REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
06-15-2007	FINAL REPORT	July 2006 to June 2007

4. TITLE AND SUBTITLE

A Business Case Analysis for Implementing and Optimizing Telemedicine at Fort Irwin

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Weed Army Community Hospital

Fort Irwin, CA 92310

8. PERFORMING ORGANIZATION REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

US Army Medical Department Center and School
BLDG 2841 MCCS-HFB (Army-Baylor Program in Health and Business Administration)
3151 Scott Road, Suite 1411
Fort Sam Houston, TX 78234-6135

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

35-07

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

None

14. ABSTRACT

Teleradiology, telepsychiatry, and teledermatology are three existing telemedicine services at Fort Irwin's Weed Army Community Hospital. This research study provides an analysis on the qualified and quantifiable financial costs and benefits of these services over the past year as well as implementing a telepharmacy program using the cost model and benefits rationale scenario-building tools. The hospital's Governing Body will have the objective scrutiny to support their business decisions regarding telemedicine services as part of the organization's Fiscal Year 2008 Business Plan.

15. SUBJECT TERMS

Teleradiology, telepsychiatry, teledermatology, telepharmacy

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Education Technician
a. REPORT	b. ABSTRACT	c. THIS PAGE			Rene L. Pryor
U	U	U	UU	77	19b. TELEPHONE NUMBER *(include area code)* (210) 221-6443

RUNNING HEAD: Fort Irwin Telemedicine

A Business Case Analysis for Implementing and Optimizing Telemedicine at Fort Irwin

A Graduate Management Project Submitted in Partial Fulfillment of the Army-Baylor University Graduate Program in Health and Business Administration

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June 15, 2007

Executive Summary

Teleradiology, telepsychiatry, and teledermatology are three existing telemedicine services at Fort Irwin's Weed Army Community Hospital. This research study provides an analysis on the qualified and quantifiable financial costs and benefits of theses services over the past year as well as implementing a telepharmacy program using the cost model and benefits rationale scenario-building tools. The hospital's Governing Body will have the objective scrutiny to support their business decisions regarding telemedicine services as part of the organization's Fiscal Year 2008 Business Plan.

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Introduction

This paper will analyze the costs and benefits of the three existing telemedicine programs at Weed Army Community Hospital (WACH). The analysis will provide the basis for a decision by the WACH Governing Body to maintain or discontinue each service as well as suggestions for optimizing the programs based on current literature and demand analysis at WACH. The business impacts of these decisions will be executed beginning Fiscal Year 2008 (FY08).

A.1. General Background of Weed Army Community Hospital

WACH is a 66,000 square foot facility with a nearby 30,000 square foot outpatient clinic located on Fort Irwin, California; 35 miles from the nearest highway in the Mojave Desert. The 20-bed hospital currently serves a population of just over 12,000 Active Duty (AD) and family member and retiree beneficiaries in addition to approximately 4,500 soldiers during monthly rotational training at the National Training Center (MEDDAC Command Briefing, 2006).

The installation and training area are roughly the size of Rhode Island and simulates realistic combat conditions for large maneuver elements safely isolated from civilian interaction (Fort Irwin Annual Report, 1980). The nearest community and hospital is in Barstow, California, a regional transportation

center of converging highways and railways positioned at midway between Los Angeles and Las Vegas.

A 35 mile stretch of road through the desert highland connects Fort Irwin to Barstow creating challenges to delivering emergent care. With only 23,000 people, Barstow's unemployment, poverty, and crime levels are higher than state averages (U.S. Census Bureau, 2006).

The hospital started as a 10-operating bed facility to support Camp Irwin in 1951 but no effort was made to hospitalize patients. Those needing hospitalization were taken to George Air Force Base 83 miles away by ground (Fort Irwin Annual Report, 1951). The Weed Army Community Hospital was built as a 24-bed hospital in 1967, opened a few months, and then was deactivated and mothballed. It reopened on October 16, 1980 with capability to treat actual illness or injuries during the simulated combat exercises in support of the National Training Center (Fort Irwin Annual Report, 1980).

Today, WACH provides mainly primary care and 24-hour emergency trauma and life support. The United States Army Medical Department Activity (MEDDAC) has an authorized staff of 21 care providers including specialists in General Surgery, Orthopedics, Pediatrics, Obstetrics and Gynecology, Internal Medicine, Family Practice, Mental Health, and Flight Surgery.

In addition to the specialists, Physical Therapists, Optometrists, and a Nutritionist provide supplementary ancillary services. The Clinical Laboratory, Radiology Department, and Pharmacy Service furnish necessary ancillary support activities, all of which result in comprehensive primary care for assigned and rotational AD personnel, family members, and retirees (Fort Irwin MEDDAC Homepage, 2006).

The population of those who live and work on Fort Irwin in support of the NTC mission is expected to continue to increase steadily over the next several years (Estimated Real Property Planning Board Brief, 2006). A senior representative from the installation contracted housing office; Clark Pinnacle, stated that there was an average of 1,750 Service Members and 4,500 dependents living in on-post housing in 2006 (G. Johnson, personal communication, December 17, 2006).

The Fort Irwin residential community initiative is expected to result in over 8,000 Soldiers and family members living in 2,376 on-post homes by 2012 (Clark Pinnacle Family Communities LLC, n.d.). Already there has been nearly a 25% increase in on-post WACH beneficiaries since the initiative began in 2004 resulting in more ready demand for primary care at WACH and access to specialty care services.

Access to a complete spectrum of specialty services is a challenge for WACH's beneficiaries whereas the variable and

insufficient demand at Fort Irwin makes offering many services cost prohibitive for the military. Fort Irwin beneficiaries routinely must commute long distances when referred to civilian network providers as part of the Western Region Managed Care Support Contract (MCSC) with TriWest for care not available at WACH. Consistent with the Army Medical Department (AMEDD) Access to Care Campaign Plan (Kiley, 2006), WACH has implemented several referral management systems to reduce access barriers.

WACH is the parent organization for the Yuma Health Clinic (YHC) at the U.S. Army Yuma Proving Grounds (USAYPG) in Arizona. Dating back to 1942, USAYPG is a 1,300 square mile multi-purpose test center for testing military munitions and hardware. The vast spans of ranges combined with sophisticated instrumentation enable assigned personnel complete control and monitoring of on-going testing. The total base population of Marines, Soldiers, Civil Service and Contract Civilians is about 1,900 (Yuma Proving Ground, 2006).

Whereas the YHC is a child unit to WACH, the unit shares the mission, vision and goals of the USA MEDDAC. The YHC's unique mission is to provide medical support for the free-fall school and Golden Knights parachute team winter training on the drop zones. YHC is not staffed to provide more than acute and routine outpatient care for the small beneficiary population of 125 AD personnel and ten prime enrollees (Yuma Health Clinic

FY08 AMEDD Business Plan, 2007) during the 46.5 hours a week the clinic remains open (Yuma Health Clinic webpage, 2006).

The YHC has a Physician Assistant (PA) as the only provider assigned. A PA requires national certification and is usually regulated by state law to have a supervising physician (National Library of Medicine, 2005). In the MHS, PAs at limited service MTFs have credentialing privileges to care for AD without oversight by a licensed provider. It is for this reason that the family members and civilian personnel are enrolled to receive their primary care at the Marine Corps Air Station (MCAS) Yuma Branch Medical Clinic located about 40 minutes away from YHC or on the economy in Yuma.

A.2. Mission and Vision

The mission of the United States Army Medical Activity, Fort Irwin is: As a United States Army Medical Department Activity (MEDDAC) with a fully integrated healthcare system, provide comprehensive healthcare to all our beneficiaries in peace and war (Ft. Irwin MEDDAC homepage, 2006). The mission statement implies that 'comprehensive healthcare' to 'all beneficiaries' also refers to access to specialty care. WACH has a comprehensive primary care capability but lacks extensive diagnostic capabilities as well as the full spectrum of specialty care providers.

In addition to the mission statement, the goal of the organization is that "The United States Army Medical Department Activity stands ready 24 hours a day to support the National Training Center mission and military families who live here. Comprehensive health and preventive medicine services are provided to the AD personnel, both assigned and rotational, their family members, and retirees" (Commander's In-Brief, 2006). The unit's succinct vision statement; Driven to Excellence…One Team! (Fort Irwin MEDDAC homepage, 2006), goals and mission show the level of importance the organization places on providing a complete line of services with superior access.

A.3. Subject of the Case

This study uses the format outlined in The Business Case Guide, 2nd Edition (Schmidt, M.J., 2002) to examine the probable costs and benefits for WACH and its beneficiaries resulting from the implementation of telemedicine services over the past year using the cost model and benefits rationale scenario-building tools. This research study provides a scenario framework using qualifiable and quantifiable measures to determine the business impacts of each of the existing telemedicine programs at WACH; teleradiology, telepsychiatry, and teledermatology as well as a proposed program implementation of telepharmacy.

These telemedicine services are at varying stages of their lifecycle and the interim changes in technology, equipment,

training, personnel, and policies all have had some affect on the costs and benefits of these programs. The decisions to start these programs were most likely based on strategic objectives, business plans, financial viability, sustainability, and return on investment but the lack of any documented quantifiable analysis suggests the decision to implement may have been more "common sense" than supported by data.

A Business Case Analysis (BCA) is generally organized around a single action (Schmidt, M.J., 2002) such as a make/buy decision. This paper is an overview of telemedicine at Fort Irwin using four separate BCAs for each of the services. The first three are organized around the primary action to continue an existing service with the alternative to discontinue the service. The fourth BCA centers on the action to implement a non-existing service and the removal from consideration.

Although the primary action for the existing services is a business as usual scenario implying no additional change or action is required, the intent of BCA is also to mitigate risks or threats and control variables to optimize current business practices. The benefits and costs from a decision to implement a telepharmacy program are projected for five years after an assumed implementation date of 1 October 2007.

Due to the cost volatility associated with automation technology, each case limits the period of analysis to five

years. The analysis is retrospective to each program's beginning and projected 60 months from that date.

A.4. Purpose of the Case

This study assesses the existing services of teleradiology, teledermatology, and telepsychiatry and a proposed telepharmacy service using the BCA. Each BCA is important to the beneficiary population who ultimately endure the consequences from modifying business practices and allocating limited funds to optimize care. The purpose of the study and each BCA is to provide the WACH Governing Body objective awareness to support their business decisions regarding telemedicine services as part of the organization's Fiscal Year 2008 Business Plan.

Other than the teledermatology program, analyses regarding the original costs and benefits used to make the decision to start each program were not available. Since beginning the programs, there have been no analyses at WACH to confirm projections or determine the possible continued added value of these programs.

This study will provide the WACH Governing Body (GB) with the necessary retrospective and projected financial information, metrics, and business impacts connected to the organization's mission and goals. A scenario and sensitivity analysis will outline the costs and benefits comparison for each BCA, reveal potential risks, and identify controls and critical success

factors. Prepared with facts and the ability to scrutinize qualified costs and benefits, the GB will be better able to defend decisions to implement, maintain or discontinue programs during the FY08 Strategic Planning Conference review in the summer of 2007.

Background

According to the American Telemedicine Association (ATA) website; "Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status" (ATA website, 2005). The ATA also estimated that the total amount of Federal spending on telemedicine in 2003 through grants and contracts was about $270 million and the Veterans Health Administration alone would deliver about 350,000 patient services remotely for the same year (ATA website, 2005).

Telehealth is a broader concept of remote healthcare that does not necessarily involve clinical care. "Videoconferencing, transmission of still images, e-health including patient portals, remote monitoring of vital signs, continuing medical education and nursing call centers are all considered part of telemedicine and telehealth" (ATA website, 2005). Several telehealth programs like improving continuing medical education and electronic medical records are potential benefits to telemedicine capability, but are not considered in this study.

The 1996 Institute of Medicine definition for telemedicine; "the use of electronic information and communications technologies to provide and support health care when distance separates the participants," (IOM, 1996) is widely accepted as the standard. It is the one quoted by the Department of Defense (DoD) authority on telemedicine; the Telemedicine and Advanced Technology Research Center (TATRC) as their accepted definition. The AMEDD defines telemedicine as "The use of information and communication technologies to access healthcare regardless of time and distance" (Poropatich, 2003).

Telemedicine has been around for decades. After the advent of the telephone, doctors used the new technology as a consult tool. In 1956, a Canadian neurosurgeon transmitted live feed via closed circuit television (Landgreen, 2002). By its most basic definition, the first telemedicine consult actually occurred with the telegraph when medical advice was relayed from Holland to Western Australia in 1917 (Mizushima et al, 2000).

Unchanged is the increased worldwide demand for improved cost, quality, and access. The technology arose from the infrequent but essential need for specialty care particularly in remote areas where specialists are cost prohibitive and underutilized. Some of the obstacles facing widespread use of telemedicine include equipment/system failure, self-referral prohibitions at both Federal and state levels, privacy and

confidentiality issues, equal access concerns (Landgreen, 2002) patient acceptance of the service, third party reimbursement authorization, uncertainty of comparable outcomes, and medical liability (Lobe, 2004).

Despite these complications, the advent of the Internet has increased the potentials of telemedicine exponentially as teleconferencing has become more sophisticated, commonplace, and inexpensive (Landgreen, 2002). Doctor Lobe (2004) states; "Telemedicine most likely will prove to be the most time-efficient and cost-effective means of consultation with medical specialists in the future as the technology continues to advance and provide us with new tools for improving patient care."

Roine, Ohinmaa, and Hailey (2001) researched existing literature over 34 years using MEDLINE, HEALTHSTAR, EMBASE, CINALH, and HSTAT databases and others to assess the evidence of telemedicine effectiveness and cost-effectiveness. Their research found most studies were of low quality and limited value. The literature preceding 2000 does not indicate effectiveness since variables in telemedicine studies include specific geographic areas or may be tainted with bias about their potential. Roine, Ohinmaa, and Hailey (2001) conclude future assessment studies must include methods of sustainability of telemedicine services, decisions about the equipment, impact on overall use of resources, and measurement of outcomes.

The international civilian community faces ethicolegal (White, 2002) and medical-legal (Hoffman, T. 2005) obstacles to universal utilization of telemedicine. State and National licensure differs as much as laws and interpretation the laws regarding liability.

Rensberger (2000) examined the choice of law regarding interstate telemedicine medical malpractice and observed disparities in applying laws of the place of treatment, plaintiff's domicile, place of injury, true conflict, and those falling under the Federal Tort Claims Act (FTCA) of 1946. He concludes that future telemedicine liability laws will likely fall into the place of treatment rationale where the patient will be considered to have "visited" the consulting physician.

In the DoD, the government assumes vicarious liability for its military providers under the FTCA. Litigation costs are still real and therefore must be considered in any economic analysis involving Federal organizations. Many of the issues of affecting the civilian community such as standardized or universal credentialing are less problematic for the military practice of telemedicine (GAO Report, 1997).

In several commentaries and editorials, arguments for and against telemedicine seem to revolve around reimbursement, economic viability, image resolution limitations, and security of information. The Federal Government has been a significant

contributor to telemedicine development with research and project grants, legislation for electronic health records and information privacy, and mandated Medicare reimbursement for certain telemedicine services (Batson, 2002).

Telemedicine has the potential for increased efficiency and lowering costs. Literature suggests similar if not higher quality diagnoses and treatments since it can be a collaborated effort and improved access to levels of care previously only available to patients with higher socio-economic status or proximity to metropolitan areas.

The AMEDD has funded more than $3.6 million each year on telemedicine projects since FY2000 (Poropatich, 2003). It seems clear that the future of Army healthcare involves telemedicine but telemedicine cost benefits have unique subjective measures like patient convenience and travel avoidance that are difficult to quantify.

Teleradiology

The American College of Radiology (ACR) definition of teleradiology is "…the electronic transmission of radiological images from one location to another for the purposes of interpretation and/or consultation" (ACR website, 2005). Government organizations have undertaken the majority of sophisticated telemedicine projects such as the remote

monitoring of astronauts by the National Aeronautics and Space Administration (Landgreen, 2002).

The Army has numerous telemedicine programs including teleradiology which enable doctors deployed in support of the Global War on Terrorism to transfer images to Walter Reed Army Medical Center and Brooke Army Medical Center. In 1998, WACH began using a Digital Imaging Network Picture Archiving and Communications System (DIN-PACS) as part of a Department of Defense (DoD) Initiative for filmless radiology however these digitized images were not transmitted outside the hospital.

In November 2005, WACH purchased a PACS software upgrade to support the General Electric equipment and enable transmission of images to radiologists at the organization's parent unit; Madigan Army Medical Center (MAMC). In mid-February 2006, WACH transmitted the first Computed Tomography (CT) images to MAMC. The images are securely encrypted and any patient information remains protected by the government network and firewalls.

The WACH radiologist at the time was a contracted service and had a limited amount and availability of hours for reading CT studies. The chief radiologist of MAMC, Dr. Carter stated; "Teleradiology seemed an efficient means to capitalize on the equipment and availability of radiologists at MAMC while not detrimentally affecting…" the WACH radiologist (J. Carter, personal communication, January 9, 2007).

MAMC is a 1.2 million square foot, 172-bed hospital facility and multi-specialty, outpatient mall located on 120 acres of Fort Lewis, Washington providing to over 350,000 beneficiaries (Madigan webpage, 2007). According to Dr. Carter, the versatility of the PACS is an excellent advancement enabling multiple physicians to view the images simultaneously vastly improving the discussion among consulting and requesting physicians (J. Carter, personal communication, January 9, 2007).

MAMC has a 4-year fully accredited residency program in Diagnostic Radiology with 18 residents in training (Madigan Radiology webpage, 2006), one of which successfully completed prior to assuming duties at WACH in August 2006. Dr. Carter recognized the need for an Army Officer with relatively flexible work hours to replace the pending loss of the contract radiologist. Despite the advantages of the military radiologist, the department is still composed of a single specialist and impacted by his absence.

In an editorial comment to Williamson's 1998 article; The Electronic Transformation of Radiology, Janower defends the radiologist's key role to analyze the numerous diagnostic possibilities, educate clinicians, perform quality control, minimize radiation exposure, and communicate with the patient in addition to clinician consultation (Janower, 1999). The primary

concern is the potential for a misdiagnosis or missed diagnosis and resulting litigation issues.

Hoffman (2005) states "The threshold question for any radiologist interpreting an image of someone located hundreds or thousands of miles away is whether they will be deemed to have a physician-patient relationship." In 2004, the Joint Commission on Accreditation of Health Organizations (JCAHO) issued new standards on Telemedicine and Contracted Services to assist small and rural hospitals to obtain otherwise unavailable specialty services like radiology.

Hoffman (2005) suggests this has allowed some hospitals to allegedly circumvent existing bylaws to establish a uniform credentialing process to acquire these services. The "Hospitals have the option of independently verifying the credentials of off-site practitioners and granting them staff privileges, or accepting the contractor's representations regarding the credentials of its physicians."

Telepsychiatry

According to Hyler & Gangure (2003), telepsychiatry has been in existence for more than 40 years. Their study reviewed 380 related articles published during a 47 year period to determine cost-effectiveness of telepsychiatry and concluded it…"can be cost-effective in selected settings and can be financially viable if used beyond the break-even point in

relation to the cost of providing in-person psychiatric services" (Hyler & Gangure, 2003).

A study done by Werner and Anderson (1998) criticized most previous telepsychiatry cost-effectiveness studies as being anecdotal, lacking peer review and minimally distributed. Their study listed variables related to infrastructure and found a telepsychiatry session was $179 to $244 more than a face-to-face visit and cited excluded costs of program set-up between unrelated health systems (Werner and Anderson, 1998). The issues presented by Werner and Anderson are less severe for the MHS since today, teleconferencing equipment is largely universal and per-use costs reduced by second and third purpose usage.

Monnier, Knapp, and Frueh (2003) concurred with Werner and Anderson that few empirical studies on telepsychiatry existed but indicated an explosion in research over the past three years due to strong interest in the field. Their fundamental argument was the need for interpersonal communication and human contact as part of the treatment process.

One of the greater challenges of telemedicine economic feasibility studies is that technology costs change as rapidly as the technology itself and are not usually generalizable since unique environmental factors such as travel costs are involved.

In their recommendations, Hyler and Gangure (2003) state; "When the alternative to telepsychiatry is no psychiatry,

whether psychiatry is worth the cost will depend on the value placed on delivering psychiatric services at all." This point emphasizes the intangible benefits and subjective weighting a decision-maker might use to determine a program's value.

WACH does not have an authorized psychiatrist position but the behavioral health clinic meets most needs of the community. In 2006, TriWest's optimization consultancy service; Joint Strategic and Operational Planning Process (JSOPP), advised that WACH's demand of 59 AD and 23 dependent psychiatry referrals suggest even a part-time provider cost prohibitive (J. Davis, personal communication, October 16, 2006). A shortage of MAMC psychiatrists and the departure of the psychiatrist routinely tasked with monthly Temporary Duty (TDY) to WACH prompted the need for an alternative to meet WACH's demand.

The movement to a telepsychiatry model was consistent with the 2006 AMEDD Access to Care Campaign Plan to reduce access barriers (Kiley, 2006). On face-value, telepsychiatry made sense since it met organizational goals, AD patients still received needed care, the psychiatrist's travel time could be better spent in sessions, and there were no additional equipment costs. The video teleconference (VTC) equipment at both installations had maintenance expenses but these costs were absorbed in the fixed labor costs of the information management staff.

Prior to May 2006, the visiting MAMC psychiatrist spent four days on TDY status; two days with patients and a travel day on either side. Each month the MAMC psychiatrist was scheduled for 18 AD and family member appointments. The monthly travel costs for a psychiatrist to visit WACH determined by the Defense Travel System is outlined in Table 1 below.

Table 1

Psychiatry Travel Expenses

Cost	Description	Amount	Quantity	Monthly Total	Yearly Total
Lodging	2006 nightly lodging rate, Fort Irwin	$87.00	3 nights	$261.00	$3,312.00
Travel Day	Meals, Incidentals, and expenses	$36.00	2 days	$72.00	$864.00
Training Day	Meals, Incidentals, and expenses	$59.00	2 days	$118.00	$1,416.00
Air Fare	Plane fare (Government Rate)	$340.00	1 ticket	$340.00	$4,080.00
Rental Car	2006 average daily economy rental car rate	$27.00	4 days	$108.00	$1,296.00
			Subtotal	**$1,625.00**	**$19,500.00**

It is MAMC policy to refer dependent beneficiaries to the TriWest network providers rather than employing telepsychiatry to receive care. After telepsychiatry was implemented, an average of nine AD-only appointments was scheduled and patients interacted with the MAMC psychiatrist using videoconference equipment. The live-streaming audiovisual sessions are relayed over the government network to protect the security and privacy

of patient health information required by Title II of the Health Insurance Portability and Accountability Act (HIPAA).

Teledermatology

The American Telemedicine Association Special Interest Group (SIG) for Dermatology claims; "Teledermatology is one of the most active applications of telemedicine in the United States" (ATA, 2006) The Teledermatology SIG goes on to explain how teledermatology is particularly suited to advanced communication technologies and the internet generally being delivered via Store-and-Forward (SAF) communications or full-motion video (ATA, 2006).

Shapiro et al (2004) report that multiple studies show Primary Care Managers (PCMs) are ill-prepared to diagnose common skin diseases and uncertain regarding management of more than one of every three dermatology cases. They also suggest PCM referral is less than 10% of these cases and rural area referral rates vary between one and two percent (Shapiro et al, 2004).

Teledermatology at WACH began in response to the 2006 JSOPP assessment regarding WACH's top ten network referrals and the 2006 Army Office of the Surgeon General (OTSG) Access to Care Plan to reduce reliance on network versus MHS providers.

In October 2006, the WACH GB considered two options; synchronous real time interaction through video teleconference equipment and asynchronous SAF teledermatology. The briefing

conducted by the Population Health Director, Captain Francisco Dominicci with assistance from the Great Plains Regional Medical Command (GPRMC) projected benefits such as increased access and reduced dermatology referrals as well as a 60-80% costs savings for the SAF methodology (Dominicci Teledermatology Brief, 2006).

In October 2006, three Soldiers were sent to San Antonio for three days of teledermatology technicians training including proper methods of image capture, uploading them to the web-based network consult system and status tracking. They returned to initiate the program and train others on system use. This system meets HIPAA requirements and is used throughout 27 MHS clinics as of August 2005 (Dominicci, 2006). Table 2 below outlines the total cost to implement the teledermatology program.

Table 2

Teledermatology Implementation Costs

Expense	Description	Amount	Quantity	Total
Camera	Fuji S5200, 5 MP with 10x Optical Zoom	$377.25	2 each	$754.50
Bag	Ambico Black Plastic, Zippered Pouches	$28.42	2 each	$56.84
Flash Drive	SanDisk 1 GB removable storage media	$26.78	2 each	$53.56
Training	Lodging, (2006 Government Rate)	$288.00	3 nights	$864.00
Air Fare	Plane fare, (Government Rate)	$362.00	3 fares	$1,086.00
Travel Day	Daily meals, incidentals and expenses	$90.00	2 days	$180.00
Training Day	Daily meals, incidentals and expenses	$123.00	3 days	$369.00
			Subtotal	$3,363.90

Store-and-Forward telemedicine services including teledermatology have the advantage over real-time connectivity like telepsychiatry in equipment costs, required space, and productivity improvement since the information can be retrieved at the specialist's convenience. Although real-time dermatology consultations have been shown to provide cost savings to patients, Shapiro et al (2004), state that SAF consultations are likely to be even more cost-effective since they use less expensive technologies; averaging $38 per consultation fee compared to $93.09 for an in-person consult.

Shapiro et al (2004) additionally cite "…costs of teledermatology to include hardware, software, office space, training of personnel, and time spent taking, up-loading, and downloading photographs and sending and receiving e-mails." Their study found that teledermatology was cost-effective reducing travel costs and time spent away from work and family as well as reducing intensity of required in-person visits.

Telepharmacy

Angaran (1999) defines telepharmacy as "A subset of telemedicine that focuses on the pharmacy-related aspects of telemedicine, including dispensing of medications and information and the provision of pharmaceutical care to patients from a distance." The growth of telepharmacy has been in large part due to a national shortage of pharmacists and the increased

demand for pharmacy services especially in rural settings. For several years, community pharmacy chains have attracted newly graduated pharmacists to larger cities offering bigger salaries and incentives creating gaps where small rural community pharmacists retired (Young, 2006).

A leading telepharmacy equipment vendor; Amerisource Bergen Technology Group, defines telepharmacy as "the integration of pharmacy software, remotely controlled dispensing cabinetry and telecommunications technologies to enable the provision of pharmaceutical services from a distance (AmerisourceBergen Technologies, n.d.). The definitions vary but both include distance as its core concept.

Telepharmacy technology and practices vary as well with a spectrum ranging from telephone counseling to web cameras to robotic dispensing devices. Costs and benefits for a complete system are dependent on the needs of the organization. Some hospitals seek after-hours pharmacy services or to supplement patient counseling. Telepharmacy provides the promise to provide access to ancillary services such as prescription drugs, health education, diagnostic tests and screening and illness prevention to remote and underserved populations (Clifton et al, 2003).

In March of 2007, the WACH Commander initiated a feasibility study on implementing a telepharmacy program at YHC to reduce possible patient safety and prescription medication

risks. Some of the patient safety risks regarded concerns of the PA's authority to provide care for other than AD Soldiers without direct supervision, conduct of proper prospective drug review, authority to dispense, and perform duties in the absence of a pharmacist.

The PA's authority to practice and level of supervision is granted and limited by the MTF Commander through privileging per Army Regulation 40-68. It is the current practice at YHC for the PA to order prescriptions for the beneficiary population in the course of providing primary care. The formulary is limited by the hospital Pharmacy and Therapeutics (P&T) Committee to drugs within the PA's scope of practice. The PA is supported by a pharmacy technician who maintains the limited formulary and is authorized to fill prescriptions in accordance with Army Regulation 40-3.

The prescription demand at YHC is relatively small. In a 180-day CHCS outpatient summary report spanning from October 6, 2006 to April 3, 2007, YHC processed only 497 prescriptions (See Appendix C) for 215 encounters compared to WACH processing more than 50,000 (almost 400 prescriptions per day) over the same period (See Appendix D).

The MHS uses the Composite Health Care System I (CHCS I) and the Armed Forces Health Longitudinal Technology Application (AHLTA) for recording transactions electronically. These systems

integrate with the Pharmacy Data Transaction Service (PDTS) for Computerized Physician Order Entry (CPOE) of medications. PDTS screens for adverse drug interactions and duplicate entries through prospective drug utilization reviews on each new and refill prescription against the beneficiaries' entire drug profile regardless of point of service (DoD Pharmacoeconomic Center, 2007).

The DoD Pharmacy and Therapeutics (P&T) Committee governs the therapeutic classes included in the Basic Core Formulary (BCF) and Extended Core Formulary (ECF) for the MHS creating a DoD Uniform Formulary (UF) (Health Affairs, 2004). Although each full service MTF pharmacy must stock all pharmaceutical agents in the BCF, the MTF Commander along with the local MTF P&T Committee determines which agents in the ECF will be carried (Health Affairs, 2004).

MTFs do not stock non-formulary medications (those not on the UF) and any orders for non-formulary medications must be based on medical necessity. Eligible non-active duty beneficiaries with medical need must pay a cost share and fill their prescriptions through the TRICARE Mail Order Pharmacy (TMOP) or a network retail pharmacy (TRICARE Fact Sheets, 2007).

There are several options for implementing a telepharmacy program at YHC. One of the least expensive options available is encrypted web camera or videophone communication between sites

to verify the patient, the prescription, the dosage, and provide therapy counseling if desired. Another option utilizes Automatic Dispensing Cabinets (ADCs), and computer software to dispense medications only after pharmacist review. The most sophisticated option involves cameras, robots, cabinets, label machines, and computer software to maintain safety and increase the dispensing efficiency of high capacity pharmacies.

The Army's senior pharmacist and pharmacy program manager, Colonel Isiah M. Harper, stated that the business model at YHC is adequate and appropriate for the facility's mission (I.Harper, personal communication, April 18, 2007). He went on to say that the WACH Commander has the latitude to limit or authorize the scope of the PA's practice to include dispensing prescriptions based on Army Regulation 40-68, competency assessments and the credentialing process.

The risks at YHC are mitigated with the limited formulary, PDTS prospective review, practice within the PA's privileging, and assurance that patients are offered prescription counseling by the PA. The limited formulary, PDTS, pharmacy audits and the school trained pharmacy technician provide additional "safety nets" to ensure patient safety. Colonel Harper suggested implementing telepharmacy or any change in business practice at YHC may be unnecessary assuming the PA maintains state licensure (I.Harper, personal communication, April 18, 2007).

Methods and Assumptions

C.1. Scenarios and Data

This study is a compilation of four separate BCAs and organized as such for clarity. The global information pertaining to all programs is presented first and followed by specific data unique to each program. Whenever applicable, the paper is consistently organized to first outline teleradiology, followed by telepsychiatry, teledermatology, and telepharmacy. The specific data for each program such as cash flow results, important non-financial impacts, and cost model and benefits rationale are distinguishable and separable from the others so that the GB may consider each on its own merit.

Each program's BCA will be divided into two scenarios for the sake of comparison and contrast as well as underscoring any cost savings/avoidance. Each existing program began six or more months ago and subsequently has enough data to support a Business as Usual (BAU) scenario. The opposing scenario will be an incremental cost/benefit analysis based on the consequences of a decision to Discontinue the Program (DP) beginning at the start of the next fiscal year. To examine the sensitivity of the BAU scenario, a best and worst case scenario will use data from the BAU scenario with an increase or decrease of 50% in current demand (High Demand (HD) and Low Demand (LD)).

Whenever possible, utilization and referral data will be obtained from the Military Health System (MHS) Data Mart (M2). Due to the lack of available recent data, utilization and referral data will be obtained from the departments overseeing the telemedicine service as reported to the M2 system through CHCS. Cost data will be obtained from Expense Assignment System (EAS IV) and records of WACH Resource Management Division and Property Book Office.

The financial impact of intangible benefits will be assessed in monetary terms for practical analysis using the benefits rationale methodology. Those programs with benefits that contribute to an organizational goal or business objective will be assigned a proportionate amount of the related tangible financial measure such as reimbursement rate.

This BCA is intended to remain highly objective. It will add practical value and enable the WACH Governing Body to retain confidence in their decision by testing the BAU scenario of each program with a sensitivity analysis to determine the influential significance of demand changes. The data for the existing programs collected retrospectively makes some of the assumptions for the business as usual scenario such as reimbursement rates known with certainty. The sensitivity analysis for the existing programs will be based on the projected results of the remaining period of the five year scope.

C.2. Scope of the Case

Time: The business case analysis for each program covers a five year period beginning on the date of implementation. This analysis will consider initial outlay costs, consider cost savings/avoidance over time with changes in demand to examine sensitivity, and utilize financial metrics beginning with date of their first telemedicine transmission in 2006 as the "zero" month. For the proposed telepharmacy program, the projected implementation date is October 1, 2007. For those programs the WACH Governing Board decides to discontinue, the termination date is projected to also be October 1, 2007.

The teleradiology program at WACH began in February 2006. Data for the teleradiology BCA retrospectively examines the first 12 months of the product's five year life-cycle and uses that data to make projections over the next four years. The telepsychiatry BCA began in May 2006 and uses the first 10 months of data to project the remaining 50 months while the teledermatology BCA uses the first six months of data beginning in September 2006 to project the remaining 54 months. The Telepharmacy BCA will use fiscal year 2007 data to project future demand at the YHC.

Organizations: This study includes expected business performance improvements in access to care standards for WACH and YHC. These improvements include quality and comprehensive

care improvements as well as possible cost savings. "Soft" cost impacts (intangible cost increases or cost savings) and benefits for this analysis will be considered if they contribute to the goals of WACH, Western Region Medical Command, the AMEDD, MEDCOM, and DoD.

Technologies: Benefits and cost estimates are restricted to impacts resulting from or directly supporting continuation, termination, or implementation, of a telemedicine service as applicable. The estimated useful life of related hardware is five years without requiring upgrade.

Periodic software upgrade estimates vary but are assumed to be included in the initial purchase cost of equipment and are included under maintenance costs. The technology costs such as web-based database development are included in the initial hardware and software purchase for each service and not considered since they can not be assigned to WACH accurately.

C.3. Financial Metrics

Cash flow estimates are in dollars and based the program's life cycle of five years. A "Year-0" is included to mark the implementation date and capture initial expenses for personnel and equipment incurred prior to offering the service. Expected cash flow results are summarized on a standard format cash flow statement and form the basis for the following metrics:

Net Cash Flow: The combined result of all estimated inflows and outflows for each program. Net cash flow and cumulative net cash flow are presented in dollars for the five year analysis period in the cash flow summary.

Net Present Value (NPV): The value of cash flows discounted at a rate of 3.5% to reflect average inflation rate and a second NPV discounted at 5.0% to represent a higher rate still appropriate for government investments. Both are presented in dollars for the five year period.

Simple Return on Investment (ROI): ROI the result of incremental gains over costs (net of investment costs) and is presented as a percentage in which all values over 0% represent a net gain from the investment.

Payback Period: The number of years required for the initial investment costs to be recovered from the gains.

Internal Rate of Return (IRR): The interest rate yielding an NPV of zero for this investment; expressed as a percentage.

C.4. Benefits

Global - The MHS is a not-for-profit system so it is not driven by earnings or revenue but operates within fixed budgets. Costs such as reimbursed patient transportation and accident risks avoided through telemedicine services do not affect the MTF directly except through patient satisfaction. Other costs to the hospital (e.g. digital camera) reduce network referrals but

the savings in avoided reimbursement dollars benefit the MHS but only indirectly benefit the hospital.

The primary MHS stakeholders who benefit from maintaining, discontinuing, or implementing a telemedicine service include the patient, WACH/YHC, MAMC, and the DoD. The stakeholders each benefit to varying degrees but add value to the case. This study uses the benefits rationale methodology to focus on the benefit's financial impact on WACH and the entire MHS. Through contributions to strategic objectives and organizational goals, a roughly equivalent dollar amount is proportionately based on its magnitude. The most significant benefits identified and analyzed for all cases include the following items:

Patient Satisfaction: Patients expect to receive the best possible care. For-profit organizations depend on patient satisfaction for competitive edge and return customer support to their bottom line. Not-for-profit organizations must cover their operating expenses and have an expectation to meet the service needs of their customers. Aside from being targeted in the OTSG Business Plan goals, WACH Strategic Plan objectives, and monitored at the MEDCOM level, patient satisfaction adds value to patient outcomes and reduces complaints.

If patients are satisfied with their care, they are more likely to come in at the onset of a virus or serious illness. This benefit measures the approximate dollar amount saved in

additional appointments prevented by early patient presentation during the illness/injury treatment process. Twenty-five percent of the actual visits multiplied by the appropriate CHAMPUS Maximum Allowable Charge (CMAC) rate are estimated to reflect the benefit's impact. Even greater savings in time and intensity to the MHS and patient are likely in illness screening and contagion containment.

Improved Access: This benefit is one of the five goals from the FY2008-2010 Army OTSG Business Planning Guidance and WACH strategic planning objectives. Improved access contributes to patient satisfaction since patients prefer to be seen when they want and for the services they need. Telemedicine provides a service that is not otherwise readily available at WACH.

WACH, like other MTFs, must meet the TRICARE 30-day access to care standard for specialty appointments. Patients benefit from a reduced wait times for scheduling a specialty appointment with a provider to include follow-up appointments. More importantly, most patients will have improved outcomes as a result of expedient specialty care with earlier detection and minimal delays in therapy.

This benefit focuses on reduced visits to the PCM and the number of avoided higher-cost Emergency Department visits as a result of better access. Twenty percent of the actual visits

multiplied by the appropriate CMAC rate are used as an estimate to be the value of the benefit of using telemedicine services.

Better Patient Service: This benefit is well aligned with the Commander's vision and captures the positive impacts for the patient. Patient service activities may improve the patient's perception of the visit by reducing time spent inefficiently. Arguably the value added is in improved patient satisfaction, but for the purpose of this study the value will be the travel reimbursement entitlement. Less than half of the eligible claims (those exceeding 100 miles from the MTF) for travel expenses are filed and not all expenses incurred are reimbursable.

Better Patient Service is calculated for each existing program as an amount equal to $1/60^{th}$ of an E-4 salary (Half a day's pay for the most common pay grade with four years service) increased 3.5% annually. This amount reflects the value of an AD member's lost duty-time productivity either as a patient or non-medical attendant. Travel to referrals is sometimes three hours away and the entire day or more can be spent in transit. For telepharmacy, the dollar estimate is based on the non-reimbursed patient's travel expenses saved in transit to the Marine Corps Air Station pharmacy for forty percent not enrolled at YHC.

Continuity of Care: Among many MHS PCMs exists a "play-it-safe" mindset to refer to specialists those cases with which the PCM may not be comfortable or familiar. Estimates range as high

as 50% of the cases are unnecessary specialty referrals that could be managed internally with the existing formulary.

The CHCS and AHLTA systems provide an electronic outpatient record accessible to all MHS physicians. Consult referrals internal to the MHS are immediately available to the referring provider upon completion. Network providers do not have access to CHCS/AHLTA and must fax the patient consult hard copy through the TriWest Service Center. This activity is not always timely if completed at all. Delays in returned results from referrals can be costly if it delays treatment.

In the 2008-2010 Business Planning Guidance, the OTSG targets a decrease in private sector care delivery. Some telemedicine services recapture visits sent to network providers resulting in cost savings for the MHS. Assuming there are no differences in specialty care outcomes between telemedicine and face-to-face consulting, it is preferred to keep patients within the MHS. This benefit represents the purchased care costs avoided by using the CMAC reimbursable rate that would be paid by the MHS through TRICARE for the same visit.

Cost Savings/avoidance: Whereas continuity of care captured cost savings to the MHS, this benefit refers to the cost savings for WACH that directly impact the unit's Operation and Maintenance Budget such as TDY expenses or ambulance service (2006 fuel expense = ($3/gallon x 5 gallons round trip) x number

of trips)). The cost savings is entered as a positive value on each program's cash flow summary to offset actual costs.

Increased Productivity: Relative Value Units (RVUs) are a nationally standardized metric used by the MHS to reflect the time, intensity, and effort to perform a procedure. In order to generate RVUs the work must occur in the facility and as such outsourced telemedicine services don't contribute to WACH except for the technician which is of lower value. Services kept within the MHS do increase work productivity in the MTF and regain RVUs otherwise lost to purchased care network providers.

The MHS also benefits by the efficient use of specialists during downtime (i.e. cancelled or unbooked appointment times during which the provider is available and not utilized). This benefit is also a WACH business objective and OTSG target goal. As an estimate for the financial analysis, ten percent of the average annual salary with minimum bonuses increased 3.1% over time for the applicable specialist with three years of service is used if the service is kept within the MHS. It is intended to capture the increased workload, improved efficiencies of automation, and impact toward meeting MHS business objectives.

C.5. Costs

Global - Some of the costs associated with telemedicine include equipment, training and credentialing workload. Each program requires support personnel to manage and there is value

of those individuals time spent toward the program. Quantifiably capturing that value is still subjective and offset by the reduction of inefficiencies such as provider downtime which help to negate fixed or sunk labor and facility costs for employing the specialist on staff. For the purpose of this study, employee time is a global cost that is not assigned a value due to the assumed equivalent efficient use of a specialist's time. The unique program costs are outlined below.

Teleradiology - In 2004, MEDCOM purchased and fielded the PACS equipment valued at $674,600 including $13,730 delivery and installation and $7,234 in network materials and labor to store digital images. After the one-year warranty, WACH had to fund the software support and maintenance contract to operate the system for the remaining five years of the equipment life-cycle.

In November, 2005 WACH purchased a $4,500 software upgrade after the teleradiology service was approved. This is the only cost directly associated with the implementation of the program. The WACH staff radiologist conducts four times as many CT studies on average per month (non-teleradiology studies) than is done by the MAMC Nighthawk radiologists. Proportionately, only 20% of the total original equipment costs are used for the teleradiology financial metrics for WACH.

Prior to implementing teleradiology at WACH, there were costs associated with the contract radiologist and patient

transport via ambulance when imaging was needed after hours. Without the MAMC "NightHawk" service or when the WACH CT scanner is inoperative, ED physicians must refer to nearby hospitals.

Telepsychiatry - The video teleconference equipment and rooms used at WACH and MAMC prior to implementing the service were bought for other uses. No training is needed to operate it. Travel costs paid by WACH to send a psychiatrist TDY from Madigan were estimated using authorized expenses generated by the Defense Travel System and increased by 3.5% annually.

Unlike the teleradiology program, the entire amount of the equipment purchase costs ($7,394) is included despite the equipment being primarily used for other purposes. The inclusion is intended to reflect the pending purchase and installation of identical videoconference equipment in the behavioral health clinic. This equipment would be used nearly exclusively for telepsychiatry and reduce the time spent escorting patients.

Teledermatology - The creation of teledermatology services in the Army is accredited to joint planning at TATRC and Walter Reed in 1998. The GPRMC has had great success developing a teledermatology network and utilizing a web-based referral system to manage the process with referrals returned within 72-hours (Dominicci, 2006). The associated costs borne by the MHS span several years of development and are not readily available.

The costs to WACH associated with training consult managers is expected to be a one-time expense since the training is now exportable on-line or with a DVD. Existing consult managers are also expected to cross train replacements. It is not anticipated that another camera or media storage will be required.

Telepharmacy - The option of ADCs has a lease price of approximately $500 per month (AmerisourceBergen Technologies, n.d.). ADCs are generally used to provide nurses access to medications for inpatients at point of use (AHRQ, 2001). This option would add about $12 to the cost of every prescription medication dispensed at the YHC.

Medication errors using ADCs may increase due to reliance on automation and inventory stock replenishment (Cina J. et al, 2006). The uses of ADCs do not provide any more benefit (e.g. decrease risk in an outpatient setting) to the MHS, WACH, or the patient than a web camera or videophone over a secure network.

Most telepharmacy systems are designed to speed the process of dispensing medication safely. The volume at the YHC is low enough that safety is not compromised by manual dispensing. If the ADDS increased the formulary to permit more prescriptions to be filled at the YHC, it might be worthy of future analysis.

A videophone concept meets the intent to expand the service by enabling patients to receive the prescription counseling from a pharmacist and is much less expensive. Videophones are similar

to teleconference equipment but intended for use by only two persons and can be transmitted over phone lines or the internet through Voice over Internet Protocol (VoIP) technology.

Further product comparison is required to meet unknown specification requirements but for the purpose of this study, a price range was obtained from three videophone companies. Table 3 below shows the three readily available commercial products that were reviewed for cost information.

Table 3

Videophone Price Range Review

Company	**Description**	Amount	Qty	Total
Vialta	Beamer FX analog 3.5" LCD 4-15 fps	$179.99	2	$359.98
Packet8	Packet8 DV326 VoIP 5" LCD, 30 fps	$177.47	2	$354.94
Ojo	Shadow PVP-900 VoIP 7" LCD	$299.99	2	$599.98
Ojo	PVP-1000 Cordless VoIP 7" LCD	$399.99	2	$799.98

The Vialta Beamer had the advantage of recording still images but has a smaller screen and only 4-15 frames per second (fps). The Ojo videophones require a $9.99 monthly service fee. The Packet8 DV326 has a larger display, uses VoIP technology, and a refresh rate of 30fps. The Packet8 DV326 was used for the cost analysis of the telepharmacy program. The YHC videophone consulting is expected to occur in five percent of the visits although telephonic pharmacist counseling has not been used.

C.6. Global Major Assumptions

The major assumptions for all programs in this analysis include:

- There was no additional office space, office equipment, or furniture requirement for any scenario.
- The useful life-cycle of equipment for each telemedicine program is five years.
- The rate of inflation and discount rate for Net Present Value is constant at 3.5% for calculations.
- 2007 gas price = $3.00/gallon, average mileage is 20 mpg.
- Retrospective demand for each service is adequate to project future demand.
- Telemedicine services result in the same or better quality of care and patient outcomes as in-person visits.
- Over-utilization of telemedicine services will not occur whereas PCMs retain the authority to refer (gatekeeper) in the managed care model.
- There is no difference in legal costs between either scenario for each program.
- The beneficiary population utilization will not increase or decrease significantly over the next five years.
- No additional information management (IM) or information technology (IT) personnel are required and IM/IT demands of each service will not result in increased labor costs.

Business Impacts

D.1 Overall Results

The expected cash flow results of each telemedicine program are summarized in Appendixes E-K. In brief, the teleradiology program was not cost-effective for the MHS although it just met the break-even point for WACH before five years. The total benefits and gains were not enough to exceed the costs when the cash flows are discounted to Net Present Value using only 3.5%.

The telepsychiatry program was very cost-effective for both the MHS and WACH although implementing the program negatively affected several key business objectives. The small investments compared to the benefits of continuing the service greatly offset each other in favor of business as usual.

The teledermatology program was the most cost-effective with the shortest payback period and highest ROI. This program also obtained the highest Net Cash Flow even when discounted at 3.5% and 5% to account the project's value in today's dollars. The contributions to the organizational strategic and business objectives were accentuated by the comparably low investment

The telepharmacy program will be cost effective with an estimated to payback in two years. The simple ROI is over 200% and even in a low demand scenario of 141 encounters, the Net Cash Flow, NPV at 3.5% and 5% and the IRR all remain positive suggesting this program is not sensitive to demand changes.

D.2. Benefits

Teleradiology - On the MHS Cash Flow Summary (Appendix E) Continuity of Care benefits are included since it benefits the MHS to recapture of purchased care costs. The average 2006 CMAC reimbursement rate for a CT study is $55.00 increased by 3.5% for each subsequent year.

On the WACH Cash Flow Summary (Appendix F), Continuity of Care is not included since WACH does not directly benefit. This analysis accurately captures all the costs associated with the PACS; however it is beyond the scope to properly reflect all the benefits of storing a digital record over film such as long-term storage, accessibility, recoverability, and reproducibility.

Increased Productivity is a shared benefit to both the MHS and WACH. It is reduced 50% in the WACH Cash Flow Summary to reflect the portion of the benefit's contribution to WACH.

The major benefits from implementing the teleradiology program at WACH are through Continuity of Care and Increased Productivity for the MHS. The reimbursement costs avoided by keeping the studies within the MHS improve the specialty provider productivity to salary cost ratio creating the most advantageous utilization of radiologists at both sites.

Telepsychiatry - The link for Patient Satisfaction to telepsychiatry is not as intuitive as other services. The twenty-five percent of actual visits used in the calculation can

be attributed to cost avoidance from attempted suicides, alcohol dependency, and domestic violence visits.

In the Telepsychiatry Cash Flow Summary for the MHS (Appendix G), Improved Access and Better Patient Service both become negative since the service previously existed at WACH and thirty percent fewer patients were seen in the MHS than before the program began. This decrease was not due to a reduction in psychiatric service demand but limited available MAMC provider time. Table 4 below shows how access dropped over time especially during January and February when there were no telepsychiatry appointments due to credentialing issues.

Table 4

Telepsychiatry Appointments from May 2006 to March 2007

	2006							2007			**TOTAL**
Month	MAY	JUN	JUL	AUG	SEP	NOV	DEC	JAN	FEB	MAR	
AD Sched Appts	10	10	4	11	4	9	6	0	0	11	65
AD Sessions	9	7	4	5	2	4	4	0	0	7	42
FM Sched Appts	5	3	2	0	0	0	0	0	0	0	10
FM Sessions	4	1	2	0	0	0	0	0	0	0	7

The family member beneficiaries' time is now spent traveling to a referred network provider and the trip is usually reimbursable with costs borne by the MHS through TRICARE. The estimate used to indicate this cost to the MHS is $40 (increased

3.5% each year) for meal and mileage multiplied by four family member visits per month considered lost to purchased care.

The Continuity of Care benefit for the MHS cash flow summary is negative since AD appointments decreased and family members were not seen at all a few months into the program. As a conservative estimate, four dependent referrals per month lost to purchased care. On the WACH statement (Appendix H), the benefit becomes zero because WACH does not directly benefit from keeping patients within the MHS.

The workload gained from the psychiatrist being available at MAMC during the two travel days previously spent TDY to WACH is captured on the Increased Productivity benefit as 144 visits (six per day x 2 days x 12 months) at the CMAC rate. Although it is not clear that the increased available time at MAMC is spent seeing 12 patients that would otherwise be lost to the network, MAMC's shortage of psychiatrists induced the policy to refer non-Active Duty to the network.

The major benefit to the MHS from implementing the WACH telepsychiatry program was the increased productivity gained at MAMC with available psychiatry time. This benefit along with the avoided costs of travel for WACH were enough to offset the negative impact from reduced access to convenient psychiatry care, patient service and care kept within the MHS. This program was extremely successful for the MHS with positive cash flows in

only six months and 936% simple ROI. For WACH, the Cost Avoidance for travel expenses outweighed the negative impact to access and patient service.

Teledermatology - Exclusion criteria assist the Program Consult Manager to determine which cases are appropriate for teledermatology and recaptures only 25-30% of the total demand at Fort Irwin. The relatively small additional demand to the GPRMC program did not require any additional personnel or equipment costs beyond that discussed previously to implement (See Appendix I). There are no notable cost savings or avoidance benefit (those borne by WACH) calculated in either the MHS or WACH Cash Flow Summary.

Similar to teleradiology, Continuity of Care is not calculated on the WACH Cash Flow Summary (Appendix J), whereas WACH does not directly benefit from avoiding reimbursement costs sent to the network. Increased Productivity is a shared benefit to both the MHS and WACH. It is reduced 85% from the MHS Cash Flow Summary to reflect the benefit's contribution to WACH through the RVUs generated by the consult manager.

This program's major benefit for the MHS was the recapture of purchased care lost to the network followed closely by the Increased Productivity consistent with literature on SAF systems. For WACH, the benefits lay primarily in Improving Patient Satisfaction and providing Better Patient Service. For

both the MHS and WACH, the service had an ROI of less than a year and positive NPVs with a discount rate at 5%.

Telepharmacy - Telepharmacy program implementation will not greatly improve Patient Satisfaction, Improve Access, or contribute to Better Patient Service since it will not increase the efficiency or scope of the business as usual scenario. The program will expand the existing service by offering pharmacist counseling in lieu of telephonic or the YHC PA's offer to counsel. Ten percent of the total encounters were used to assign the expected number of the patients who would use the videophone to be counseled by a WACH pharmacist instead of the YHC PA.

Some of the benefits offered in a telepharmacy business model include: maximizing pharmacist and staff efficiency, enhancing accuracy to reduce medication errors, control costs, speed the dispensing process, and expanding pharmacy services (AmerisourceBergen Technologies, n.d.). The low volume at and unscheduled real-time transactions would likely reduce the WACH pharmacist efficiency dispensing at the higher volume facility. The low volume would not help control costs and makes speeding the dispensing process unneeded.

The prescription medication errors in the military are estimated by Nosek, McMeekin, and Rake to represent half of all reported errors (2004). The YHC dispensing process is likely not free from error but more expensive automated systems would not

necessarily reduce or eliminate errors. The risk to YHC patients is mitigated by several measures; CHCS prospective review, use of the pharmacy technician, and a limited formulary. Connecting patients to pharmacists could be an inexpensive means to reduce medication errors as well as expand pharmacy services.

D.3. Costs

Teleradiology - The major costs to the MHS associated with the teleradiology program at WACH was the initial purchase of the DIN-PACS. The total cost of $1,092,593 to the MHS over the five-year period includes the software upgrade of $4,500 needed to transmit images. The total costs were reduced by 80% to account for the fraction attributable to transmitting teleradiology studies to MAMC.

The major costs to WACH are the maintenance contract and software support required to keep the equipment operational. WACH paid the portion remaining on both contracts following the expiration of the manufacturer's warranty and prior to the upgrade. The equipment life cycle is actually six years placing it at five years remaining when the teleradiology program began. The gain in benefits to WACH ($95,804) nearly breaks even with the costs ($417,993) after being reduced by 80% ($96,575).

Telepsychiatry - The major cost impact for telepsychiatry was the video teleconference equipment which was purchased years before primarily for meetings. The costs were entirely funded by

WACH and therefore appear on both the MHS and WACH Cost Flow Summary. The total costs were estimated to be $7,394 while the gain in benefits for the MHS is over ten times higher and almost four times higher to WACH.

Teledermatology - The training costs to send three people to San Antonio for consult manager training averaged $800 per person. This start up cost was the greatest impact for both the MHS and WACH but is not expected to be repeated since the training program is available online. The next highest cost was the digital camera. It had to be capable of high resolution images that could be stored on a removable drive. The five year simple ROI for total cost of $3,364 was 3642.97% for the MHS meaning this investment paid for itself over 100 times in benefits and cost avoidance during that time period.

Telepharmacy - The costs for telepharmacy were obtained with an online search for videophones and the removable storage drives. The same items may be found for less but the prices used were intended to illustrate the approximate costs of readily available items. If either item is actually purchased for less, the cash flows and return on investment would only improve.

Sensitivities, Risks and Contingencies

For each service, there is a demand for the business as usual scenario which is obtained beginning with the date of implementation or past 12 months for telepharmacy. The demand in the BAU scenario is then decreased (Low Demand - LD) and increased by 50% (High Demand - HD) to test the sensitivity of each program to utilization. The results are outlined in the Cash Flow Summary for each program.

Some of the risks associated with discontinuing or implementing a new telemedicine service include a disruption of service, patient privacy concerns, and unforeseen costs.

Contingencies to counter these risks would include installation or removal completed after clinic hours, marketing to ensure the population is aware of the new service or termination of an old service, and monitoring to ensure the programs presence or absence remains financially viable.

Recommendations and Conclusions

One of the significant limitations of this study is that the reader must accept the logic used to financially quantify the assumptions and benefits. Estimates of prices and salaries were selected in the low to middle ranges (e.g. paygrade of E4 with four years) to avoid over estimating the financial value of benefits and retain credibility for the study.

Teleradiology - Based on the analysis presented above, the service is not cost effective for the MHS and the decision should be to discontinue the business as usual scenario. Using the Cost Flow Summary for WACH, the teleradiology investment doesn't break even until the final year and the NPV becomes negative when discounted for inflation.

The recommendation however, is maintain the teleradiology program. The costs are accurate, quantifiable, and finite, but not all the benefits are. There more opportunities for improved peer review and supporting opinions whereas the image is digitally available to more than one reader in more than one location at the same time. The specialists can review the images simultaneously and gain concurrence on the interpretation thus improving the efficiency and quality of care to the patient.

A symbiotic relationship has formed between departments in which MAMC forwards teleradiology consults to be read by the WACH radiologist during periods of low productivity. The WACH radiologist recently completed residency and the additional workload from MAMC helps him to retain or develop image-reading skills while MAMC shifts the intensity of the workload among available resources. In return, the WACH radiologist is able to be absent (instead of 24-hour on-call), since a MAMC radiologist is available at all times.

Telepsychiatry - Based on the analysis the BCA strongly supports the business as usual scenario. Despite losses in benefits compared to the practice of sending a MAMC psychiatrist TDY, telepsychiatry had positive cash flows for both the MHS and WACH. Having a program for AD only still meets several of the business objectives for the unit and MHS.

Patient satisfaction, cost savings or avoidance, and increased productivity would decrease or become negative if the service was discontinued and AD patients were referred to the network or nearest MTF in San Diego. The literature supports that there is no difference in patient outcomes compared to face-to-face meetings and cost avoidance for the organization.

The recommendation is based on positive cash flows for both the MHS and WACH despite changes in demand. Another recommendation is to connect VTC equipment in the behavioral health conference room to avoid patient movement out of the clinic and retain patient privacy. The simple ROI of 280% and IRR of 67% indicate these costs would be recouped by WACH in less than two years.

Teledermatology - The analysis very strongly supports the business as usual scenario. For both the MHS and WACH, the benefits far exceeded the implementation costs of $3,364. In both situations, the investment paid for itself in less than a

year and positively supported five of the six benefits which were also strategic and business plan objectives.

For these reasons, teledermatology program should be considered highly successful. The recommendation is to continue the business as usual scenario. The WACH Governing Body should also consider supplementing this program with a circuit rider dermatologist to see the patients within the MHS that are excluded from using teledermatology.

Telepharmacy - The telepharmacy BCA strongly supports the business as usual scenario. The payback period is two years and the gains exceed the costs under all scenarios for both the MHS and WACH. The program meets three of the organizational strategic and business objectives. Even if the copay difference is not increased in 2009, the Cash Flow Analysis for the business as usual scenario still remained positive for IRR, Net Cash Flow, and discounted NPV.

The recommendation is for the WACH Governing Board to implement the telepharmacy program. The expansion of the existing service will allow YHC patients with questions related to their treatment. The costs are significantly outweighed by the gains in benefits including another level of risk mitigation.

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Appendix A: Definitions of terms

Expense Assignment System IV (EAS IV) - EAS IV is a standard cost accounting/assignment system that consists of a cost-assignment application and data repository. The system receives information electronically from a variety of DoD financial, manpower, and workload systems, and allocates this expense information to Medical Treatment Facility/Dental Treatment Facility (MTF/DTF) direct and indirect work centers (US Department of Health and Human Services, 2006).

CHAMPUS Maximum Allowable Charge (CMAC) - CHAMPUS was the DoD managed care program predecessor to TRICARE. The CMAC rate was previously based on the 80th percentile of physician's actual charges statewide. Using this approach, CHAMPUS reimbursement rates were, in many cases, significantly higher - 50% higher on average - than those paid for the identical treatment under the Medicare program. CMAC is the maximum physician reimbursement level that will be paid by the DoD (Government Accounting Office, 2001).

Pharmacy Data Transaction Service (PDTS) - Military Health System Integrated Pharmacy System business rules that identify issues and processes used by the pharmacists and providers in the direct care system when interacting with PDTS. The

integrated pharmacy system will operate with several Government systems to screen an eligible patient's prescription against the patient's total drug profile for drug interactions, drug overlaps, drug dosage, and patient compliance. Additionally, retrospective, concurrent, and prospective drug utilization reviews will be accomplished (Army Regulation 40-3).

Store and Forward (SAF) - A type of telehealth encounter or consult that uses still digital images of a patient for the purpose of rendering medical opinion or diagnosis. Common types of SAF services include radiology, pathology, dermatology, and wound care. SAF also includes the asynchronous transmission of clinical data such as blood glucose levels and electrocardiogram measurements from one site to another site.

Appendix B: Glossary of Abbreviations

AD - Active Duty

ADC - Automatic Dispensing Cabinet

AMEDD - Army Medical Department

ATA - American Telemedicine Association

BCA - Business Case Analysis

CMAC - CHAMPUS Maximum Allowable Charge

CT - Computed Tomography or Computed Axial Tomography

DoD - Department of Defense

ED - Emergency Department

FTE - Full Time Equivalent

GB - Governing Body

GPRMC - Great Plains Regional Medical Command

IRR - Internal Rate of Return

JSOPP - Joint Service and Operational Planning Process

MAMC - Madigan Army Medical Center

MCSC - Managed Care Support Contractor

MEDDAC - Medical Department Activity

MHS - Military Health System

NPV - Net Present Value

PA - Physician Assistant

PACS - Picture Archiving and Communication System

PCM - Primary Care Manager

PDTS - Pharmacy Data Transaction Service

ROI - Return on Investment

RVU - Relative Value Unit

SAF - Store-and-Forward

TATRC - Telemedicine and Advanced Technology Research Center

TDY - Temporary Duty (includes travel to duty station)

TIE - Telemedicine Information Exchange

WACH - Weed Army Community Hospital

Appendix C: YHC Six Month CHCS Report

WEED ARMY COMMUNITY HOSPITAL 04 Apr 2007@1747 PAGE 12

OUTPATIENT SUMMARY REPORT (TOTAL)

From: 06 Oct 2006 To: 03 Apr 2007

Division / Site	New	Refills	Total
YUMA ARMY PROVING GROUND			
YUMA PROVING GROUND RX	491	6	497
Division total ->	491	6	497
REPORT TOTAL ->	491	6	497

Appendix D: WACH Six Month CHCS Report

WEED ARMY COMMUNITY HOSPITAL 04 Apr 2007@1403 PAGE 1

OUTPATIENT SUMMARY REPORT (TOTAL)
From: 01 Oct 2006 To: 03 Apr 2007

Division / Site	New	Refills	Total
WEED ACH, CA			
WEED ACH, CA	36316	3178	39494
MCLB-REFILL	9	1875	1884
REFILL-WEED	60	4939	4999
ER PHARMACY	4345	0	4345
NON-FORMULARY	168	1	169
Division total ->	40898	9993	50891
REPORT TOTAL ->	40898	9993	50891

********** END OF REPORT **********

Appendix E: MHS Teleradiology Cash Flow Statement

Teleradiology Business Case	CASH FLOW SUMMARY	MHS

Summary of Financial Results and Assumptions

Net Cash Flow			$ (44,715)	(108,035)	17,905
Net Present Value @ 3.5% discounting			$ (56,268)	(109,431)	148
Net Present Value @ 5% discounting			$ (60,646)	(110,001)	(6,600)
Simple ROI			-20.46%	-49.44%	8.19%
Payback Period			> 5 Years	> 5 Years	4 Yrs 8 Mo
Internal Rate of Return			N/A	N/A	35.32%
Total Benefits / Gains			$ 173,803	110,483	236,424
Total Costs	$1,092,593	x 20% =	$ 218,519	218,519	218,519
Analysis Period			10 Feb 2006 through 10 Feb 2011		
Analysis Period Length			5 years		

CASH FLOW STATEMENT

		Year 0 Feb 2006	Year 1 Feb 2007	Year 2 Feb 2008	Year 3 Feb 2009	Year 4 Feb 2010	Year 5 Feb 2011	TOTAL
MAMC Nighthawk CT Studies			181	181	181	181	181	905
CMAC Reimbursement Rate	$		$55.00	$56.92	$58.92	$60.98	$63.11	
Benefits/Gains								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	2,489	2,576	2,666	2,759	2,856	13,346
Improved Access		N/A	1,991	2,061	2,133	2,207	2,285	10,676
Better Patient Service		N/A	5,968	6,154	6,344	6,541	6,744	31,751
Continuity of Care		N/A	9,955	10,303	10,665	11,037	11,423	53,382
Cost Savings/Avoidance		N/A	3,258	3,377	3,496	3,616	3,747	17,485
Increased Productivity		N/A	8,866	9,141	9,424	9,716	10,017	47,163
Total Benefits/Gains	$	N/A	32,526	33,611	34,718	35,878	37,071	173,803
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
GE DIN-PACS Equipment		(653,636)	0	0	0	0	0	(653,636)
Network Labor and Equipment		(7,234)	0	0	0	0	0	(7,234)
Total Hardware	$	(660,870)	0	0	0	0	0	(660,870)
Software								
Software Support		(9,325)	(12,789)	(12,789)	(12,789)	(12,789)	0	(60,481)
Software Upgrade		(4,500)	0	0	0	0	0	(4,500)
Total Software	$	(13,825)	(12,789)	(12,789)	(12,789)	(12,789)	0	(64,981)
Personnel and Services								
Training Costs		0	0	0	0	0	0	0
Delivery and Installation		(13,730)	0	0	0	0	0	(13,730)
Maintenance Contract		(58,124)	(73,722)	(73,722)	(73,722)	(73,722)	0	(353,012)
Total Personnel and Services	$	(71,854)	(73,722)	(73,722)	(73,722)	(73,722)	0	(366,742)
Total Costs and Cost Savings	$	(746,549)	(86,511)	(86,511)	(86,511)	(86,511)	0	(1,092,593)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	32,526	33,611	34,718	35,878	37,071	173,803
20% Costs applied to teleradiology		(149,310)	(17,302)	(17,302)	(17,302)	(17,302)	0	(218,519)
NET CASH FLOW		(149,310)	15,224	16,308	17,415	18,576	37,071	(44,715)
Cumulative Net Cash Flow		(149,310)	(134,086)	(117,778)	(100,362)	(81,787)	(44,715)	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(149,310)	14,709	15,224	15,708	16,188	31,213	(56,268)
5% Discounted Cash Flow		(149,310)	14,499	14,792	15,044	15,282	29,046	(60,646)

Appendix F: WACH Teleradiology Cash Flow Statement

Teleradiology Business Case	CASH FLOW SUMMARY	WACH

Summary of Financial Results and Assumptions

Net Cash Flow		$	264	(36,365)	36,488
Net Present Value @ 3.5% discounting		$	(2,398)	(35,400)	30,239
Net Present Value @ 5% discounting		$	(3,372)	(34,987)	27,894
Simple ROI			0.27%	-37.65%	37.78%
Payback Period			4 Yrs 11 Mo	> 5 Yrs	2 Yrs 7 Mo
Internal Rate of Return			0.32%	N/A	45.66%
Total Benefits / Gains		$	96,839	60,210	133,063
Total Costs	$417,993 x 20% =	$	96,575	96,575	96,575
Analysis Period			10 Feb 2006 through 10 Feb 2011		
Analysis Period Length			5 years		

CASH FLOW STATEMENT

		Year 0 Feb 2006	Year 1 Feb 2007	Year 2 Feb 2008	Year 3 Feb 2009	Year 4 Feb 2010	Year 5 Feb 2011	TOTAL
MAMC Nighthawk CT Studies			181	181	181	181	181	905
CMAC Reimbursement Rate	$		$55.00	$56.92	$58.92	$60.98	$63.11	
Benefits/Gains								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	2,489	2,576	2,666	2,759	2,856	13,346
Improved Access		N/A	1,991	2,061	2,133	2,207	2,285	10,678
Better Patient Service		N/A	5,968	6,154	6,344	6,541	6,744	31,751
Continuity of Care		N/A	0	0	0	0	0	0
Cost Savings/Avoidance		N/A	3,258	3,377	3,486	3,616	3,747	17,485
Increased Productivity		N/A	4,433	4,570	4,712	4,858	5,009	23,582
Total Benefits/Gains	$	N/A	18,138	18,738	19,341	19,983	20,640	96,839
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
GE DIN-PACS Equipment		N/A	0	0	0	0	0	0
Network Equipment		N/A	0	0	0	0	0	0
Total Hardware	$	0	0	0	0	0	0	0
Software								
Software Support		(9,325)	(12,789)	(12,789)	(12,789)	(12,789)	0	(60,481)
Software Upgrade		(4,500)	0	0	0	0	0	(4,500)
Total Software	$	(13,825)	(12,789)	(12,789)	(12,789)	(12,789)	0	(64,981)
Personnel and Services								
Training Costs		N/A	0	0	0	0	0	0
Delivery and Installation		N/A	0	0	0	0	0	0
Maintenance Contract		(58,124)	(73,722)	(73,722)	(73,722)	(73,722)	0	(353,012)
Total Personnel and Services	$	(58,124)	(73,722)	(73,722)	(73,722)	(73,722)	0	(353,012)
Total Costs and Cost Savings	$	(71,949)	(86,511)	(86,511)	(86,511)	(86,511)	0	(417,993)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	18,138	18,738	19,341	19,983	20,640	96,839
20% Costs applied to teleradiology		(14,390)	(17,302)	(21,628)	(21,628)	(21,628)	0	(96,575)
NET CASH FLOW		(14,390)	836	(2,890)	(2,287)	(1,645)	20,640	264
Cumulative Net Cash Flow		(14,390)	(13,554)	(16,444)	(18,730)	(20,376)	264	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(14,390)	808	(2,698)	(2,062)	(1,434)	17,378	(2,398)
5% Discounted Cash Flow		(14,390)	796	(2,621)	(1,975)	(1,354)	16,172	(3,372)

Appendix G: MHS Telepsychiatry Cash Flow Statement

Telepsychiatry Business Case	CASH FLOW SUMMARY	MHS

Summary of Financial Results and Assumptions

		BAU	LD	HD
Net Cash Flow	$	59,882	57,029	62,735
Net Present Value @ 3.5% discounting	$	53,193	50,823	55,763
Net Present Value @ 5% discounting	$	50,637	48,175	53,099
Simple ROI		809.83%	771.25%	848.41%
Payback Period		7.2 Months	7.5 Months	7 Months
Internal Rate of Return		170.54%	163.23%	187.44%
Total Benefits / Gains	$	67,276	64,423	70,129
Total Costs	$	7,394	7,394	7,394
Analysis Period		24 May 2006 through 24 May 2011		
Analysis Period Length		5 years		

CASH FLOW STATEMENT

		Year 0 May 2006	Year 1 May 2007	Year 2 May 2008	Year 3 May 2009	Year 4 May 2010	Year 5 May 2011	TOTAL
MAMC Psychiatry Sessions			56	56	56	56	56	280
CMAC Reimbursement Rate	$		$76.00	$78.66	$81.41	$84.26	$87.21	
Benefits/Gains (Losses)								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	1,064	1,101	1,140	1,180	1,221	5,706
Improved Access		N/A	(2,736)	(2,832)	(2,931)	(3,033)	(3,140)	(14,672)
Better Patient Service		N/A	(1,920)	(1,920)	(1,920)	(1,920)	(1,920)	(9,600)
Continuity of Care		N/A	(3,648)	(3,776)	(3,908)	(4,045)	(4,186)	(19,562)
Cost Savings/Avoidance		N/A	8,712	9,017	9,333	9,659	9,997	46,718
Increased Productivity		N/A	10,944	11,327	11,723	12,134	12,558	58,687
Total Benefits/Gains	$	N/A	12,416	12,918	13,437	13,975	14,531	67,276
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
Telex Telephone Conference Equip		(494)	0	0	0	0	0	(494)
PolyCom Video Conference Equip		(5,599)	0	0	0	0	0	(5,599)
Sony KD 36" FlatScreen		(1,051)	0	0	0	0	0	(1,051)
Total Hardware	$	(7,144)	0	0	0	0	0	(7,144)
Software								
Software Maint and Operations		N/A	0	0	0	0	0	0
Software Upgrade		N/A	0	0	0	0	0	0
Total Software	$	0	0	0	0	0	0	0
Personnel and Services								
Training Costs		N/A	0	0	0	0	0	0
Delivery,Installation and Maint		(250)	0	0	0	0	0	(250)
Total Personnel and Services	$	(250)	0	0	0	0	0	(250)
Total Costs and Cost Savings	$	(7,394)	0	0	0	0	0	(7,394)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	12,416	12,918	13,437	13,975	14,531	67,276
Costs and Cost Savings		(7,394)	0	0	0	0	0	(7,394)
NET CASH FLOW		(7,394)	12,416	12,918	13,437	13,975	14,531	59,882
Cumulative Net Cash Flow		(7,394)	5,022	17,939	31,376	45,351	59,882	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(7,394)	11,996	12,059	12,119	12,178	12,235	53,193
5% Discounted Cash Flow		(7,394)	11,825	11,717	11,607	11,497	11,385	50,637

Appendix H: WACH Telepsychiatry Cash Flow Statement

Telepsychiatry Business Case	CASH FLOW SUMMARY	WACH

Summary of Financial Results and Assumptions

		BAU	LD	HD
Net Cash Flow	$	20,757	17,905	23,610
Net Present Value @ 3.5% discounting	$	17,946	15,376	20,516
Net Present Value @ 5% discounting	$	16,873	14,411	19,335
Simple ROI		280.72%	242.14%	319.30%
Payback Period		1 Yr, 5 Mo	1 Yr, 7 Mo	1 Yr, 3.5 Mo
Internal Rate of Return		67.35%	59.27%	75.30%
Total Benefits / Gains	$	28,152	25,299	31,005
Total Costs	$	7,394	7,394	7,394
Analysis Period		24 May 2006 through 24 May 2011		
Analysis Period Length		5 years		

CASH FLOW STATEMENT

		Year 0 May 2006	Year 1 May 2007	Year 2 May 2008	Year 3 May 2009	Year 4 May 2010	Year 5 May 2011	TOTAL
MAMC Psychiatry Sessions			56	56	56	56	56	280
CMAC Reimbursement Rate	$		$76.00	$78.66	$81.41	$84.26	$87.21	
Benefits/Gains (Losses)								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	1,064	1,101	1,140	1,180	1,221	5,706
Improved Access		N/A	(2,736)	(2,832)	(2,931)	(3,033)	(3,140)	(14,672)
Better Patient Service		N/A	(1,920)	(1,920)	(1,920)	(1,920)	(1,920)	(9,600)
Continuity of Care		N/A	0	0	0	0	0	0
Cost Savings/Avoidance		N/A	8,712	9,017	9,333	9,659	9,997	46,718
Increased Productivity		N/A	0	0	0	0	0	0
Total Benefits/Gains	$	N/A	5,120	5,366	5,621	5,885	6,159	28,152
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
Telex Telephone Conference Equip		(494)	0	0	0	0	0	(494)
PolyCom Video Conference Equip		(5,599)	0	0	0	0	0	(5,599)
Sony KD 36" FlatScreen		(1,051)	0	0	0	0	0	(1,051)
Total Hardware	$	(7,144)	0	0	0	0	0	(7,144)
Software								
Software Maint and Operations		N/A	0	0	0	0	0	0
Software Upgrade		N/A	0	0	0	0	0	0
Total Software	$	0	0	0	0	0	0	0
Personnel and Services								
Training Costs		N/A	0	0	0	0	0	0
Delivery,Installation and Maint		(250)	0	0	0	0	0	(250)
Total Personnel and Services	$	(250)	0	0	0	0	0	(250)
Total Costs and Cost Savings	$	(7,394)	0	0	0	0	0	(7,394)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	5,120	5,366	5,621	5,885	6,159	28,152
Costs and Cost Savings		(7,394)	0	0	0	0	0	(7,394)
NET CASH FLOW		(7,394)	5,120	5,366	5,621	5,885	6,159	20,757
Cumulative Net Cash Flow		(7,394)	(2,274)	3,092	8,713	14,599	20,757	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(7,394)	4,947	5,010	5,070	5,129	5,185	17,946
5% Discounted Cash Flow		(7,394)	4,876	4,867	4,856	4,842	4,825	16,873

Appendix I: MHS Teledermatology Cash Flow Statement

Teledermatology Business Case	CASH FLOW SUMMARY	MHS

Summary of Financial Results and Assumptions

		BAU	LD	HD
Net Cash Flow	$	117,226	75,725	158,727
Net Present Value @ 3.5% discounting	$	105,286	67,897	142,676
Net Present Value @ 5% discounting	$	100,723	64,905	136,542
Simple ROI		3484.83%	2251.11%	4718.55%
Payback Period		1.5 Months	3 Months	1.3 Months
Internal Rate of Return		704.02%	443.69%	904.81%
Total Benefits / Gains	$	120,590	79,089	162,091
Total Costs	$	3,364	3,364	3,364
Analysis Period		1 Oct 2006 through 1 Oct 2011		
Analysis Period Length		5 years		

CASH FLOW STATEMENT

		Year 0 Oct 2006	Year 1 Oct 2007	Year 2 Oct 2008	Year 3 Oct 2009	Year 4 Oct 2010	Year 5 Oct 2011	TOTAL
GPRMC Network Cases			108	108	108	108	108	540
CMAC Reimbursement Rate	$		$76.28	$78.95	$81.71	$84.57	$87.53	
Benefits/Gains								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	2,060	2,132	2,206	2,283	2,363	11,044
Improved Access		N/A	1,648	1,705	1,765	1,827	1,891	8,835
Better Patient Service		N/A	3,561	3,672	3,785	3,903	4,024	18,945
Continuity of Care		N/A	8,238	8,527	8,825	9,134	9,454	44,177
Cost Savings/Avoidance		N/A	0	0	0	0	0	0
Increased Productivity		N/A	7,066	7,285	7,511	7,743	7,983	37,588
Total Benefits/Gains	$	N/A	22,572	23,320	24,092	24,891	25,715	120,590
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
Fuji S520 Digital Camera		(755)	0	0	0	0	0	(755)
Camera Bag		(57)	0	0	0	0	0	(57)
1 GB Removable Storage Drive		(54)	0	0	0	0	0	(54)
Total Hardware	$	(865)	0	0	0	0	0	(865)
Software								
Software Support		0	0	0	0	0	0	0
Software Upgrade		0	0	0	0	0	0	0
Total Software	$	0	0	0	0	0	0	0
Personnel and Services								
Training Costs		(2,499)	0	0	0	0	0	(2,499)
Delivery and Installation		0	0	0	0	0	0	0
Maintenance Contract		0	0	0	0	0	0	0
Total Personnel and Services	$	(2,499)	0	0	0	0	0	(2,499)
Total Costs and Cost Savings	$	(3,364)	0	0	0	0	0	(3,364)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	22,572	23,320	24,092	24,891	25,715	120,590
Costs and Cost Savings		(3,364)	0	0	0	0	0	(3,364)
NET CASH FLOW		(3,364)	22,572	23,320	24,092	24,891	25,715	117,226
Cumulative Net Cash Flow		(3,364)	19,208	42,528	66,620	91,511	117,226	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(3,364)	21,809	21,770	21,730	21,691	21,651	105,286
5% Discounted Cash Flow		(3,364)	21,497	21,152	20,812	20,478	20,149	100,723

Appendix J: WACH Teledermatology Cash Flow Statement

Teledermatology Business Case	CASH FLOW SUMMARY	WACH

Summary of Financial Results and Assumptions

		BAU	LD	HD
Net Cash Flow	$	42,855	23,442	62,267
Net Present Value @ 3.5% discounting	$	38,280	20,789	55,770
Net Present Value @ 5% discounting	$	36,531	29,755	53,287
Simple ROI		1273.97%	696.88%	1851.05%
Payback Period		3.5 Months	8 Months	3 Months
Internal Rate of Return		260.16%	150.84%	368.50%
Total Benefits / Gains	$	46,219	28,806	65,631
Total Costs	$	3,364	3,364	3,364
Analysis Period		1 Oct 2006 through 1 Oct 2011		
Analysis Period Length		5 years		

CASH FLOW STATEMENT

		Year 0 Oct 2006	Year 1 Oct 2007	Year 2 Oct 2008	Year 3 Oct 2009	Year 4 Oct 2010	Year 5 Oct 2011	TOTAL
GPRMC Network Cases			108	108	108	108	108	540
CMAC Reimbursement Rate	$		$76.28	$78.95	$81.71	$84.57	$87.53	
Benefits/Gains								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	2,060	2,132	2,206	2,283	2,363	11,044
Improved Access		N/A	1,648	1,705	1,765	1,827	1,891	8,835
Better Patient Service		N/A	3,561	3,672	3,785	3,903	4,024	18,945
Continuity of Care		N/A	0	0	0	0	0	0
Cost Savings/Avoidance		N/A	0	0	0	0	0	0
Increased Productivity		N/A	1,390	1,433	1,477	1,523	1,570	7,394
Total Benefits/Gains	$	N/A	8,658	8,942	9,234	9,537	9,849	46,219
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
Fuji S520 Digital Camera		(755)	0	0	0	0	0	(755)
Camera Bag		(57)	0	0	0	0	0	(57)
1 GB Removable Storage Drive		(54)	0	0	0	0	0	(54)
Total Hardware	$	(865)	0	0	0	0	0	(865)
Software								
Software Support		0	0	0	0	0	0	0
Software Upgrade		0	0	0	0	0	0	0
Total Software	$	0	0	0	0	0	0	0
Personnel and Services								
Training Costs		(2,499)	0	0	0	0	0	(2,499)
Delivery and Installation		0	0	0	0	0	0	0
Maintenance Contract		0	0	0	0	0	0	0
Total Personnel and Services	$	(2,499)	0	0	0	0	0	(2,499)
Total Costs and Cost Savings	$	(3,364)	0	0	0	0	0	(3,364)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	8,658	8,942	9,234	9,537	9,849	46,219
Costs and Cost Savings		(3,364)	0	0	0	0	0	(3,364)
NET CASH FLOW		(3,364)	8,658	8,942	9,234	9,537	9,849	42,855
Cumulative Net Cash Flow		(3,364)	5,294	14,236	23,470	33,006	42,855	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(3,364)	8,365	8,347	8,329	8,311	8,292	38,280
5% Discounted Cash Flow		(3,364)	8,246	8,111	7,977	7,846	7,717	36,531

Appendix K: MHS and WACH Telepharmacy Cash Flow Statement

Telepharmacy Business Case	CASH FLOW SUMMARY	MHS and WACH

Summary of Financial Results and Assumptions

		BAU	LD	HD
Net Cash Flow	$	991	281	1,701
Net Present Value @ 3.5% discounting	$	842	206	1,477
Net Present Value @ 5% discounting	$	785	178	1,392
Simple ROI		230.70%	65.35%	396.05%
Payback Period		2 Years	2 Yrs 3 Mo	1 Yr, 5 Mo
Internal Rate of Return		51.64%	17.57%	80.12%
Total Benefits / Gains	$	1,420	710	2,131
Total Costs	$	430	430	430
Analysis Period		1 Oct 2006 through 1 Oct 2011		
Analysis Period Length		5 years		

CASH FLOW STATEMENT

		Year 0 Oct 2006	Year 1 Oct 2007	Year 2 Oct 2008	Year 3 Oct 2009	Year 4 Oct 2010	Year 5 Oct 2011	TOTAL
Annual Prescription Encounters			282	282	282	282	282	1410
Copay Difference	$		$6.00	$6.00	$9.00	$9.00	$9.00	
Benefits/Gains								
Cash Inflows (Outflows)								
Patient Satisfaction		N/A	42	85	127	127	127	508
Improved Access		N/A	85	85	127	127	127	550
Better Patient Service		N/A	68	70	72	75	78	363
Continuity of Care		N/A	0	0	0	0	0	0
Cost Savings/Avoidance		N/A	0	0	0	0	0	0
Increased Productivity		N/A	0	0	0	0	0	0
Total Benefits/Gains	$	N/A	195	239	326	329	331	1,420
Costs and Cost Savings								
Cash Inflows (Outflows)								
Hardware								
Packet8 DV 326 VoIP Videophone		(380)	0	0	0	0	0	(380)
1 GB Removable Storage Drive		(54)	0	0	0	0	0	(54)
Total Hardware	$	(414)	0	0	0	0	0	(414)
Software								
Software Support		0	0	0	0	0	0	0
Software Upgrade		0	0	0	0	0	0	0
Total Software	$	0	0	0	0	0	0	0
Personnel and Services								
Training Costs		0	0	0	0	0	0	0
Delivery and Installation Costs		(16)						
Maintenance Contract		0	0	0	0	0	0	0
Total Personnel and Services	$	(16)	0	0	0	0	0	0
Total Costs and Cost Savings	$	(430)	0	0	0	0	0	(414)
Cash Flow Summary								
Cash Inflows (Outflows)								
Benefits		0	195	239	326	329	331	1,420
Costs and Cost Savings		(430)	0	0	0	0	0	(430)
NET CASH FLOW		(430)	195	239	326	329	331	991
Cumulative Net Cash Flow		(430)	(235)	4	331	660	991	
Discounted Cash Flow								
3.5% Discounted Cash Flow		(430)	188	223	294	287	279	842
5% Discounted Cash Flow		(430)	185	217	282	271	260	785