. However, 29% and 40% at both UMass and Aga Khan said that physicians were not always as close as they should be. There was some variation here with a greater amount of people saying physicians do bring comfort to their patients at UMass than at Aga Khan, but not by a large percent.

III. *What is necessary and most important in this relationship?*

The majority of the patients at each hospital said that the most essential factor in this relationship is the feeling of trust. There also has to be clear

communication so both the patient and physician understand and feel comfortable with each other.

IV. What factors prevent this close relationship?

One patient at UMass felt that the disability to speak to and get the information to the physician may hinder the relationship. Others said that patients should feel at ease so he or she is fully able to explain their illness. Time was also mentioned as a factor preventing this relationship. Similar answers were seen at Aga Khan where time was also a main factor listed. Many believed that there are too many patients and too little time for each doctor to give more individual attention. Another said that communication can also hinder this relationship as often times, patients are not able to clearly state the problem nor do the physicians fully understand their illness. The similar responses of both time constraints and miscommunication which prevent this relationship are listed in Table 9 below.

Table 9

UMass	Aga Khan
Disability to speak to physician	Time
Time	Miscommunication

V. Is a personal relationship vital in the treatment of a patient?

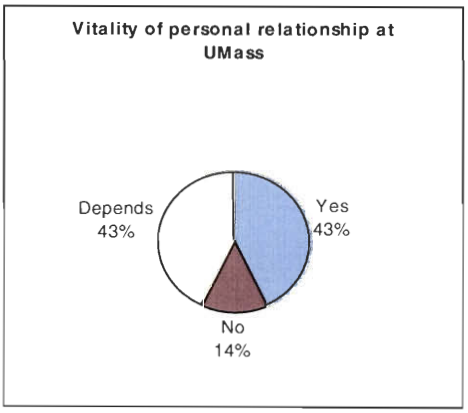

Figure 20

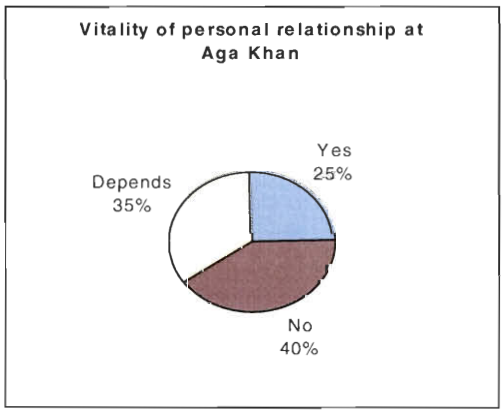

Figure 21

A patient at UMass said that she would not necessarily call it a personal relationship, but there is definitely a need for a good trusting relationship between both essential members of a health care system. Some said yes it is vital for it helps in bettering their treatment. Others said it could depend on the treatment and type of illness, as seen in Figure 20. Ideally to enhance health care delivery, there should be a trustful relationship, but it is not necessarily vital in patient treatment. At Aga Khan, shown in Figure 21, a higher percentage of patients than those at UMass said the relationship is not as vital. A smaller percentage of Aga Khan patients said it is vital, and a relative similar amount of patients at both Aga Khan and UMass said it could depend upon the treatment. This might be that in a country with not many health care options, a close relationship is a privilege, not a necessity. Here, in the United States, however, people have choices of switching health care plans if not satisfied with the patient/doctor relationship: an option not available in Pakistan, thus not found as that important there.

VI. *Has medical technology altered the patient/doctor relationship?*

There were mixed reactions about the effect of medical technology on this relationship. A few believed that it has not greatly affected the relationship. However, about an equal amount at UMass and Aga Khan believed that it slightly may have, due to the emphasis on quick and immediate treatment, instead of a close clinical one-to-one approach. A possible way to change it would be to put the patient and his/her thoughts before the technical aspect of health care delivery. The patient would feel less alienated and more important and trustful if the physician listens carefully.

Analysis of health service and technology:

Patients at both hospitals had many similar responses in the questions asked. They have undergone similar experiences in relation to exposure to technology, and thus, their answers related in many ways. All felt that a close personal relationship is important as it develops trust between the main members of a health care system. Again, this relationship does not always exist and both institutions agree it is because of two main factors: time constraints and poor communication. With the impact of medical technology in each department, it is necessary to pay special attention to revive and regain the doctor/patient relationship. Only in this way, it is possible to gain the full benefits of the latest technology and give the best health service they can, though some patients believe it is not as vital. At this point, a difference was seen among both hospitals where a greater amount of patients at Aga Khan believed the relationship is not that essential to their treatment. Again, this may be due to the fact that the patients there are grateful enough for the treatment, and the patient/doctor relationship is not one of their top priorities in that treatment.

Delivery of care and technology:

I. *Has medical technology affected the delivery of patient care?*

All patients at both hospitals agreed that yes it has affected patient care delivery.

II. *Has it affected how quickly patients are attended to?*

Many patients at Aga Khan said that it has not really affected how quickly they are attended to as seen in Figure 23. It usually depends on the number of patients waiting for that procedure and number of physicians and equipment available. The exact opposite is seen at UMass where some were not really sure if

it has changed the time factor. However, the majority believed that it has, as displayed in Figure 22, since people are treated faster, and the waiting time has been somewhat reduced due to the speed of the newer technology. Further work is needed to do a statistical analysis of the rate at which technology has affected the waiting time of patients.

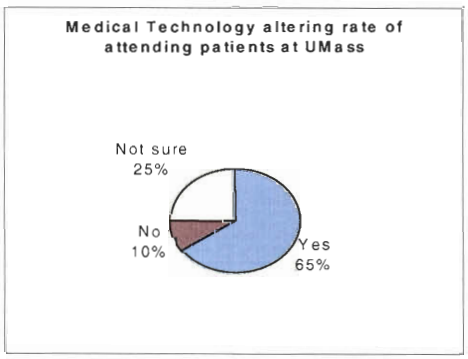

Figure 22

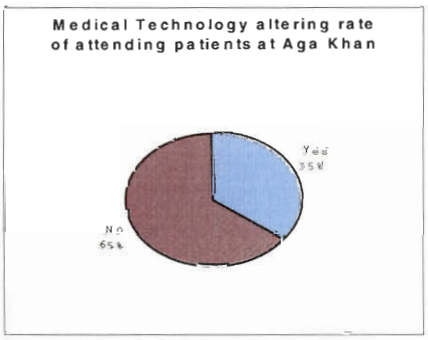

Figure 23

III. Has it affected the recovery time and period of stay at the hospital?

The responses varied from technology to technology. However, at both UMass and Aga Khan, the great majority of patients said yes, that it has definitely reduced the overall recovery time and length of stay at the hospital. The recovery process is much faster, greatly reducing the pain and suffering that would normally occur without the use of technology. Also, many patients do not need to stay overnight for test results or for recovery due to the faster technology now available at each hospital.

Analysis of delivery of care and technology:

Again, patients at both hospitals had similar views and believed that medical technology is a benefit to the health care system. Undoubtedly, they also believed that medical technology has impacted health care delivery. Though it is not clear whether it

has affected how quickly the patients are attended to, it has definitely reduced the overall recovery time at both hospitals. Patients agreed at both UMass and Aga Khan that with newer faster equipment, they get their exams done and results back quicker. Their healing process has also been reduced. With these outcomes, they can return back to their normal lives at a much faster pace. Thus, patients are relatively satisfied with the impact of technology on their recovery time.

UMass patients on First World Status:

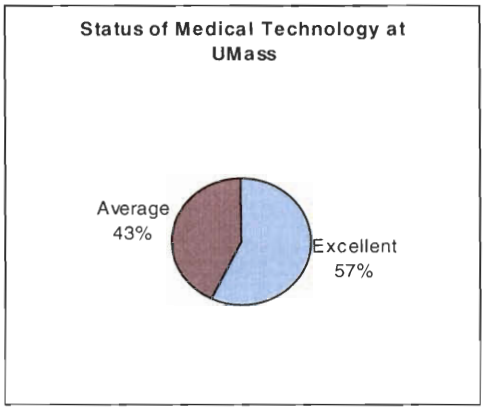

Figure 24

Patients were generally content with the status of medical technology at UMass as displayed in Figure 24 above. One patient said that they can do things that most smaller hospitals are unable to offer to their patients. Others were happy with the treatment and believed UMass is well advanced. A few listed UMass as a good average hospital. All the patients agreed that technology is an essential factor in the treatment of patients, especially with newer and latest developments being introduced into all fields at all times. All people want the best and quickest of treatment, and they believe they will get it with the use of new technology.

Aga Khan patients on Third World Status:

The majority of the patients at Aga Khan were very pleased with the technological status of the hospital as seen in Figure 25 below. Many rated it as excellent, very good, and one of the best in Pakistan. Most were happy with the availability of the technology and the service provided to the patients. Similar to UMass, all believed that technology is an obvious essential factor in the treatment of patients. Other factors that can benefit health care delivery are proper and accurate diagnosis and physician attentiveness and awareness.

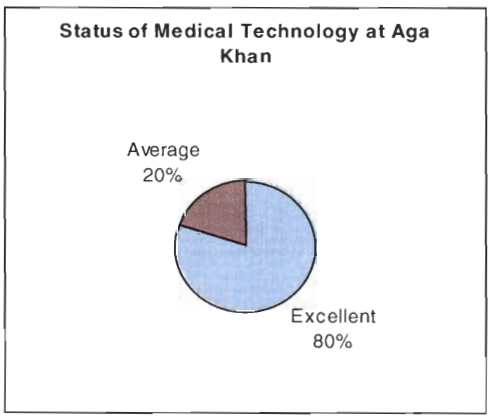

Figure 25

Again, there was a difference among the UMass patients' opinions on the status of medical technology and the Aga Khan patients. A higher percentage at Aga Khan believed their treatment and experience there is excellent. Almost half the percentage of UMass patients at Aga Khan believed that it just average. This leads back to the idea of Aga Khan being a unique rare institution in Pakistan, thus not typical of the average hospital there. As a result, a greater amount of people were happy with their experience there than the patients here in the United States.

Analysis of Hospital statuses:

By observing the responses, it is quite obvious that many, if not all, patients believed their hospital is providing great service. I encountered no patient who was greatly dissatisfied with his or her treatment at any hospital. Both hospitals were noted as up-to-date, advanced, and well equipped with latest technology and trained personnel. All patients believed that these two factors, latest technology and trained personnel, are the most important and necessary aspects of a well-managed health care system. With these factors in place, the hospitals can satisfy all the needs of the general public in need of a good health care system.

From the patient surveys, it is observable that many have similar opinions among UMass and Aga Khan. Because both hospitals offer comparable technological services, the responses of the patients between the two institutions resembled each other greatly in some areas. All patients want to feel comfortable and trustful of their physician, no matter what procedure or treatment they are in for. They want the best treatment possible, and that includes the implementation of modern technology. However, more patients were satisfied at Aga Khan, most likely because they are not used to or exposed to this treatment in many other places. UMass, on the other hand, services patients in many similar ways to the other reputable hospitals throughout the nations. Thus, though the patients have similar opinions as to how medical technology has altered health care, they have a slight difference as to how their hospital serves that technology.

Physician and Patient Comparisons at UMass and Aga Khan

Health service and technology:

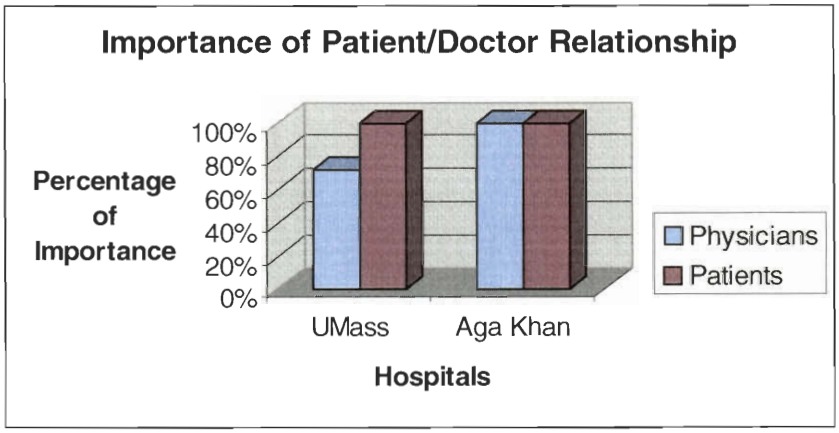

Figure 26

As shown in the figure above, the majority of physicians and patients at both hospitals believed that the patient/doctor relationship is quite important in a health care system. At UMass, there was a slightly greater amount of patients who all believe it is important than compared to the physicians, with about 72% believing it is important. However, at Aga Khan, there was an equal agreement on both the physicians and the patients, with all stating they believe this relationship to be quite important in the treatment of patients. After all, there has to be some kind of a relationship between the care giver and the care receiver, in order for there to be some beneficial results. Otherwise, the person who is given the care will feel alienated, and more as an object than a human being. Physicians also acknowledge that this relationship is essential for them also in order to give the best treatment possible.

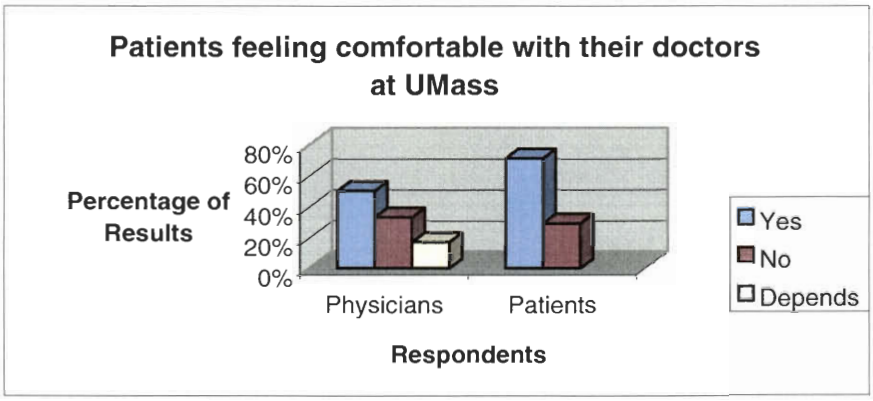

Figure 27

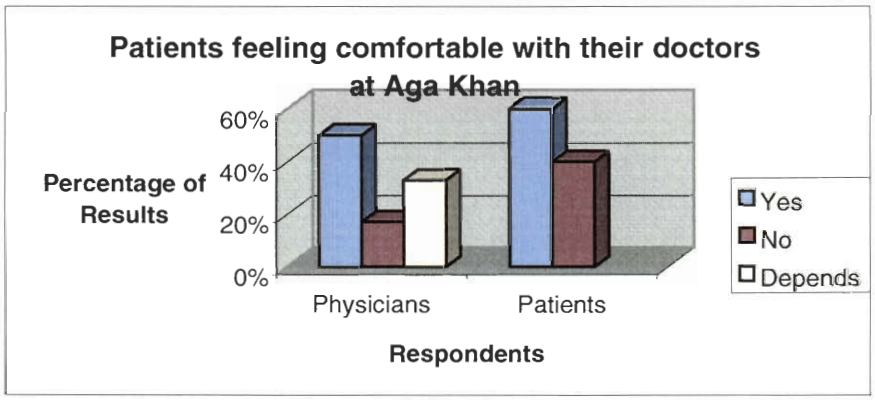

Figure 28

Figure 27 shows the opinions of both patients and physicians on the comfort of patients with their doctors. Again, there were a greater number of patients at UMass who believed the doctors do bring comfort as compared to the physicians. A small percentage of the physicians believed it depends on the field and the treatment. When Figure 27 is compared to Figure 28, we see a drastic change in the physicians' column. Here, we see a greater percentage of physicians at Aga Khan who believe strongly that closeness with patients depends on the procedure than at UMass, where a greater amount say physicians are not close at all. The reason for this difference is outside the scope of my surveys and would require further work to answer and explain. However, in the patients' column, we see a greater similarity, with relatively equal responses to this question.

Table 10: Necessary and important factors in patient/doctor relationship

	UMass	Aga Khan
Physicians	• Trust • Listening to patients • Attentiveness	• Confidence • Honesty • Communication • Moral Support • Trust
Patients	• Trust • Communication	• Trust • Communication

Table 10 above shows the essential components of the patient/doctor relationship listed by the physicians and patients at each hospital. The physicians had various responses at UMass and Aga Khan. However, the patients between the hospitals had the exact answers on what they feel is most necessary. Both of these factors from the patients overlapped with those of the physicians. All the patients mentioned that feeling of trust is most needed, in order for this relationship to thrive. The physicians also agreed that this factor is necessary, along with the physician's ability to listen to the patient's needs carefully. This would allow the patient to feel at ease, and would essentially build the trust, if the patient feels that his/her treatment is top priority to the doctor. Thus, both hospitals are similar, with very minute differences in this area.

Table 11: Factors preventing patient/doctor relationship

	UMass	Aga Khan
Physicians	• Time • Poor communication • Personal biases	• Time • Hospital environment • Lack of Privacy • Pressure
Patients	• Disability to speak • Time	• Communication • Time

The above table displays the variables that may hinder the patient/doctor relationship. Again, another major similarity among patients and physicians between

both hospitals is time being the main factor possibly preventing this relationship. Poor communication is also common among all the respondents. Here, though these factors are personal opinions, both institutions still do not vary much in their responses.

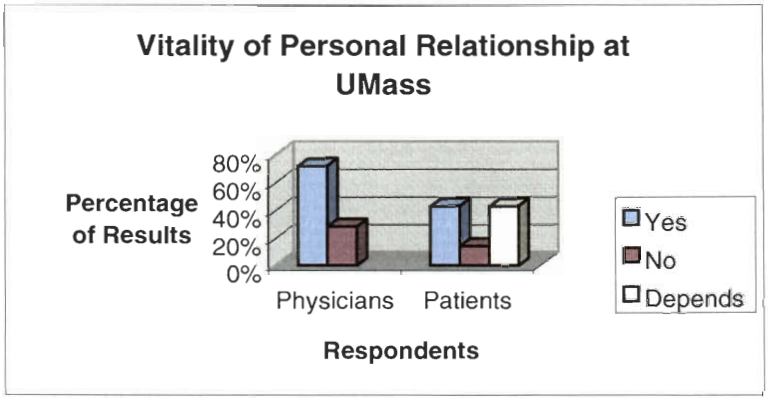

Figure 29

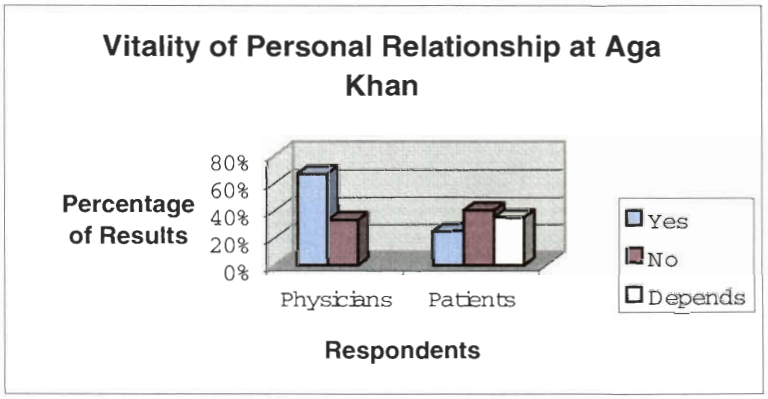

Figure 30

Figure 29 displays the percentages of responses from the physicians and patients at UMass regarding whether or not they believe a personal relationship is vital in the treatment of a patient. There was a same percentage of patients who said it can depend on various factors and those who said yes, it is vital. Not many patients believed it is not essential. By looking at Figure 30, we see the opposite of Figure 29. A relatively small amount of patients at Aga Khan believed this relationship is vital, and here we have almost equal amounts of those who said it is not vital and those who said it can depend,

quite the opposite at UMass. However, both hospitals had similar physician responses, with about 70% saying it is vital and 30% saying it is not. Thus, UMass and Aga Khan had similar physician responses to this survey question, but different patient responses, due to the different patient expectations of physicians at both institutions.

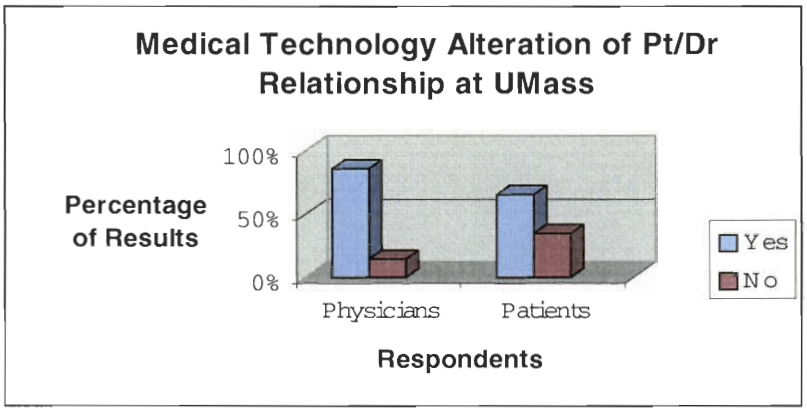

Figure 31

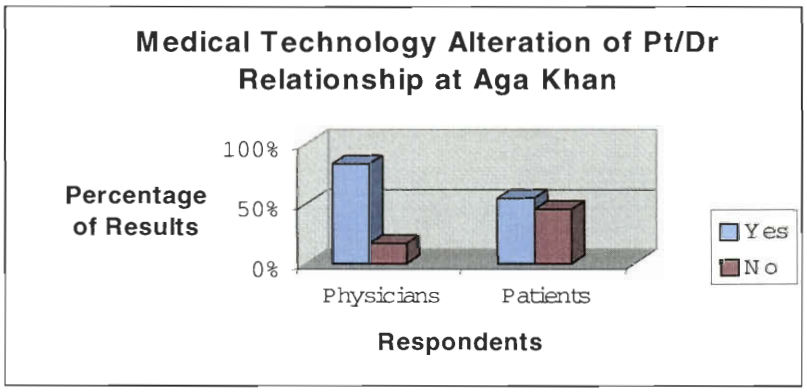

Figure 32

By observing Figures 31 and 32 above, we can see relatively similar responses among the physicians and patients at both hospitals. A greater amount of all surveyed physicians believed that medical technology has altered the patient/doctor relationship than the patients do. Many patients believed it has not altered the relationship. UMass patients had a greater split between their responses than Aga Khan patients. At both hospitals, relatively few physicians believed that it has not affected this relationship. At

Aga Khan, there was a great mix between opinions from the patients, as about 55% said medical technology has changed the relationship, whereas about 45% said no, it has not. The great difference among the patients' and physicians' responses may be due to the fact that since physicians are the implementers of technology, they have more of an idea on the direct and long-term effects of technology than the patients do. As a result, physicians can see the effects of technology on health service than the patients do, and thus are more skeptical.

Delivery of care and technology:

In an exact proportion, all patients and physicians at both UMass and Aga Khan believed that medical technology has affected the delivery of patient care. They all believed it has provided accurate and rapid treatment of the patients.

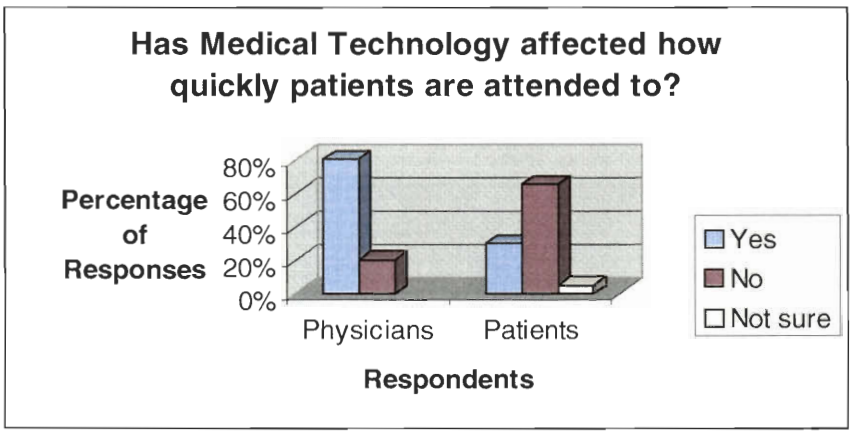

Figure 33

The above figure displays some differences between the patients and physicians in regard to this question. The majority of physicians (about 80%) believed that medical technology has enhanced how quickly the patients are attend to, since it hastens the diagnosis process. As a result, the physicians can attend to more patients than they were capable of before. However, some patients disagreed by a great fold in saying that how

quickly the patients are attended to is not really dependent on the speed of the technology, but more of the availability of the physicians and the equipment. They had not seen a decrease in the patient waiting time as a result of the new technology. There were some patients who were not really sure if medical technology has altered the speed of patient care.

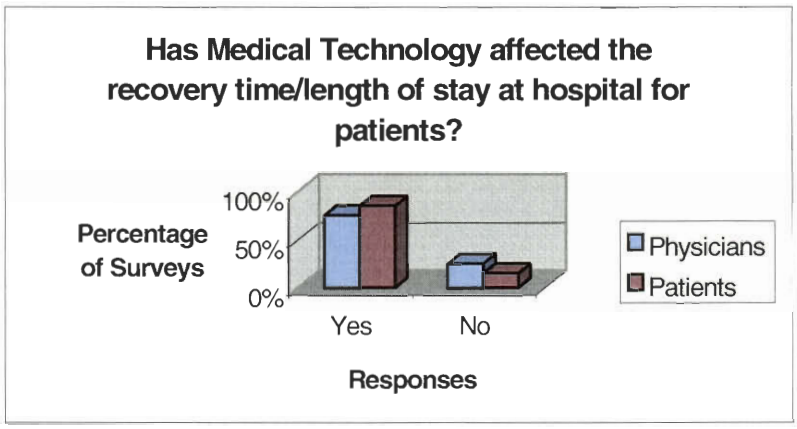

Figure 34

Figure 34 above shows how approximately the same percentages of patients and physicians believed that medical technology has in fact, affected the overall recovery time and period of stay in the hospital for the patients. Many of the latest procedures reduce the suffering and pain that would occur otherwise, thus many patients are allowed to leave earlier from the hospitals. There were some physicians and patients who said that medical technology has not affected the recovery time because it might depend on the procedure and treatment the patients are in for. Each technology varies from the other. Thus, it is hard to say whether the latest technology always reduces the recovery time and length of stay at the hospital. But the majority of both respondents agreed in saying that it has. Further work with statistical data would need to be done in order to accurately see if there is an actual effect of technology on a patient's recovery time.

First World and Third World Status:

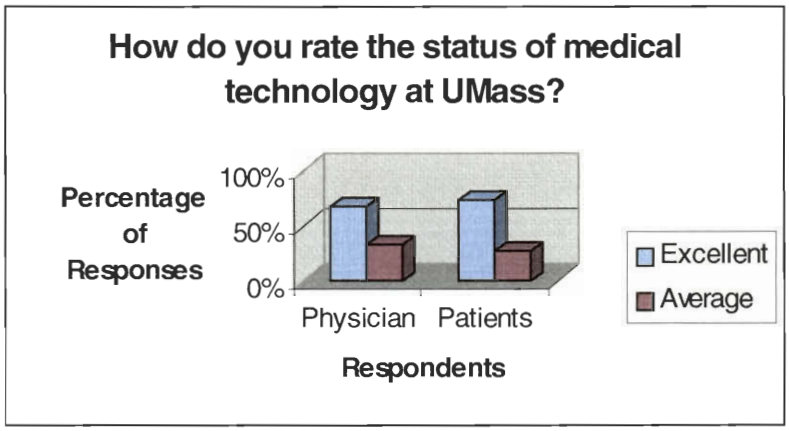

Figure 35

According to Figure 35, it can be seen that relatively the same amount of both patients and physicians believed that the technological status of UMass is quite excellent. There was also a similarity between those who believed that it is reasonable, and more on the average level. Figure 36 below shows similar responses at Aga Khan.

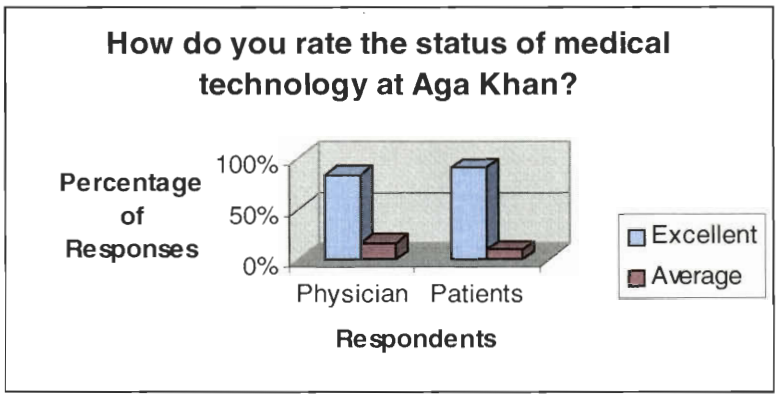

Figure 36

In this figure, we can see that again, there was practically an equal amount of responses which said that the medical technology status at Aga Khan is quite excellent. Very few of both patients and physicians said that it is just average. There is probably a lesser amount of those who say the status is just average due to the fact that Aga Khan is a "rare" institution in Pakistan. Very few other medical institutions in Pakistan provide

the kind of service that is available at Aga Khan; hence, the people who work or go to Aga Khan for treatment find it usually above average. As a result, Aga Khan is not comparable to the other hospitals, whereas since UMass is typical of the institutions that can be found in numerous amounts throughout the US, it is comparable to the other hospitals. Both these figures prove the rareness of Aga Khan type institutions in Pakistan and the common availability of UMass type institutions in the United States.

When asked the question if the respondents believed technology was essential to the treatment of a patient, all physicians and all patients at both UMass and Aga Khan agreed that yes it was. As to the other factors that influence health care delivery, there were a variety of answers among all the respondents. Physicians and patients both agreed that trust is essential for the patient to have, and compassion, attentiveness, and awareness is essential for the physician. Proper health education, diagnosis, treatment, and follow-ups are also factors that can influence health care delivery positively.

Conclusion on Institution Comparison

After observing both UMass and Aga Khan, it is quite clear that both hospitals are providing quality care to satisfy the public's needs. Each, in its own provincial area, tries to give the best of health care, including a well-trained staff and the latest technology. This is not that surprising as "teaching hospitals, with both their complexity and their level of sophistication, are usually the leaders in adopting new technology."[lii] This has been somewhat proven by my limited sample of physician, patient, and technician surveys. The majority of these respondents seemed content with the medical care that is being provided at each hospital.

In regards to the cross comparison between these two institutions, the surveys have shown that both hospitals are relatively on the same level with each other technologically, as discussed earlier. Both UMass and Aga Khan carry out similar technologies and procedures and have similar responses between the survey respondents. However, from just the surveys, it is hard to conclude and compare whether both institutions are similar in the delivery of health care. Though both institutions try their best to implement both medical science and medical art to health care delivery, we do not know for sure how much of this actually takes place. Due to my limitations in my research, I am not able to compare health care delivery at both hospitals. However, in regards to the technological aspect, though there are a few differences among some technical areas of the health care systems at each hospital, both institutions do provide similar services in technology.

This conclusion on similar technology availability at each hospital is something not expected by many. After all, Aga Khan is an institution situated in a third world country, with not many technological advancements. As a result, Pakistan's health care and technological situation is definitely not in par with the Western world. However, despite this setback, my research has shown that Aga Khan is providing efficient service with the use of the latest technology, similar to that of UMass, an established institution in a country whose health care system is one of the best in the world. Thus, their basic equality in technology delivery gives some comfort in knowing that the latest technology and advancements in medicine, though limited, is available in Pakistan. However, this is not to say that though these institutions are comparable, as shown in the previous Figures 11 and 12, the countries' health systems are not, as described in the next section.

Health Care Comparison between Pakistan and United States

As concluded from the previous section, comparing two similar medical institutions in Pakistan and the United States displayed that the latest medical technology does exist in both these countries. However, though both institutions are comparable in medical technology, the countries in which these institutions are situated are not. Since health care is a complex process in studying the patient/doctor relationship and the health care system, any input based on this study about health care would at best be tentative. Thus, in this section, I will discuss the general health care system each country implements and how they are quite different, thus, incomparable. As a result, my IQP will show that though medical technology is available in a third world country, both countries are not equal in delivery of health care to their public.

It is a known fact that United States is one of the richest, most powerful nations in the world. It has the most diverse and technologically advanced economy in the world, with a per capita GDP of $30,200, the largest among major industrial nations.[liii] From this thriving economy, a significant portion of the budget is given to the health care system of the country, with a large part given to Medicare and Medicaid. On the contrary, Pakistan is a relatively new country, with a booming population in a finite amount of land. Thus, Pakistan has a case of where the demand is much greater than the supply. A very small amount of the budget is awarded to the health care aspect of the nation.

Though Pakistan is slightly less than twice the size of California[liv], it has about half the population of the United States. According to *The Cambridge Factfinder*, edited by David Crystal, Pakistan has a population of approximately 141,783,000 people, with the United States almost double that amount with 262,693,000 people.[lv] Pakistan has an

annual growth rate of 2.77%[lvi], whereas the United States has 0.9% rate of annual growth, as seen in Figure 37 below.[lvii] The growth rate is almost two and a half times greater in a country which is almost twice the size of California than in the United States. Again, the Pakistan government is unable to satisfy or help the large number of people living in the country. Thus, as the population is rapidly increasing, the health care system is not able to catch up with the needs of the public.

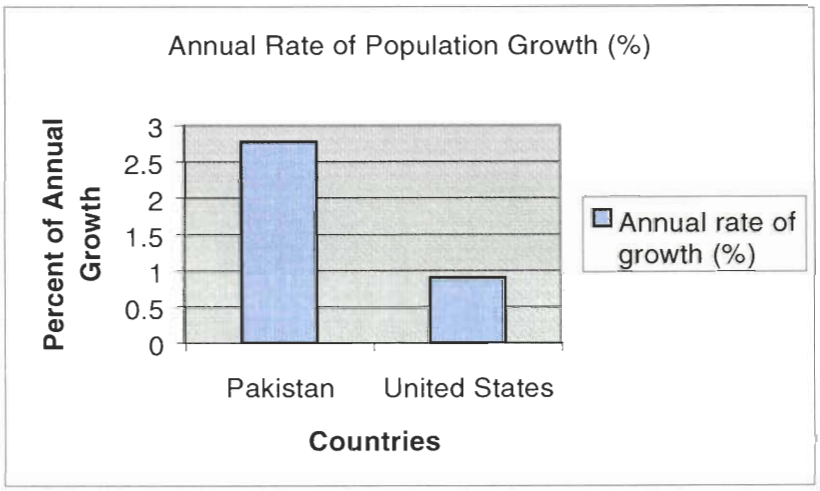

Figure 37

Pakistan has a lot of health issues to deal with. In many of the rural areas, there is a high rate of infectious diseases, malnutrition, and other such health illnesses which infect and often kill a large number of people in that area. There are not enough health institutions or facilities to deliver health care and teach health awareness to the people. The 1999 World Almanac shows that in a 1995 census, Pakistan has 1 physician for every 1863 persons. This is quite unbelievable when compared to the United States, which has 1 physician for every 365 people.[lviii] Another figure displays that Pakistan has 1 hospital bed for every 1517 persons, whereas the United States has 1 hospital bed for every 243 persons.[lix] Figure 2 below indicates the ratios of physician and hospital beds available per person. United States quite clearly displays a much higher ratio by having

5.5 times greater physicians and 6.5 times greater hospital beds available per person than Pakistan. According to the Government of Pakistan official home page, Pakistan has about 830 hospitals, 86,921 beds, 74,229 registered doctors, 2,938 registered dentists, 22,810 registered nurses, and 501 rural health centers.[lx] United States, on the other hand, as thousands of hospitals with many more registered medical personnel. All these statistics quite clearly show that Pakistan is very much lacking in its health care availability.

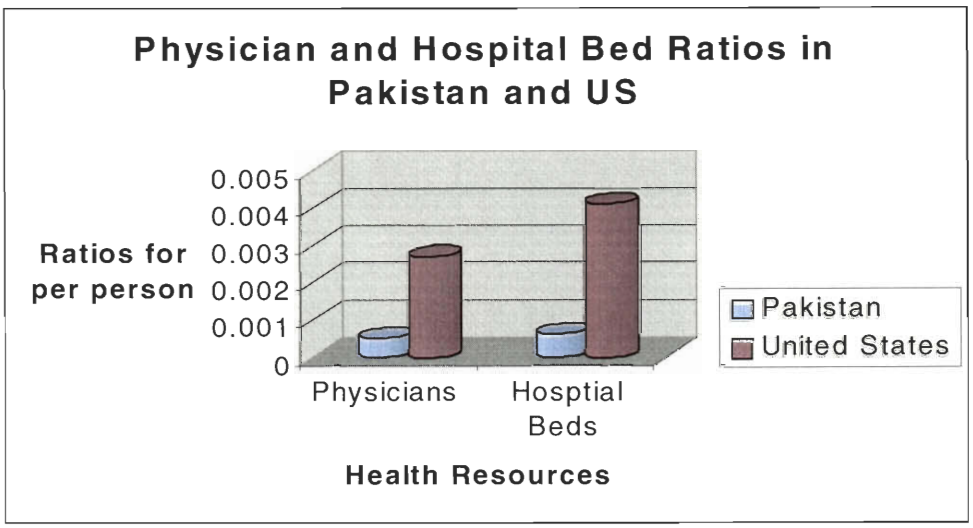

Figure 38

Out of the Pakistan economy, "the total outlay on health is budgeted at Rs.18.34 billion. The total expenditure on health has been increased by around 12.5 percent, and as a percent of GNP it is 0.74 percent."[lxi] The percent of national health expenditure devoted to local health care is 50% taken from the reference years between 1991-93.[lxii] In the United States in 1995, the national health expenditures per person were $3,510.[lxiii] In 1997, these expenditures amounted to $1.1 trillion, an approximate 13.5% of Gross Domestic Product.[lxiv] Figure 39 below displays the percentage of health expenditure

taken from either the GDP or GNP. As seen, a very small amount of money is given to the health expense in Pakistan, practically invisible in the figure.

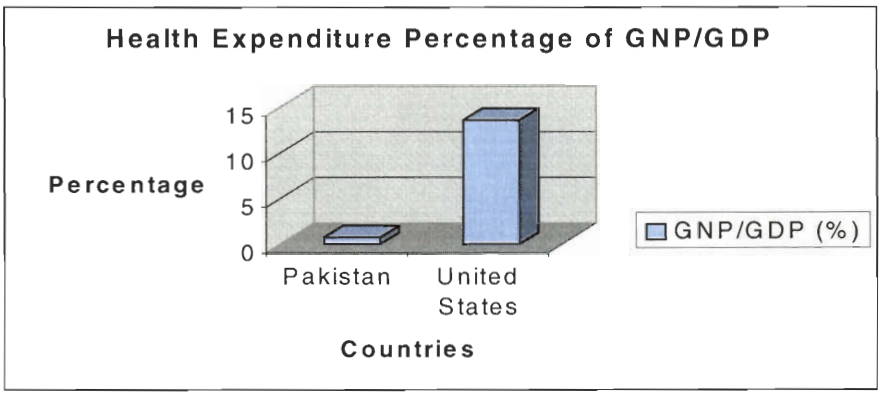

Figure 39

As Figure 40 below displays, a comparison cannot even be made comparing the economy and health expenditures between these countries. Again, the United States, with a GDP of $8.083 trillion, gives about 13.5% of that to health expenditure, whereas Pakistan, with a GDP of $344 billion, gives about 0.74% to health expenditure.[lxv]

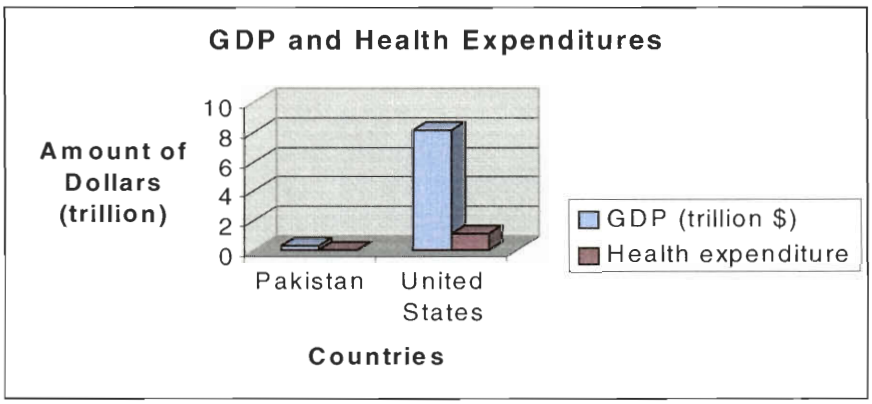

Figure 40

Pakistan is no where close in delivering similar health care to that of the US, since it lacks the money and resources. Thus, a comparison between both countries is unreasonable.

Health Care Technology VS Health Care Delivery

By my research, we have seen that medical technology is comparable at UMass and Aga Khan. Another aspect I wanted to study was how health care technology has impacted health care delivery. As seen by the patient and physician survey responses, the majority believed that medical technology has affected health care delivery without a doubt. However, does more technology necessarily mean better health care?

By looking at the Aga Khan and UMass responses, a greater number of respondents at Aga Khan believed that more technology does mean better health care. This may be that people in Pakistan have not had technology available to them for a great period of time. They also do not have much of a choice in their health care plan and what type of health care they want. They are grateful for the service they do get, let alone choosing what they want. As a result, they are more optimistic on the effects and benefits of the latest medical technology, since people often automatically believe that technology is a always a good and "positive" thing.

A much lesser number of respondents at UMass believed more medical technology results in better health care. Again, this may be due to the fact that people in the United States have encountered medical technology much longer than the Pakistanis have and know of its consequences. They also have the opportunity to pick their health care plans and decide for themselves whether more technology is important or more personal care is.

With an increase in medical technology, greater measures are taken when a patient comes in for treatment. This could be either good or bad: good if the ailment is

not easy to diagnose and further evaluation is needed and bad if a small ailment is thrown out of proportion by extra tests that are not needed. Also, if an illness is not within the scope of the technology's measurements, then a patient is in great trouble. Miscalculations on part of the technology can result in serious consequences. As a result, people have to realize that technology is not perfect and a human mind is needed behind that technology to evaluate and assess the information given. Though more medical technology seems like a great asset, one has to beware of the impact it has on the patient and the overall health care system.

Limitations

In my IQP, there were many limitations that might have affected my research and study on medical technology and delivery of health care. My first limitation was my inaccessibility to other hospitals in both Pakistan and the United States that might have been more representative of the common average hospital seen throughout both nations. This would have enabled me to get more accurate results to see if the latest medical technology was readily available to the public in each country.

My research methods were also limited. With more time and accessibility, I would have been able to interview the physicians, patients, and technicians firsthand to get more direct immediate responses. This way, I might have been able to increase my sampling size by getting more respondents for my analysis and more detailed specific answers than replied on the surveys from the respondents. Also, the technologies I chose might not be the latest available in the medical field. Thus, they might not be an accurate newer representation of what "medical technology" is.

With my limited research, I was not able to compare the health care delivery at both Aga Khan and UMass. My surveys were not sufficient enough to come to any conclusions on health care delivery. Also, since one of the institutions is not representative of the hospitals in that country, their comparison did not really compare the quality and delivery of care in the two countries.

Any of these limitations might have hindered or affected my results and may have led to inaccurate conclusions. However, with limited accessibility and time, I tried to get

the most representative institutions and respondents for my surveys that were in my reach. Thus, my conclusions are just extracted from the results and analysis of my data.

To further study in this area of research, larger sampling sizes have to be obtained. This can be done by studying more hospitals in Pakistan and the United States and expanding the research to all medical departments. Obtaining representative hospitals in both regions would also provide more accurate comparable situations. This would allow us to compare health care delivery and come to better conclusions. Also, taking more than one technology under each department would give a better idea of the availability of the latest technology. Various survey methods would also help in getting more accurate data to analyze at all institutions in each country.

Conclusion

Medical technology is undoubtedly an important and advantageous tool in health care delivery around the world. Many believe it is absolutely essential to the treatment and quality of health care. One objective of this IQP was to see if the latest medical technology that existed in an average hospital in a first world country also existed in a third world country. With my limited sample and research, I found that yes, it did.

The technology at Aga Khan in Karachi, Pakistan was quite similar to that of UMass in Worcester, MA. It was not as lacking in this aspect as expected. However, though I can say that the latest technology does exist in Pakistan, it is not as readily available as it is here in the United States. UMass is the typical common hospital found in many towns and cities throughout the United States. One does not have to travel far anywhere in the United States to find the treatment that is available at UMass. Aga Khan, on the other hand, is a unique and rare institution in Pakistan. It is among the very few hospitals throughout the whole nation which delivers top rate treatment, with the latest technology. People often travel great distances from other less efficient areas to be treated at Aga Khan.

Patient expectations are also quite different in both countries. Patients in the United States expect good health care along with the best personal one-to-one treatment. With the many different options of medical care available here, the patients have a choice in what kind of health care they want. If they are not satisfied with their health care plan, the patients have the option of switching their physician or their plan. However, the quite opposite is in effect in Pakistan. Because of the lack of health care service there, patients

are content with just their treatment. One-to-one attentive care is a privilege or bonus there; it is not something required or expected. As a result, they are satisfied with and grateful for just diagnosis and treatment. Also, because of the lack of variety of health plans, the patients have to just stick with what they have. They have very little, if any, choice in their health care service. Thus, patients in both countries have very different expectations of health care from each other.

As a result, from my research alone, I can compare both institutions technologically in Pakistan and United States and see that they are very much similar in this aspect of a health care system. However, I can go no further in comparing both countries, as their similarities in health care stop there. Both these nations have very different economic situations, thus different health care situations. So, though the latest advanced medical technology is available in the third world land of Pakistan, it is not a common asset to the people of Pakistan as it is here.

Another aspect I wanted to study in my IQP was whether medical technology has altered or enhanced health care delivery at UMass and Aga Khan. There were many mixed opinions as to this topic. However, the majority of the respondents of my survey agreed that medical technology has both altered and enhanced health care delivery. Technology and its wonders can sometimes be too good to be true. It is inevitable that there are bound to be some disadvantages of this infiltrating force in the field of medicine. There is an increase in patient expectations and an increase in higher costs. However, despite some of the setbacks, many find medical technology to be a positive asset to the field of medicine, if used properly and accurately. Even if it has often caused alienation of patients, it has bettered their treatment by reducing pain, suffering, and

recovery time. Though patients want both the human and medical aspects to their treatment, they are somewhat content with the effects of technology in their health care service.

However, as more and more newer and advanced technology enters all medical departments, it is essential to remember that the old methods of diagnosis and treatment should not be forgotten. At this point, patients are relatively happy with the integration of technology and health care. But if alienation and de-humanization continue, so much so that the patients feel ignored and neglected, then the implementation of technology should be rethought.

Since Aga Khan and UMass have the latest technology, each institution should pay special attention to the integration of technology into the health care systems. Only with proper use and understanding can the full benefits of technology be displayed. Technology is a great tool which all medical institutions should take full advantage of. Hopefully, Aga Khan and UMass will continue to implement their technology in such a way that all patients receive the best treatment they deserve.

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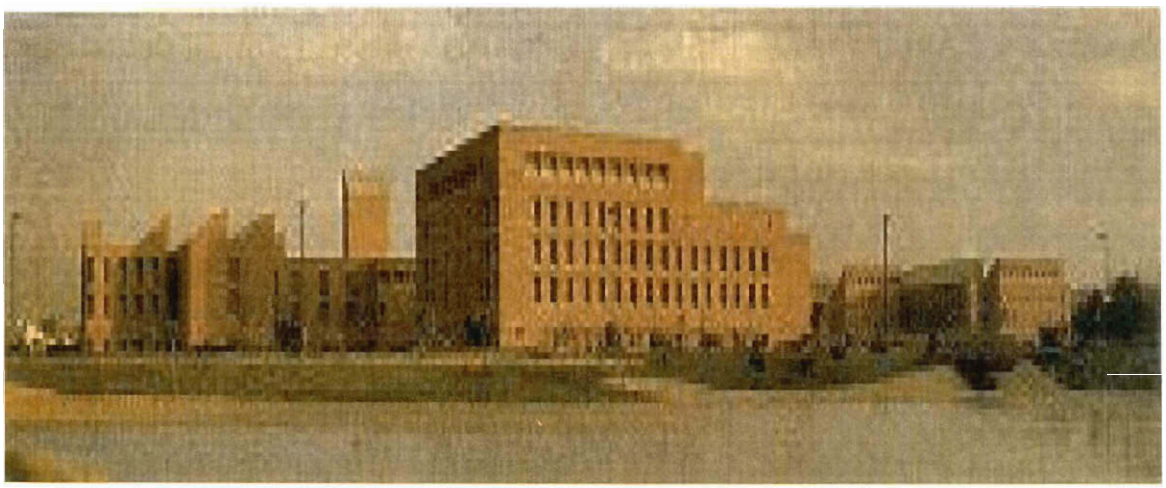
Appendix A:

UMass Memorial Health Care

Worcester, Massachusetts – USA

Aga Khan University Hospital



Karachi, Pakistan

Appendix B :

Physician Questionnaire

Technology info:

1. Does your department have the following technology _____?
   a) What are the main components of this technology?

   b) How many units of technology do you have?

   c) How old are the units?
2. What are the benefits of these technologies?
3. What are the potential harms of these technologies?
4. How often are these technologies used and in what types of cases?
5. Are these technologies given to any specific types of patients?
6. Who decides what technology is given and when it is given?
7. What other factors play into the availability and use of technology?
8. Are the physicians up-to-date with the newest technologies and their use?
9. How much does this technology cost?
10. How is it funded?
11. How time efficient is this technology if it is?

Health Service and Technology:

1. How important is the patient/doctor relationship?
2. Are the doctors generally intimate with their patients?

3. What is necessary and most important in this relationship?

4. What factors might prevent this close relationship? (time, hospital environment, etc)?

5. Do you believe that a personal relationship is vital in the treatment of a patient?

6. Has medical technology in anyway altered the patient/doc. Relationship?

   a) If so, how has it affected this relationship?

   b) If in a negative way, how can we change that?

Delivery of care and Technology:

7. Has medical technology in general affected the delivery of patient care?

8. Has it affected how quickly patients are attended to? How so?

9. Has it affected the recovery time of patients?

   a) Period of stay at hospital?

   b) Overall recovery time?

10. What have been the advantages of this technology in relation to health care?

11. What have been the disadvantages?

12. What have been the benefits resulting from this technology in the patients outcomes?

13. Has there been or do you foresee any possible harm in patient outcomes?

Technology in relation to First World and Third World Status:

1. Based on your personal opinion, what is your say on the status of medical technology at UMass?

2. How do you think we can improve the use and availability of technology at UMass?

3. Do you think technology is an essential factor in the treatment of patients?

4. What other factors do you believe are essential in health care delivery?

Appendix C :

Patient Questionnaire

Health Service and Technology:

1. How important is the patient/doctor relationship?

2. Are the doctors generally intimate with their patients?

3. What is necessary and most important in this relationship?

4. What factors might prevent this close relationship? (time, hospital environment, etc)?

5. Do you believe that a personal relationship is vital in the treatment of a patient?

6. Has medical technology in anyway altered the patient/doc. Relationship?

a) If so, how has it affected this relationship?

b) If in a negative way, how can we change that?

Delivery of care and Technology:

7. Has medical technology in general affected the delivery of patient care?

8. Has it affected how quickly patients are attended to? How so?

9. Has it affected the recovery time of patients?

a) Period of stay at hospital?

b) Overall recovery time?

10. What have been the advantages of this technology in relation to health care?

11. What have been the disadvantages?

12. What have been the benefits resulting from this technology in the patients outcomes?

13. Has there been or do you foresee any possible harm in patient outcomes?

Technology in relation to First World Status:

1. Based on your personal opinion, what is your say on the status of medical technology at UMass?

2. How do you think we can improve the use and availability of technology at UMass?

3. Do you think technology is an essential factor in the treatment of patients?

4. What other factors do you believe are essential in health care delivery?

Appendix D :

Technician Questionnaire

Technology info:

1. Does your department have the following technology _____?

    a) What are the main components of this technology?

    b) How many units of technology do you have?

    c) How old are the units?

2. What are the benefits of these technologies?

3. What are the potential harms of these technologies?

4. How often are these technologies used and in what types of cases?

5. Are these technologies given to any specific types of patients?

6. Who decides what technology is given and when it is given?

7. What other factors play into the availability and use of technology?

8. Are the physicians up-to-date with the newest technologies and their use?

9. How much does this technology cost?

10. How is it funded?

11. How time efficient is this technology if it is?

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