

RETURN ON INVESTMENT ANALYSIS OF THE VISN1 TELEHEALTH PROGRAM

A Major Qualifying Project Report:

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by

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ABSTRACT

Telehealth is an online healthcare service for patient encounters, and the New England Veterans Integrated Service Network (VISN1) is one of its providers. As the initial source of funding for VISN1 Telehealth ends in FY14, the project team was requested to evaluate the program's return on investment (ROI). The ROI analysis indicates that Telehealth costs outweigh its financial benefits; however, a multi-attribute analysis reveals that the qualitative benefits outperform Telehealth's associated costs. The team recommends the continued funding of Telehealth.

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AUTHORSHIP PAGE

This group worked collectively to complete this project within the 2013 fall semester. The first term of the project was focused on background research and data collection while the second term was used to complete the data analysis and make final recommendations. The work was split evenly between each member, and the members supported each other throughout the process. In order to effectively complete the project, the analysis was broken up into four sections. Each member of the group focused on a specific section. Kelsey focused on the analysis of the clinic encounter cost, Mike analyzed the staff salary and training cost, Adam analyzed the travel reimbursements, and Madalyn evaluated the intangibles. The group collaborated in order to accomplish the goal of the project.

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1 INTRODUCTION

At the end of FY14, VISN1 will no longer receive funding from VHA Transformation Initiatives for their Telehealth modality program. As a result, VISN1 medical facilities will have to begin funding the program in order for its continued use in the facility's Community Based Outreach Centers in the future.

This project team led VISN1 and its associated New England VERC's efforts in conducting a return on investment analysis and overall benefit analyses for the Clinical Video Telehealth (CVT) and Store and Forward (SF) Telehealth modalities. We based these analyses on data that was previously collected and stored within the VHA intranet of databases as well as previously conducted case studies.

The team, in collaboration with VISN1, defined the scope of this project to focus on the top eight CVT clinic encounter types and top two SF clinic types as these represent the majority of those used in the Telehealth program within the eight medical facilities.

As an overarching industry, healthcare services strive to ensure the well-being of the public. Healthcare responds to the needs of continued healthy living while ensuring fair financial contributions from both the citizens and government. The United States government established the Department of Veterans Affairs, or the VA, to consolidate all activities affecting war Veterans. The Department of Veterans Affairs operates based on the core values of Integrity, Commitment, Advocacy, Respect, and Excellence. After the government reworked this Veteran service on many different occasions, the Department of Veterans Affairs today has three main branches: Veterans Benefits Administration (VBA), National Cemetery Administration (NCA), and the Veterans Health Administration (VHA). The VBA and NCA provide benefits and gravesite maintenance to Veterans, whereas the VHA is the sole provider of healthcare services to Veterans.

The VHA is the largest integrated healthcare system in the nation. Its mission is to "Honor America's Veterans by providing exceptional health care that improves their health and wellbeing" (VA New England Healthcare System, 2013a). The VHA houses 152 medical centers and 1400 community-based outpatient clinics (CBOCs), community living centers, Domiciliaries, and Vet Centers. The various medical service facilities collaborate with over 53,000 licensed healthcare practitioners to provide health care services to 8.3 million Veterans each year. The VHA is organized into 21 Veterans Integrated Service Networks, herein referred to as VISNs or networks. These networks are located throughout the United States and are based on region.

This project focuses on the New England Healthcare System, also known as VISN1. VISN1 serves the New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. Within VISN1 are eight medical facilities that have on-site and off-site centers through partnerships with 11 medical centers, 46 CBOCs, six community living centers, and five domiciliaries (VA New England Healthcare System, 2013b). VISN1, like all the other VISNs, receives its funding through a reimbursement program known as the Veterans Equitable Resource Allocation System or VERA. This program annually allocates funds based on a patient classification hierarchy.

The New England Veterans Engineering Resource Center, or VERC, is a division within the New England VISN1 region that applies systems engineering to "improve effectiveness, efficiency, and

reliability of VA operations and healthcare delivery” (Veterans Engineering Resource Center (VERC), 2013). The project team is working with this organization to understand the return on investment and overall benefit of Telehealth, which is an online healthcare service modality introduced to VISN1 in 2011.

One of the main goals of the VHA is to make quality healthcare easily accessible for Veterans. In order to accomplish this goal, the VHA introduced Telehealth, which uses technology to connect patients with a healthcare provider who may be located anywhere in the world. There are three modes of Telehealth: Clinical Video Telehealth (CVT), Store and Forward (SF), and Home Telehealth (HT).

With CVT, patients can see a specialist without traveling to the location of the specialist if there is a closer medical service facility than where the specialist is located. These CBOCs are equipped with video conferencing technology, which allows the patients to be seen by a specialist stationed in a different location (United States Department of Veteran Affairs, 2010). Store and Forward is used to capture and send data, images, sound, and video to a specialist for evaluation. This is similar to CVT in that a patient does not need to travel to the specialist; they can simply visit a CBOC for their encounter needs (United States Department of Veteran Affairs, 2013c). Home Telehealth is used within a patient’s home. Specific conditions require a patient to frequently undergo a health check. Rather than a patient traveling to a medical center for these checkups, HT can be used to monitor a patient’s status in the comfort of their own home (United States Department of Veteran Affairs, 2013b).

In order to assess the Telehealth program, the team developed a methodology. The main problem VISN1 faces is that they will no longer receive funding from VHA Transformation Initiatives for their Telehealth modality program after FY2014. As a result, VISN1 medical facilities will have to begin funding the program in order for it to continue to be utilized in the future.

The team addressed the problem by focusing on seven main tasks:

1. Understand the history of the VHA, the Telehealth program, and the implications of the Telehealth program to VISN1’s operations and operational cost.
2. Identify the Telehealth program’s tangible versus intangible costs and the program’s overall implication to VISN1 operations.
3. Collect all data necessary to complete the analyses.
4. Complete the ROI.
5. Incorporate the ROI calculation into a Multi-Attribute Decision Making Analysis.
6. Design process for future analyses.
7. Report findings on the significance of this program to VISN1 staff.

Quantifying the metrics proved challenging, as some benefits are explicit to dollar savings, while other benefits are quality-based; therefore, the team defined those explicit to dollar savings as tangibles and those relating to quality as intangibles. Tangible variables for Telehealth include the difference in cost of a Telehealth and Non-Telehealth clinic encounter, Veteran travel reimbursements, and Telehealth staffing and training costs. Intangibles include level of access, patient satisfaction, decrease in no-shows, decrease in wait time until encounter, decrease in unnecessary referrals, decrease in hospital admissions, and decrease in days of hospitalization. Defining these two levels of analysis adds clarity and quality to our work.

The team conducted the Return on Investment analysis based on the tangible factors only since these factors directly affect the costs of the program's utilization in the medical facilities. Intangible benefits are generally difficult to quantify in medical return on investment analyses, but are often the difference between a successful project and a failed project. Our team recognized the importance of the intangible data as well and used the Multi-Attribute Decision Making Analysis (MADMA) to quantify and evaluate the intangible and tangible Telehealth benefits.

For the tangible factors listed above, the group analyzed Telehealth's 2013 data in order to understand the benefits of the program and how they measured up to the costs of implementing the technologies. One year is a normal measurement of a program's level of success within the VISN1, and 2013 is considered the most thorough set of data, given that it is Telehealth's most utilized period of service. Some assumptions needed to be made in order to make the analysis possible, including a standard Telehealth CBOC versus MC reimbursement rate, a standard training cost, and a standard attrition rate across the VISN1. In addition, some of the primary data sources that would have helped the group analyze the total benefits, including fee basis encounters at third party clinicians and time studies of Telehealth savings, could not be collected. As a result, the team used previous case studies that were primarily conducted outside of the Department of Veterans Affairs that correlate to the program's intangibles.

Overall, a strictly financial return on investment would demonstrate that the program may not worth continuing on an individual medical facility source of funding. In total, the 2013 variables that we were able to collect on travel, staffing, training, and encounter data weigh out at a cost of \$4,551,576.17, as the only direct benefit is the travel savings experienced through CBOC Telehealth encounters. The program likely experiences more savings through the avoidance of extra time per encounter and paying reimbursement to fee basis providers; however, the intangible factors and their benefits illustrate the importance of continuing the Telehealth program in VISN1.

As we concluded our final calculations for the ROI of Telehealth, we began to connect the Multi-Attribute Decision Making Analysis to the calculated ROI in order to make a final recommendation. The intangible or non-monetary factors are critical returns that help VISN1 improve upon many areas in the entire medical field. Although we classified them as intangible, future studies can be conducted to determine the value of these attributes by quantifying and converting them to measurable values. We realized the importance of these savings and weighted each accordingly.

The results of the MADMA demonstrated that the intangible returns and tangible costs with Telehealth outweigh the Non-Telehealth aggregate scores. These attributes are crucial in the analysis of Telehealth as they measure both the tangible and intangible data, showing how Telehealth matches up to the medical facilities without Telehealth. Important returns from Telehealth include increase in patient satisfaction, decrease in wait time until an encounter, decrease in unnecessary referrals, decrease in hospital admissions, and decrease in days of hospitalization.

Our final recommendation to VISN1 is to continue the funding of the Telehealth program due to the results of the MADMA. As the Return on Investment of the Telehealth program was not high, it is important to consider the added intangible benefits of the program when making this decision at each medical facility. When analyzing the multi-attribute evaluation, we see that the score with Telehealth is much greater than the score without, citing crucial returns allocated using Telehealth. As a result, the team suggests continued funding of this program at all of the medical facilities because the intangible benefits significantly outweigh the tangible costs.

The team also recommended converting Non-Telehealth encounters to Telehealth encounters when the Telehealth encounter costs less. If the medical facility does not have any Telehealth encounters that cost less than Non-Telehealth encounters, we suggest that the facility tries to model one of its offered Telehealth clinic types after a program at a different medical facility that does have its Telehealth encounter cost less. Suggested programs to model are Dermatology or Mental Health for Individuals. This modeling would enable the medical facility to incur some savings from the integration of Telehealth into its services. Additionally, the team also recommends measuring additional intangible factors when conducting future analysis. These intangibles include decrease in patient encounter time, decrease in provider travel time, decrease in hospital readmissions, and staff satisfaction. For future studies, all of the intangibles should be converted to tangibles for a more clear understanding on the costs and benefits associated with the program.

2 LITERATURE REVIEW

Healthcare is defined as “the clinical care, health insurance, new medical research, disease prevention, & drug treatments, among other methods, used to provide physical and mental treatments and maintenance” (Farlex, 2013). Healthcare relies heavily on financial contributions from both people and government; these contributions are primarily from taxes paid by the people to the county, state, or municipality.

2.1 HISTORY OF VETERANS AFFAIRS

With roots back to the war between the Pilgrims of Plymouth Colony and Pequot Indians, a healthcare system that benefits United States Veterans has been at the forefront of our nation’s concerns. Prior to the 1800s, state and communities provided direct medical care to the Veterans. The Federal Government authorized the first national Veteran domiciliary and medical facility in 1811 and expanded the Veteran assistance program to include benefits and pensions later in the nineteenth century. State Veteran homes were also established to provide all treatment for Veteran’s injuries and diseases.

In 1917, upon the United States entrance into World War I, the Federal Government introduced “programs for disability compensation, insurance for service persons and [V]eterans, and vocational rehabilitation for the disabled” to be included in the current Veteran assistance program (About VA.2013). By the 1920s, three different Federal agencies distributed the various Veteran benefits; these agencies were the Veterans Bureau, the Bureau of Interior Department, and the National Home for Disabled Volunteer Soldiers.

The Department of Veterans Affairs, herein referred to as the VA, was established in 1930 under Congressional authorization “to consolidate and coordination of all Government activities affecting war Veterans” (About VA.2013). When the VA was first created, it had “54 hospitals, 4.7 million living Veterans, and 31,600 employees” (Department of Veterans Affairs, 2009).

At the end of World War II and upon its Veterans’ returns, Congress enacted the GI Bill of Rights. This law gave the VA the responsibility of providing education and training, loan guaranty, and unemployment pay to all Veterans; in turn, this new policy positively influenced the Veteran American way of life¹ (The GI BILL's history.2012).

The VA became responsible for operating the National Cemetery System, such as grave marking all national and state cemeteries, in 1973 and soon established a Cabinet-level position in 1989. This position nationally operates to provide programs for health care, burial assistance, and financial benefits (Department of Veterans Affairs, 2009). The VA continues to provide these programs, adhering to President Lincoln’s 1865 inaugural affirmation that the United States must “...care for him who shall have borne the battle and for his widow, and his orphan”(VA New England Healthcare System, 2013a).

¹ This bill was most recently revised in 2008, giving Veterans with active duty on or after 9/1/01 “enhanced educational benefits that cover more educational expenses, provide a living allowance, money for books, and the ability to transfer unused educational benefits to spouses or children” (“The GI BILL's History”, n.d.).

President Obama appointed Secretary Eric K Shineski in 2009 to be the Secretary of Veterans Affairs and transform the traditional VA into a “21st century organization that can better serve Veterans”. This 2009 transformation instigated a number of reconstructive initiatives on a national level as well as strategic goal reassessment. All initiatives were guided to be “people-centric, results-drive, and forward-looking” (About VA.2013).

The VA continues to provide compensation, pension, education, training, medical care, loan assistance, insurance, vocational rehabilitation, and cemetery maintenance to United States Veterans. The VA also researches innovative ways to address areas of Veteran concern and continues to have results that demonstrate “an international reputation for excellence in areas such as aging, chronic disease, prosthetics, and mental health” (Department of Veterans Affairs, 2009).

2.2 VA ORGANIZATIONAL STRUCTURE

The Department of Veterans Affairs operates on five core values: Integrity, Commitment, Advocacy, Respect, and Excellence. These core values, representing the acronym known as I CARE, “influence [the VA] mission, strategy, and day-to-day operations”, guiding how everything else is built within the organization (VA New England Healthcare System, 2013a). The VA operates three branches that provide different benefits to United States Veterans. These three branches are the Veterans Benefits Administration (VBA), National Cemetery Administration (NCA), and the Veterans Health Administration (VHA). In 2012, the VA had a \$205.2 billion spending, with \$151.6 billion, \$194 million, \$53.4 billion allocated to the VBA, NCA, and VHA respectively (VA New England Healthcare System, 2013a).

2.2.1 VETERANS BENEFITS ADMINISTRATION

The VBA houses four main offices: Disability Assistance, Economic Opportunity, Field Operations, and Strategic Planning. These offices provide oversight for Veteran “disability assistance, economic opportunity, field operations” as well as VA “strategic planning, management, resource management, and performance analysis and integrity” (About VBA.2013). Each office’s responsibilities are depicted in Figure 1.

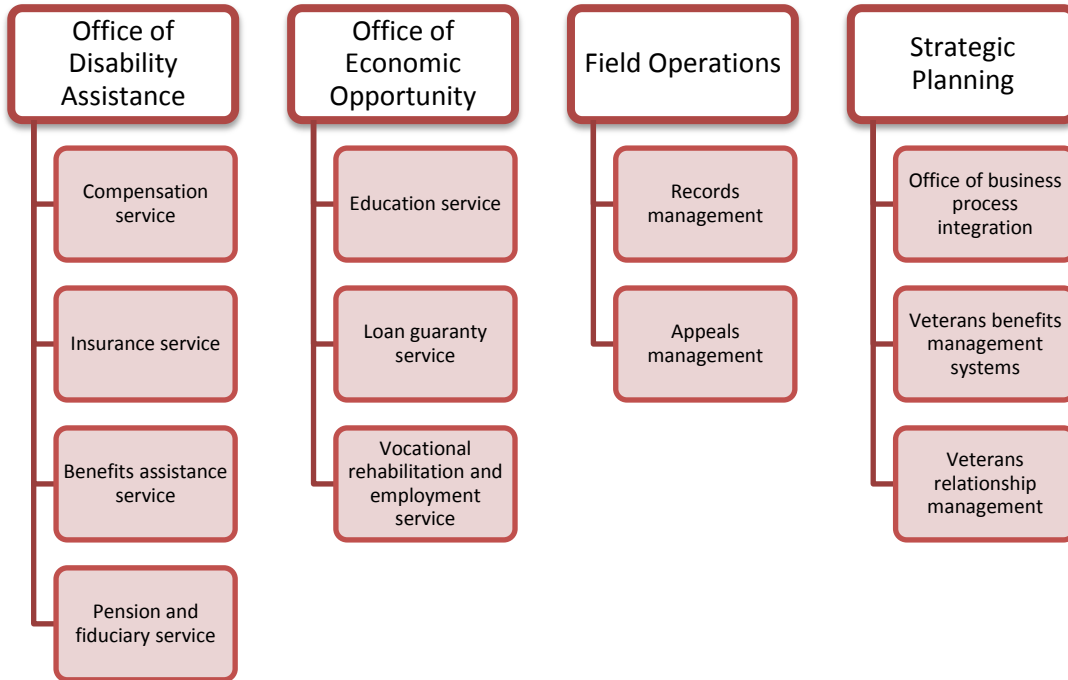


FIGURE 1: VBA STRUCTURE

The VBA provides compensation and pension benefits to four million in Veterans and their beneficiaries. In 2010 alone, there were one million claims from Veterans for disability benefits; and the VBA processed 97.5% of these claims (Department of Veterans Affairs, 2011).

2.2.2 NATIONAL CEMETERY ADMINISTRATION

The NCA operates five memorial service networks centered in Atlanta, Denver, Indianapolis, Oakland, and Philadelphia respectively. This division of the VA aims to “honor Veterans with final resting places in national shrines and with lasting tributes that commemorates their service to our Nation” (Department of Veterans Affairs, 2013). In 2009, the NCA maintained three million gravesites at 165 properties (Department of Veterans Affairs, 2011).

2.2.3 VETERANS HEALTH ASSOCIATION

The VHA is the largest integrated healthcare system in the nation. Its mission is to “Honor America’s Veterans by providing exceptional health care that improves their health and wellbeing” (VA New England Healthcare System, 2013a). The VHA houses 152 medical centers and 1400 community-based outpatient clinics (CBOCs), community living centers, Domiciliaries, and Vet Centers. The various medical service facilities collaborate with over 53,000 licensed health care practitioners to provide health care services to 8.3 million Veterans each year. General services include surgery, critical care, mental health, orthopedics, pharmacy, radiology, and physical therapy. Some facilities offer audiology and speech pathology, dermatology, dental, geriatrics, neurology, oncology, podiatry, prosthetics, urology, and vision care services as well (About VHA.2013).

The VHA is organized into 21 Veterans Integrated Service Networks². These networks are located throughout the United States and are based on region (Figure 2).

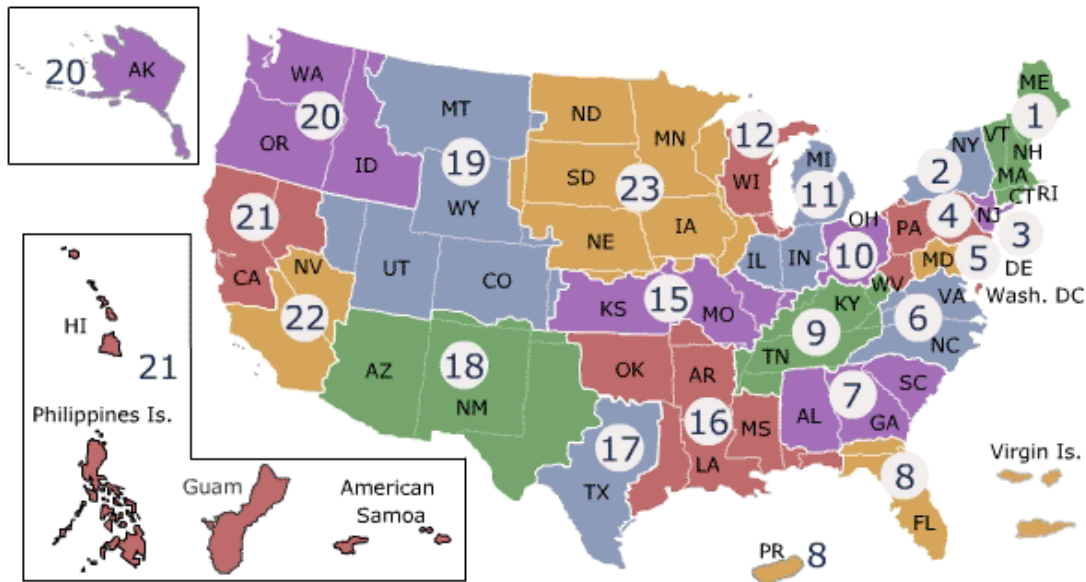


FIGURE 2: UNITED STATES VISN STRUCTURE (VETERANS HEALTH ADMINISTRATION.2010)

Each VISN is responsible for developing their own vision and for managing internal operations to meet Veteran Administration National requirements (Andren, 2013b). Each VISN operates one or more medical center and CBOC. The center(s) and clinics are “organized in a hub and spoke model, such that one (or more) VA medical center(s) is associated with multiple outpatient clinics distributed throughout the surrounding community for geographic convenience” (Andren, 2013b). These medical centers join forces with one another and their surrounding CBOCs to create what is referred to herein as a medical facility. Figure 3 demonstrates two of the many different scenarios for a facility composition.

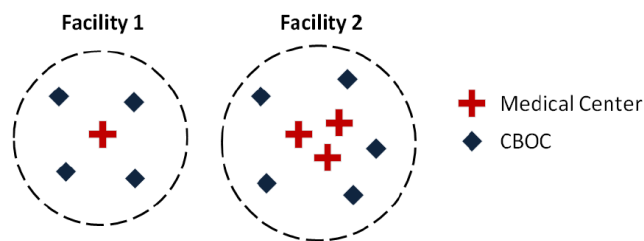


FIGURE 3: POTENTIAL FACILITY COMPOSITIONS (ANDREN, 2013B)

² VISN 13 and VISN 14 merged to form VISN 23 (Andren, 2013b).

2.3 VISN1: NEW ENGLAND HEALTHCARE SYSTEM

This project focuses on the New England Healthcare System, which is also known as VISN1. VISN1 serves the New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. Within VISN1 are eight medical facilities that have on-site and off-site centers through partnerships with 11 medical centers, 46 CBOCs, six community living centers, and five domiciliaries (VA New England Healthcare System, 2013b). Table 1 illustrates each of the eight different medical facilities, their associated medical centers, and the locations of the different CBOCs.

TABLE 1: VISN1 MEDICAL FACILITIES

Medical Facility	Medical Center(s)	Locations of CBOCs
Edith Nourse (Bedford)	Bedford	Gloucester, Haverhill, Lynn
Boston	West Roxbury, Jamaica Plain, Brockton	Boston, Framingham, Lowell, Plymouth, Quincy
Central Western MA	Northampton	Fitchburg, Greenfield, Pittsfield, Springfield, Worcester
Connecticut	West Haven, Newington	Danbury, New London, Stamford, Waterbury, Willimantic, Winsted
Maine	Togus	Caribou, Bangor, Calais, Fort Kent, Houlton, Lewiston/Auburn, Lincoln, Portland, Rumford, Saco
Manchester	Manchester	Conway, Portsmouth, Somersworth, Tilton
Providence	Providence	Hyannis, Martha's Vineyard, Middletown, Nantucket, New Bedford
White River Junction	Vermont	Bennington, Brattleboro, Colchester, Keene, Littleton, Newport, Rutland

VISN1 employs 13,600 staff members throughout its medical facilities in New England. Its staff and contracted providers focus on providing “comprehensive outpatient, inpatient, and extended care” services (VA New England Healthcare System, 2013a). VISN1 has five main service lines, which include primary care, mental health, medicine, surgery, and geriatrics/extended care to enable the network to best serve its stakeholders.

In 2012, VISN1 had 3.2 million outpatient visits from approximately 250,000 unique Veteran patients³ with an expenditure of \$2.1 billion. For 2013, VISN1 has a \$2.45 billion budget, which is allocated to them by the Veterans Equitable Resource Allocation (VERA) system.

2.3.1 VETERANS EQUITABLE RESOURCE ALLOCATION (VERA) SYSTEM

VERA, established in 1997, served to improve allocation methods to the 21 VISNs based on the congressionally appropriated health care funds. This system “was designed to adjust to changes in the geographical distribution of Veterans over time as well as to regional differences in health care needs and the costs of providing care by periodically adjusting allocations” (Asserman, Ringel, Wynn, Zwanziger, & Ricci, 2001). VERA funds are allocated based on a patient classification hierarchy as depicted in Table 2.

³ The total population of Veterans in New England is 950,000.

TABLE 2: VERA PATIENT CLASSIFICATION HIERARCHY (*FACILITY ALLOCATION METHODOLOGY*. 2011)

	Class Number	Price Group	Patient Class	Abbrev. Class Criteria
Non-Reliant	1	1	Employee/Collaterals*	VA employee, collateral
	2		Pharmacy*	No care, exclusively pharmaceuticals
	3		Compensation and Pension (C&P) Exam	POV = "01" and includes Vesting CPT code
	4		Non-Vested Patient	Only OP care, no Vesting CPT for 3yrs
BASIC VESTED CARE	5	2	Other Acute Diseases	Dx
	6		Ear, Nose and Throat	Dx
	7		Endo Nutr Metab Disorders	Dx
	8		Musculoskeletal Disorder	Dx
	9		Central Nervous System	Dx
	10		Cardiovascular Disease	Dx
	11		Gastroenterology	Dx
	12	Pulmonary Disease	Dx	
	13	3	Acute Mental Disease	Dx
	14		Addictive Disorders	Dx
	15	4	HIV+ w/out Anti Retro-Viral Therapy	Clinical Case Registry (CCR)
	16		Legally Blind	Dx
	17		Hepatitis C w/out Anti-Viral Therapy	Dx
	18		Oncology	Dx
	19		Multiple Sclerosis	Dx
	20	5	Medical/Psych+Substance	Dx plus significant workload
	21		CCHT - Chronic Care Management	CCHT CCM asmt & 3 months of CCHT visits
	22		Multiple Sclerosis w/Rx	DX plus specific MS drugs
	23		Psych+Substance Abuse	Dx plus significant workload
	24		Homeless Multiple Medical	Homeless DX plus significant OP workload
	25		Multiple Medical	Dx plus significant workload
	26		History of Transplant	History of transplant
	27	PTSD - Acute	Dx (IP only)	
	28	6	Acute MI	Specific Dx
	29		Metastatic Cancer	Specific primary or sec. dx.
	30		Respiratory Failure	Specific Dx
	31		High Cost Pneumonia	Specific Dx
	32		High Cost Conditions	Specific Dx
COMPLEX CARE	33	7	Hepatitis C with Anti-Viral Therapy	Dx coding w/Rx
	34		AIDS or HIV+ w/ Anti RV Therapy	CCR: AIDS or HIV+w/ARV
	35		Stroke	Inpatient Dx coding in first year
	36		Chronic PTSD	Primary dx 309.8X w/41 BDOC/ Ret. crit
	37		CCHT-Noninstitutional Care	CCHT NIC asmt & 3 months of CCHT visits
	38		Traumatic Brain Injury	Inpatient Dx coding in first year
	39	8	Home-Based Primary Care (HBPC)	10 qualified visits per year
	40		Blind Rehabilitation Service	1 BDOC in BR service (TS= 21)
	41		Residential Rehab. (Domiciliary)	91 BDOC in Dom or RRT
	42		Community Nursing Home	31 PTF BDOC/41 Fee BDOC
	43		Legacy LTC/Intermediate	31 PTF BDOC in Intermediate bed
	44		Skilled Nursing & Rehab	7 to 27 CLC BDOC & specific RUG III
	45	9	SCI Para-old Injury	Primary or Secondary dx
	46		SCI Quad-old Injury	Primary or Secondary dx
	47		Substance Abuse	Primary dx w/180 BDOC
	48		Homeless-CMI	Homeless dx w/15 CMI BDOC 41 Individual
	49		Other Psychosis	Primary dx w/41 BDOC/Retention crit.
	50		Schizophrenia & Dementia	Primary dx w/41 BDOC/Retention crit.
	51		Mental Health Inten. Case Mgt (MHICM)	41 visits to cs 552/ CMI Retent. criteria
	52	10	End Stage Renal Disease	Procedure Codes
53	Short Stay CLC		28 to 90 CLC BDOC and RUG	
54	SCI Para-New Injury/ SCI Instit.		Pri. or Sec. dx or 28 BDOC in TS 22 or CLC	
55	SCI Quad-New Injury/ SCI Instit.		Pri. or Sec. dx or 28 BDOC in TS 22 or CLC	
56	Transplant		Procedure code(s)	
57	Ventilator Dependent		Code 96.72 & 31 BDOC	
58	10A	Long Stay CLC	>90 CLC BDOC and RUG	

VERA’s basic patient care categories comprise 95% of patients in a given year and fall into price groups one through six. Five percent of patients comprise VERA-categorized complex care patients. As VERA only allocates funds on a national level, VISN1 has implemented a way to allocate funds on a facility level based on Patient Weighted Work. Patient Weighted Work (PWW) is a “risk-adjusted workload measure used to quantify patient workload at the facility level” (*Facility allocation methodology*. 2011).

2.3.2 VA HOSPITAL COSTS

Every return on investment analysis has a foundation of studying the basic investments being made for the perceived benefits. In the case of this project, evaluating the basic hospital costs upon which the VA operates unveils the current and future role of the Telehealth program for VISN1.

Hospitals calculate their annual budgets based on operational needs, typically based on previous years' spending trends and forecasted expenses. For the Department of Veterans Affairs, being a government-funded agency provides more stringent adherences to capital management. VISN1 establishes an annual strategic financial goal based upon a validated capital formula, taking into account both the volumes and complexities found at each service location (VA New England Healthcare System, 2013a).

VISN1 then distributes the budget by splitting the total funding per medical facilities, where it calculates respective floors and ceilings for the next twelve months of operations. Total operating plans are submitted for proper data centralization, while monthly updates are given towards matching or fluctuating monetary patterns to the set boundaries. Deficits are handled with identifiable action items, which aim to minimize deficits or unplanned surpluses (VA New England Healthcare System, 2013a).

As it stands, the FY2013 budget for the VA hospital system nationwide is \$140.5 billion, which is 4.5% over their FY2012 annual budget (Andren, 2013a). The total VA funding has grown in 2014 by 58% from 2009 (Veterans Affairs, 2013). Specifically, the Telehealth program within the VISN1 has received approximately \$21 million, with the third and final year of guaranteed VERA and VHA Transformation Initiatives funding amounting to \$7,498,310. This funding has gone toward staffing the program, while \$22,279 has been requested to cover travel expenses. VERA did not fund maintenance and new equipment for Telehealth in 2012; however, VHA Transformation Initiatives did and will continue to do so after FY13. Critical financial success factors in this project include additional equipment, staffing, and patient need as the program only finds returns on investment if the equipment and its technological capabilities are leveraged (VA New England Healthcare System, 2013b).

In the FY2014 plans, the total budget number nationally stands at \$152.7B as shown in Figure 4. This budget covers the healthcare, benefits, and memorial services honored to Veterans (Crowley, 2012; VA New England Healthcare System, 2013b).

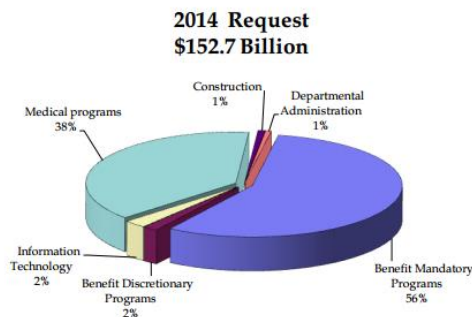


FIGURE 4: FY14 VA BUDGET REQUEST (CROWLEY, 2012)

The Department of Veterans Affairs approved a \$120M investment in information technology development in part to support a \$5M push toward the national eBenefits program; however, this was primarily attributed toward continued development of new capabilities to better manage the VA's relationship with its customers. Specifically, a \$250M investment was line-itemed toward rural health initiatives, including Rural Health Resource Centers and the acceleration of telemedicine deployment. As a focus highlight of 2014, the VA has noted Telehealth, as it will become an

advantage to the medical staff employing their services. The goal is to hit 3.5 million users online in the Veterans Relationship Management system, of which Telehealth is a tool, by September 30, 2013, compared to the two million registered online profiles at the beginning of the fiscal year (Veterans Affairs, 2013).

In the VISN1 specifically, there are about 240,000 patients across New England, which receive healthcare services in the forms of medical center visits, clinical-based operation centers, and now, Telehealth services (Roland, 2013).

2.3.3 VETERANS ENGINEERING RESOURCE CENTER

The New England Veterans Engineering Resource Center, or New England VERC, is a division within the New England VISN1 region that began operating in 2009. In collaboration with academic departments of engineering, the VISN1 Improvement Resources Office, and VA clinicians and staff, the New England VERC applies systems engineering to “improve effectiveness, efficiency, and reliability of VA operations and healthcare delivery” (Veterans engineering resource center (VERC).2013). The New England VERC balances national priorities, VISN strategic goals and needs, and local facility projects to ensure that the New England VERC’s projects are capable of reaching multiple levels of the organization. The New England VERC is one of four VERCs in the United States VHA system.

2.4 TELEHEALTH

One of the VHA’s main goals is to make quality healthcare for Veterans easily accessible. In order to meet this goal, the VHA has introduced a Telehealth expansion. Telehealth is a form of healthcare that uses technology to connect patients and doctors synchronously or asynchronously. Three key Service Lines in medical facility initiatives include access, cost of service, and productivity (VA New England Healthcare System, 2013a). That being said, the purpose of Telehealth resonates in these three criteria being regionally distributed, providing more proactive and frequent information to clinicians and creating more lead time to invasive surgery avoidance.

There are three modes of Telehealth: Clinical Video Telehealth (CVT) which uses videoconferencing, Store and Forward (S&F) uses image capturing, and Home Telehealth (HT) which uses home monitoring (Andren, Nag, Riechel, & Wessendorf, 2012). From these modalities, Telehealth can then be separated into two general types of applications: real time communication such as CVT and HT, or store and forward as done by SF (U.S. Department of Health and Human Services, d). Specific types of treatment, such as podiatry or mental health, are known as “modalities,” and this term will be used frequently from this point forward.

2.4.1 TELEHEALTH, TELEMEDICINE, AND E-HEALTH

Language used throughout healthcare can often overlap and hold different meanings. The distinction between Telehealth, Telemedicine, and E-health is not always clear. “Telehealth is understood to mean the integration of telecommunication systems into the practice of protecting and promoting health, while telemedicine is the incorporation of these systems into curative medicine” (Maheu, Whitten, & Allen, 2001). On the other hand, E-health refers to all forms of electronic healthcare delivered over the internet including information, education, products, and

services whether professional or not. The difference is that E-health is consumer driven while healthcare professionals lead Telehealth and Telemedicine. The one thing these electronic healthcare systems do have in common is their dependence on Health Information Technologies (HIT) (Maheu et al., 2001). The modalities for which this project is concerned are Telehealth modalities used within the Department of Veterans Affairs

2.4.2 TELEHEALTH MODALITIES

2.4.2.1 CLINICAL VIDEO TELEHEALTH (CVT)

The VA has created many community based outpatient clinics, or CBOCs, in order to limit the distance traveled by patients. Despite these efforts, these clinics do not offer all of the same specialty services as the regional medical center such as cardiology, neurology, or psychology. Rather than sending the patient to the regional medical center, CVT has made it possible for patients to see a specialist without as much travel. These CBOCs are properly equipped to videoconference using different forms of Telehealth technologies.

This project focuses on the top eight CVT modalities used within the New England Veterans Healthcare network. These modalities are as follows: Mental Health for Individuals, MOVE Program⁴, Physical Therapy, Mental Health for Groups, Amputation Clinic, Podiatry, Substance Abuse Disorder for Groups, and Nutrition/Dietetic Screening for Individuals.

2.4.2.2 STORE AND FORWARD (S&F)

For some healthcare fields, clinical visits are required for areas such as radiology, dermatology, and diabetes examinations. Similar to CVT, rather than traveling to a specialist, S&F has made it possible for clinical information to be stored and forwarded. Local CBOCs and medical center can capture data, images, sound, and video using this technology and send the information to a specialist at any medical center for evaluation.

This project focuses on the top two SF modalities used within the New England Veterans Healthcare network. These two modalities are Dermatology and Pulmonary Function.

2.4.2.3 HOME TELEHEALTH (HT)

Patients with conditions such as diabetes, chronic heart failure, chronic obstructive pulmonary disease, depression, or post-traumatic stress disorder are often moved into nursing homes in order to have their symptoms checked frequently. Home Telehealth has made it possible for these patients to remain living independently. The patients are trained on how to use the devices and check their symptoms on their own. The device is directly connected to a VA hospital through the patient's telephone lines. The patient's primary physician can then assess the symptoms and offer feedback without the need for the patient to enter the hospital (United States Department of Veteran Affairs, 2013b).

Between July 2003 and December 2007, the VHA introduced Care Coordination/Home Telehealth (CCHT), which is a program that combines home Telehealth and disease management technologies

⁴ TeleMOVE, which stands for Managing Overweight and/or Obesity in Veterans, is an initiative to help Veterans attain a healthy weight by examining behavior, physical activity, and nutrition

(Darkins et al., 2008). The VHA's computerized patient record system (CPRS) has allowed Veterans with chronic conditions to progress from hospital care to home care.

Currently 40% of Veterans have become members of the CCHT; with each enrollment, the member is assigned a care coordinator/nurse (Darkins et al., 2008). The care coordinator then evaluates the members based on their condition and technological skills to determine the most appropriate device. The patient and caregiver are then trained on how to use the devices such as videophones, messaging devices, digital cameras, and/or telemonitoring systems. These devices allow care coordinators to remotely monitor the Veterans' health status while at home.

CCHT promotes self-management and disease management with virtual visits. Between 2000 and 2003, VISN8 decided to test the use of this new Telehealth program. VISN8 implemented the program in 7 hospitals, 10 outpatient clinics, and 28 CBOCs. The results of the pilot showed a 40% reduction in emergency room visits, a 63% reduction in hospital admissions, an 88% reduction in days of home bed care, and finally, a 94% level of patient satisfaction (Darkins et al., 2008). Currently the CCHT program is available at 140 VHA medical centers (Darkins et al., 2008).

This project does not include Home Telehealth in its analysis as the VISN1 has already conducted a Return on Investment analysis for the program. Additionally, its administration to Veterans is very different from how CVT and S&F are administered within CBOCs and MCs.

2.4.3 CASE STUDIES

2.4.3.1 CASE STUDY 1: TELEDERMATOLOGY PATIENT SATISFACTION IN THE PACIFIC NORTHWEST

In July of 2009 SF Teledermatology was implemented in VISN20 (Hsueh, Eastman, McFarland, Raugi, & Reiber, 2012). In order to evaluate the implementation, patients were surveyed to compare Teledermatology with face-to-face care.

In July 2009, up to 23 clinics within VISN20 were utilizing Teledermatology. The Teledermatology survey was administered over the phone after the patients received Teledermatology care. The target population was 2,641 and the goal was to survey 20 to 25 patients within each clinic (Hsueh et al., 2012). Patients were asked questions such as where they received care, how many miles they had to travel, how long they had to wait, overall satisfaction, and whether they preferred teledermatology or face-to-face care. The surveys were then scored on a five point scale.

A random sample of 631 participants was selected; and of this selection, 504 completed the survey. The results of this survey determined that 66% of veterans that received teledermatology care preferred it over face-to-face care (Hsueh et al., 2012).

2.4.3.2 CASE STUDY 2: CLINICAL VIDEO TELEHEALTH IN A CARDIOLOGY PHARMACOTHERAPY CLINIC

In December of 2010, the West Palm Beach Veteran Affairs Medical Center (VAMC) integrated the use of CVT into the cardiology clinic. The goal was to improve patient access to the cardiology clinic. Records were kept of patients receiving Telecardiology care as well as those not utilizing CVT. By November of 2013, 236 patients had utilized Telecardiology. The no show rate for CVT encounters was 4% while the no show rate for face-to-face encounters was 10%, which is a 60% decrease in no shows (Coakley, Hough, Dwyer, & Parra, 2013).

2.4.3.3 CASE STUDY 3: WALK-IN TELEMENTAL HEALTH CLINICS IMPROVE ACCESS AND EFFICIENCY: A 2-YEAR FOLLOW-UP ANALYSIS

The Otis R. Bowen Center for Human Services is a non-profit community mental health center which serves nine sites within five counties in northeast Indiana. Among these nine were a total of 500 staff (Neufeld, 2013). This often resulted in providers traveling to multiple sites a week.

In 2009, the Bowen Center received funding from the Indiana Rural Health Association. The goal was to utilize telemedicine networks in rural areas of Indiana in order to increase access to mental healthcare (Neufeld, 2013). Two of the most rural areas served by the Bowen Center were chosen to implement telemental health clinics.

With the implementation of the Telemental Health program, providers were able to connect with patients using CVT. This allowed providers to stay on site and see more patients a day. Due to this increase in efficiency, scheduling became more flexible; and the Bowen Center was able to offer walk-in encounters for telemental visits.

Data was collected over a two year period and examined patients' access to care. Access was evaluated based on time to first service, which is equal to the time between the first request for service and the days until the patient actually received service. Shorter times indicated better access and quality. During the two years of the study, 350 patients experienced telemental care. The study revealed that the days to first service when using telemedicine was 19.1 while those using face-to-face care had 33.1 days to first service (Neufeld, 2013).

2.4.3.4 CASE STUDY 4: TELEPULMONOLOGY: EFFECT ON QUALITY AND EFFICIENCY OF CARE

General practitioners in the Netherlands began utilizing Telepulmonology in 2009. General practitioners used S&F to digitally send patient information to a pulmonologist who then provided advice to aid the general practitioner in diagnosing a patient (Thijssing et al., 2013). The goal of this study was to evaluate the efficiency of Telepulmonology care. When finishing a Telepulmonology consult, general practitioners are required to answer questions as shown in Figure 5 below. The answers to these questions were used to measure the efficiency of Telepulmonology consults, which is represented by the percentage of prevented unnecessary physical referrals of patients to the pulmonologist.

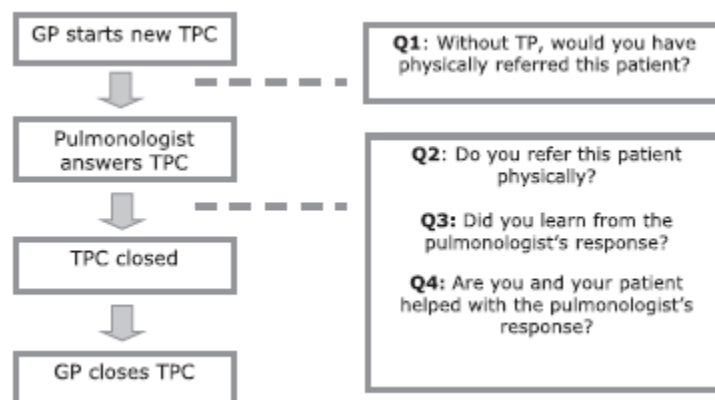


FIGURE 5: GENERAL PRACTITIONER QUESTIONS (THIJSSING ET AL., 2013)

The percentage of prevented unnecessary physical referrals was calculated as shown below. The total number of patients that would have been referred are represented with the answer “Yes” to Q1. The total number of patients physically referred is equivalent to the answer “Yes” to Q2 (Thijssing et al., 2013).

$$1 - \frac{\text{Total number of patients physically referred}}{\text{Total number of patients that would have been referred without Telepulmonology}} * 100\%$$

Data was gathered between April 2009 and November 2012. The results of the study showed that 68% of teleconsultations prevented a physical referral to the pulmonologist. With the implementation of Telepulmonology, 307 patients were referred to the pulmonologist rather than the 420 patients who would have been referred without Telepulmonology. This concludes that 27% of physical referrals were prevented with the use of Telepulmonology (Thijssing et al., 2013).

2.4.3.5 CASE STUDY 5: OUTCOMES OF 98,609 U.S. DEPARTMENT OF VETERANS AFFAIRS PATIENTS ENROLLED IN TELEMENTAL HEALTH SERVICES, 2006–2010

This study assessed 98,609 mental health patients within the VA (Godleski, Darkins, & Peters, 2012). The study compared the number of inpatient psychiatric admissions and days of psychiatric hospitalization before and after the implementation of telemental health services. Patients involved in the study were those that received mental health services using CVT between 2006 and 2010. Mental health services include general psychiatry, substance abuse, and posttraumatic stress disorder units. Long term psychiatric hospitalization and residential treatments were excluded.

The results of the study are shown in Table 3. The results concluded that with the implementation of telemental health services admissions decreased by 24.2% and hospitalization decreased by 26.6% (Godleski et al., 2012).

TABLE 3: COMPARISON OF ADMISSIONS AND DAYS OF HOSPITALIZATION (GODLESKI ET AL., 2012)

Fiscal year	N	N admissions			Days of hospitalization		
		Before enrollment	After enrollment	% decrease	Before enrollment	After enrollment	% decrease
2007	18,137	812	612	24.6	6,829	5,160	24.4
2008	20,738	885	741	16.3	7,772	6,487	16.5
2009	27,075	1,019	625	38.7	9,792	5,536	43.5
2010	32,659	1,232	1,016	17.5	11,139	8,897	20.1
Total	98,609	3,948	2,994	24.2	35,532	26,080	26.6

2.4.4 TELEHEALTH ENTERPRISE

2.4.4.1 TELEHEALTH STAKEHOLDERS

The Telehealth stakeholders are separated into three groups: leadership, partners, and end users. There are three levels of leadership in the Telehealth enterprise. On the national level, the leaders are responsible for setting policies and convincing others to use Telehealth. At the regional level is VISN, which is responsible for providing general direction for the program locally. Finally at the local level are the Quadrad members who lead the facility (Andren et al., 2012).

The Telehealth enterprise consists of two partners. The first partner is the Office of Information and Technology. This office provides the enterprise with a network. The second partner is the national training offices. This office trains the clinicians and technicians to use the different Telehealth programs. The partners train the clinicians and technicians who can then use the equipment and supply health services to the patients.

Finally, the end user is the patients. Each stakeholder is expected to understand Telehealth in order to improve the quality, specifically to the end user. The VHA is focused on providing quality care to Veterans (Andren et al., 2012).

2.4.4.2 FUNDING

Many departments and offices manage Telehealth. At the top of these departments is the U.S. Department of Health and Human Services (HHS). This department created a federal agency called the Health Resources and Services Administration (HRSA). The goal of the HRSA is to improve access to healthcare for those who are uninsured, isolated, or medically vulnerable (U.S. Department of Health and Human Services, a). Within the HRSA is the Office of Rural Health Policy (ORHP). ORHP is dividing into four divisions, each with the role of analyzing policy effects on rural communities. One of these divisions is the Office for the Advancement of Telehealth (OAT). This office supports Telehealth technologies and therefore is a major source of funding for Telehealth. In 2010, the OAT budget was \$11.6 million. (U.S. Department of Health and Human Services, d)

Another major source of funding, specifically for VISN1, is the VHA Transformation Initiatives. VHA Transformation Initiatives started funding Telehealth in October 2011. The funding was set to last for three years and end in September 2014, which is the end of FY2014. For FY2013, VISN1 received \$7,498,310 in VHA Transformation Initiatives and VERA funding (Crowley, Roland, & Goss, 2012).

Today, the VHA Transformation Initiatives has 21 sub-initiatives (VA NW Health Network, 2011); however, originally the initiative focused on five major sub-initiatives (Kamensky, 2010):

1. Creating a “virtual lifetime electronic record” to ensure uniform registration of all military service members, in conjunction with the Defense Department
2. Accelerating a “Telehealth” and home care initiative, primarily for older, chronically ill Veterans in order to keep them out of hospitals
3. Eliminating homelessness among Veterans
4. Self-service devices so Veterans can improve interactions with VA staff, and an integrated “Veterans relationship management” system
5. Developing a human capital plan for strategically managing VA’s staff of nearly 300,000

As a government funded program, the Office of Telehealth Services (OTS) must follow the Federal Budget Process. Each year the office must evaluate their progress following the budget requests and objectives that were defined the previous year. Under the Federal Budget, Telehealth is categorized as discretionary spending, which is defined as spending not required by law (Andren et al., 2012).

The Department of Veterans Affairs spent \$158M in expanding the Telehealth program in 2011 (Andren et al., 2012). Various programs and offices throughout the VA participate in Telehealth funding. The Office of Information and Technology is responsible for telecommunication charges and IT management systems. The Office of Rural Health has funded the expansion of clinics as well

home-based Telehealth care services. Other funding comes from offices such as Public Health, Research and Development, Vet Centers, Patient Safety, and Quality and Performance.

A standard has not yet been set for Telehealth reimbursement policies. Policies vary between states and companies. Reimbursements depend on what is considered valuable by a state or company. Medicare has been working on setting a standard for reimbursing Telehealth services. Currently, Medicare will reimburse for Telehealth services when a patient visits a medical facility such as practitioners' offices, hospitals, and rural health clinics; but the facility has to be located in a Health Professional Shortage Area or outside of a Metropolitan Statistical Area. On the other hand, Medicare will only cover patients that are physically in a medical facility and are using interactive video consultation; therefore, Medicare will only cover CVT (U.S. Department of Health and Human Services, c).

2.4.4.3 TELEHEALTH STRATEGIC PLAN

The value of the Telehealth program is based on the resulting benefits to each stakeholder. For the VISN Executive Teams, the program is designed to increase revenue as well as improve efficiencies in resource allocation. The new technology introduced through the program also benefits the clinicians, who are now vested due to their ability to adapt to the new models of care delivery. Lastly, the Veteran patients have increased access to quality healthcare (Crowley et al., 2012).

In order to procure the benefits of the program, the VHA developed a strategic plan. In 2012, the VHA's main goal was to implement the Telehealth organizational infrastructure. With the support of the Office of Healthcare Transformation, the VHA was able to achieve this goal after \$6.1 million in equipment was installed and more than 70 staff members were employed (Crowley et al., 2012). To introduce the idea of virtual care, such as Telehealth, a goal was set, stating that by October of 2014 at least 50% of unique Veteran patients (United States Department of Veteran Affairs, 2013a) would be receiving virtual care (Andren, 2013b).

For FY 2013, Telehealth has two new goals. The first goal is to have a minimum of 15% of unique patients involved in one of the three Telehealth modalities. The second goal, defined by VHA Transformation Initiatives, is to have at least 98,830 patients encounter Telehealth (Crowley et al., 2012). The following are three main tasks that have been developed to aid the completion of the 2013 goals (Crowley et al., 2012):

1. Expand established Telehealth modalities based on clinical needs assessment data analysis where Telehealth applications can address the gaps in care delivery
2. Implement innovative Telehealth approaches into care delivery using the three main Telehealth modalities (Home Telehealth [HT], Clinical Video Telehealth [CVT], and Store-&-Forward Telehealth [SFT])
3. Devise a system of metrics to evaluate program effectiveness

2.4.4.4 TELEHEALTH DIVISIONS

As illustrated in Figure 6, there are three ways to organize Telehealth care divisions: by modality, geography, and disease. The current Telehealth enterprise strategy is categorized by modality. This means that Telehealth is administered to patients based on which modality the patient uses. Choosing the appropriate management system for the division of Telehealth is essential (Andren et al., 2012).

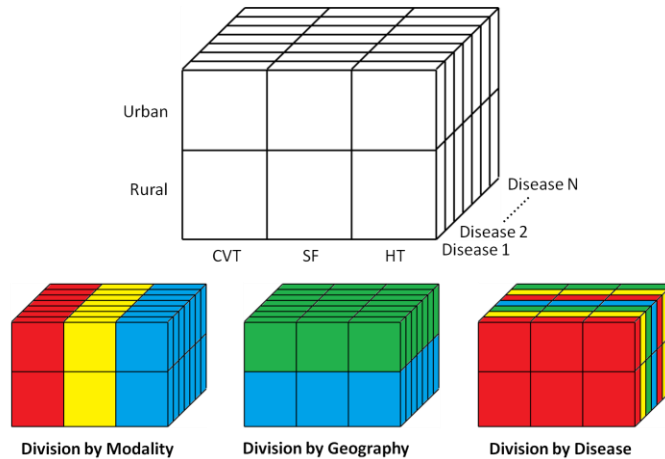


FIGURE 6: TELEHEALTH DIVISIONS (ANDREN ET AL., 2012)

2.4.4.4.1 DIVISION BY MODALITY

There are three different modalities which patients fall under: CVT, S&F, or HT. Each modality utilizes different Telehealth technology, which is why this is one option for care management.

2.4.4.4.2 DIVISION BY GEOGRAPHY

Telehealth is an effective method for increasing access to healthcare as well as reducing the cost of providing healthcare. This is especially true for patients living in rural areas, which is about 32% of VHA patients (Darkins et al., 2008). Medical centers are located in heavily populated regions; therefore, patients living in rural areas often have a longer commute due to traffic and distance. Telehealth reduces travel for patients in rural areas as well as reduces reimbursement costs for the VHA.

Additionally, Telehealth reduces wait time for patients living in urban areas. By offering healthcare at CBOCs as well as at medical centers, there are more opportunities for encounters. This benefits the patients as well as the providers who are now under less pressure (Andren et al., 2012).

2.4.4.4.3 DIVISION BY DISEASE

Division by disease focuses on the different needs of patients depending on their disease, such as diabetes, depression, or post-traumatic stress disorder. Based on the disease the care required can then be administered. Based on the care needed, the patient would then be paired with an available physician in that department. Patients would not be limited to one physician and could therefore have multiple consultations with physicians in different departments if needed. Division by disease would improve the overall quality of the patients visit as well as decrease the patients wait time to see their necessary physicians.

2.4.4.5 TELEHEALTH IMPLEMENTATION

Stakeholder commitment, from leaders to end users, is necessary in order for the implementation of Telehealth to be successful. Implementation of Telehealth at the VHA has centered on leadership and culture, reengineering existing processes, and training the Telehealth workforce (Broderick, 2013).

Pilots played a major role in the implementation of programs throughout the VHA. Programs are used and tested on a smaller scale to work out the clinical, technology, and business aspects of each program. When introducing programs, the VHA forms the process around existing processes; this reduces the overhead cost as well as the efficiency of the program (Broderick, 2013).

Training has been one of the most crucial aspects in the implementation of Telehealth. Because there are no formal Telehealth certifications, the VHA has established a national training center (Broderick, 2013). This program would not benefit Veteran patients without appropriately trained care providers. These care providers must understand the program and the technology used throughout the program (Crowley et al., 2012).

There are four main training centers, which specialize in different Telehealth departments. The first training center is the Rocky Mountain Telehealth Training Center, which offers educational programs such as the Facility Telehealth Coordinator and VISN Lead Intensive program. The second center is the Boston Telehealth Training Center, which focuses on Teledermatology Growth. Teledermatology is the next Store-and-Forward program to be deployed nationally throughout the VHA. This center will provide training for Teledermatology imagers and clinical technicians (VHA Telehealth Services, 2011). Home Telehealth trainings are offered at the third training center, the Sunshine Telehealth Training Center. This center has courses to train lead coordinators, care coordinators, and support staff involved in Home Telehealth. The fourth training center is the National Telemental Health Center. This center gives mental health clinicians the opportunity to be trained in remote videoconferencing in order to expand their services to Telemental health (VHA Telehealth Services, 2011).

There are seven major challenges associated with Telehealth: money, definitions, regulations, hype, fear, credentialing and privileging, adoption, technology, success, and evidence. Money is a major aspect of the implementation of Telehealth. As previously discussed, reimbursements have not yet been defined; therefore, it has become difficult for organizations to manage costs. The definition of rural is also a barrier in relation to money. Depending on the definition, some patients may fall out of Medicare coverage (Lustig, 2012).

There are many regulations, which have become a barrier for Telehealth. Licensing regulations limit national Telehealth systems, practice regulations require an in-person consultation before use of Telehealth services, and the Social Security Act limits providers' use of Telehealth (Lustig, 2012).

Hype of these services is another issue. The hype of successful Telehealth services often drowns out the facts about specific services, which are not effective. Telehealth cannot move forward without accepting all the facts and improving the system based upon them.

Another large barrier is fear. Many centers and hospitals do not want patients of other facilities to be seen by a remote provider in their own facility. The centers and hospitals are nervous that they will be liable for these new patients and fear medical malpractice.

Another issue is the credentialing and privileging of hospitals. In order to receive credentials for launching this program, many hospitals must change their bylaws. In addition, it takes a lot of time and money to apply for program privileges. These barriers often deter hospitals from Telehealth participation (Lustig, 2012).

Providers often resist the adoption of Telehealth in order to avoid competition. One type of competition providers want to avoid is technology. Rather than compete over who offers the most unique technology, providers are focusing on simply offering quality services. The success of Telehealth is dependent on avoiding any type of competition. Networks and hospitals should be working together to improve Telehealth services. Finally, in order to improve services, each aspect of Telehealth must first be evaluated. Without the proper evidence, Telehealth services cannot be improved (Lustig, 2012).

Previous evaluations of Telehealth have focused on metrics such as communication, right care, right place, right time, cost, and scalability (Andren et al., 2012). Communication of information throughout the enterprise is a key component of Telehealth. This includes the flow of information from the national office down to the administrators and providers. At the same time, information needs to flow upward, such as feedback from the providers up the national office. Without this flow of communication, Telehealth cannot be improved.

Right place and right time are also very important. Travel distance is one of the key evaluation metrics (Andren et al., 2012). The distance should be short enough to be convenient for the patient. With convenience of travel comes the convenience of time. This includes the time a patient spends under observation before being treated. Right time is also comprised of the time a patient spends waiting to receive care.

When evaluating the cost of Telehealth, there are fixed costs, such as overhead costs, as well as variable costs, such as cost per patient encounter. The final evaluation criterion is the ability to scale Telehealth care delivery. Each year the goal of patients using Telehealth is increased (Andren et al., 2012).

2.4.5 VISN1 TELEHEALTH USE

Telehealth is being instituted across the United States in the Veterans Integrated Service Networks (VISNs). In order to assess the program's integration, performance evaluations must be conducted per each respective VISN. This analysis educates the VISN as to how to best allocate future funds towards specific Telehealth modalities or clinic types after the centralized funding for the program switches over to individual medical facilities funding at the end of FY2013.

Within VISN1, the top ten most frequented clinic types encompass 83.8% of the total Telehealth utilization within 2013. In descending order of frequency, these clinics include Mental Health for Individuals, MOVE Program, Dermatology, Physical Therapy, Mental Health for Groups, Amputation, Podiatry, Substance Abuse Disorder for Groups, Nutrition and Dietetic Screening for Individuals, and Pulmonary Function. Eight of these ten clinic types utilize CVT Technologies. The remaining two, Dermatology and Pulmonary Function, utilize S&F Technologies. These ten technologies are the focus of this project. For each clinic, the total number of encounters in 2013 and percentage of the total Telehealth encounters are outlined in Figure 7. The remaining 38 types of Telehealth clinics will be excluded from this analysis as they do not represent the majority of VISN1 Telehealth uses. From this pool of clinic types, the team has gained an overall understanding of the costs and benefits of the program without spending excessive time on the remaining 16.2% of type of clinics offered through the service.

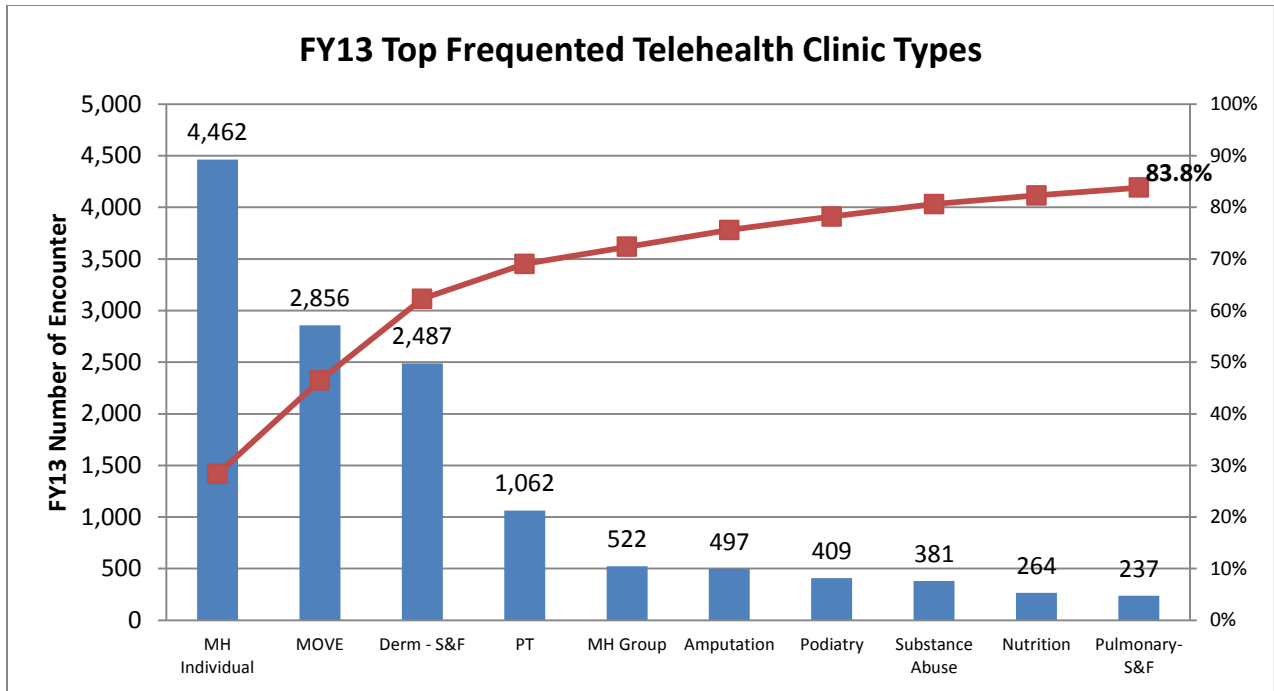


FIGURE 7: TOP FREQUENTED TELEHEALTH CLINIC TYPES

There are two types of clinics, electrocardiograms and diabetic retinal screenings, which have respectively held 12,288 and 2,570 encounters up through Quarter 3 in 2013. These would normally be considered within the top ten most frequented encounter types; however, these two clinics do not have comparable Non-Telehealth encounter types, which are essential to conduct a cost-benefit analysis of the program when comparing Telehealth to not having Telehealth. As a result, the team has excluded these clinics for the purposes of this project.

3 METHODOLOGY

At the end of FY14, VISN1 will no longer receive funding from VHA Transformation Initiatives for their Telehealth program. As a result, VISN1 medical facilities will have to begin funding the program in order for it to continue to be utilized in the future.

This project team led VISN1 and associated VERC's efforts in conducting a return on investment analysis and overall benefit analysis for the CVT and SF Telehealth modalities. We based these analyses on data that was previously collected and stored within the VHA intranet of databases as well as previous Telehealth case studies conducted outside of VISN1.

The team, in collaboration with VISN1, defined the scope of this project to focus on the top eight CVT clinic types and top two SF clinic types as these represent the majority of those used in the Telehealth program within the eight medical facilities. VISN1 also requested that the return on investment analysis only consider quantifiable measures, which are herein referred to as tangibles.

The team addressed the problem statement and all areas of the scope by focusing on seven main tasks:

1. Understand the history of the VHA, Telehealth program, and implications of the Telehealth program to VISN1's operational cost.
2. Identify the program's tangible versus intangible costs and its overall implication to VISN1 operations.
3. Collect all data required to complete the analyses.
4. Complete the Return on Investment analysis.
5. Incorporate the ROI calculation into a Multi-Attribute Decision Making Analysis.
6. Design desired process for future analyses.
7. Report findings and recommendations to VISN1 staff.

3.1 TASK ONE: UNDERSTAND THE HISTORY OF THE VHA AND TELEHEALTH

The first task in the team's methodology was to understand the history of the VHA and its current online service program provided through Telehealth. The team needed to first know how the VHA operated so to better understand the value created from Telehealth.

This task was completed through individual project member research, along with conference calls to several important points of contact in the VISN1. Our team had multiple conference calls with the following individuals:

- Kathleen Crowley, Director of Telehealth
- Preston Roland, Telehealth Programs Specialist
- Stephanie Chan, VISN1 Analyst
- Kyaani Robinson, New England VERC Industrial Engineer

3.2 TASK TWO: IDENTIFY PROGRAM'S TANGIBLE AND INTANGIBLE COSTS

In order to conduct a return on investment analysis and overall benefit analysis, the team identified key factors that provided value to VISN1's operations. The group examined previous return on

investment analyses to gain a better understanding of possible key factors. In addition, the group had multiple conversations with Preston Roland and met with both him and Charles Hillman, a Telehealth Clinical Technician, to understand what specifically influences VISN1 Telehealth operations. Their experiences offered insight as to what factors are essential. Additional conversations with Professors Konrad and Johnson, who have experience in the healthcare field, as well as correspondence with Professor Tulu, who is a Telemedicine health expert provided more insight into the potential intangible factors as well. The team has outlined in Figure 8 the tangibles and intangibles of the Telehealth program for VISN1.

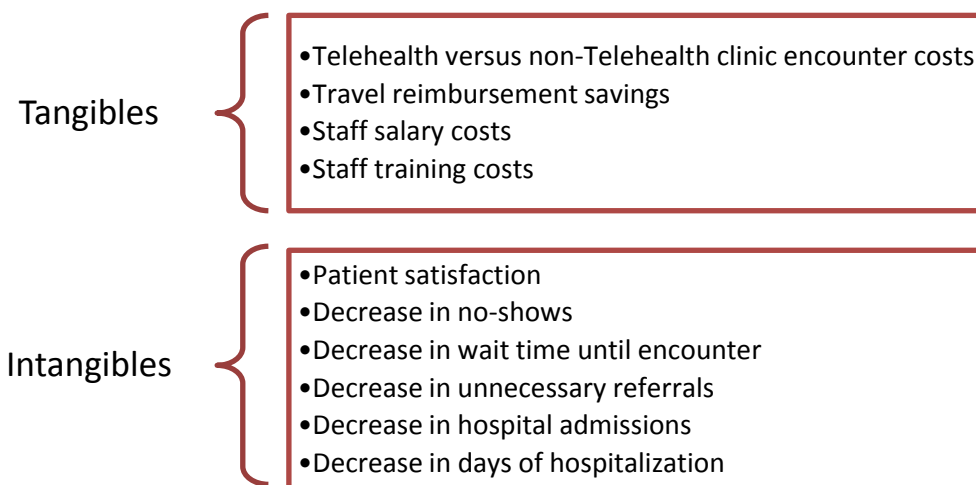


FIGURE 8: TELEHEALTH TANGIBLES AND INTANGIBLES

3.3 TASK THREE: COLLECT DATA REQUIRED TO COMPLETE THE ANALYSES

Once relationships between the project group and the VISN1 staff were established through multiple conference calls, the project team next communicated the data necessary to answer the questions above. This data, as broken down by tangible and intangible, is as follows:

- Tangibles
 - Telehealth versus Non-Telehealth clinic encounter costs
 - Number of Telehealth encounters for each clinic type for each medical facility
 - Number of Non-Telehealth encounters for each clinic type for each medical facility
 - Cost of Telehealth encounter for each type of clinic for each medical facility
 - Cost of Non-Telehealth encounter for each type of clinic for each medical facility
 - Travel reimbursement costs saved when traveling to CBOCs versus medical centers
 - Average mileage reimbursement rates for CBOCs versus medical centers
 - Number of CBOC versus medical center encounters for a given facility
 - Staff salary costs
 - Number of staff designated to support Telehealth in VISN1
 - Number of staff designated to support Telehealth per medical facility
 - Salary levels of each staff member designated to support Telehealth

- Staff training costs
 - Cost of training a new staff member
 - Staff attrition rates
- Intangibles:
 - Patient Satisfaction
 - Case Study 1: Tele dermatology
 - Decrease in no-shows
 - Case Study 2: Telecardiology
 - Decrease in wait time until encounter
 - Case Study 3: Telemental
 - Decrease in unnecessary referrals
 - Case Study 4: Telepulmonology
 - Decrease in hospital admissions
 - Case Study 5: Telemental
 - Decrease in days of hospitalization
 - Case Study 5: Telemental

After meeting with Preston Roland, Stephanie Chan, Kyaani Robinson, and Daniel Clarke, it was determined that the tangible data necessary for this analysis was already collected. All four individuals assisted the team in the gaining access to the data.

3.4 TASK FOUR: COMPLETE THE RETURN ON INVESTMENT ANALYSIS

A return on investment analysis, or ROI, is a performance measure used to evaluate the efficiency of an investment made in a product or service (Return on investment - ROI.2013). The initial step before performing a ROI is to establish a specific project scope and clearly define the returns and costs in the product or service. Once the returns and costs are gathered, the following equation is applied (Return on investment - ROI.2013):

$$ROI = \frac{(Gain\ from\ Investment - Cost\ of\ Investment)}{Cost\ of\ Investment}$$

If an outcome of an analysis shows a negative ROI or the minimum project requirements are not met, the project will lose funding or another alternative investment will be utilized. In our case, we need to assess the values and costs that are associated with Telehealth in VISN1 by medical facility. These returns and costs are not always in the form of monetary value, and many times are intangible entities that either help or hurt the hospital staff and patients.

ROI analyses can be manipulated to fit the analyst's opinions, depending on the assignment of the returns and costs. The project scope and success criteria allow the firm using the analysis to determine whether the returns and costs are valid for accepting the proposed project. ROI is the simplified way of defining the financial returns of an investment. There are many other factors that are imbedded in the simple formula that are needed to determine if the project is worth the investment. There is no one "right" number for ROI; the analysis can be done many times with different results.

The steps to develop a successful ROI analysis include limiting scope and organizing the data findings, establishing measures and stating them before starting calculations, stating the period of

study, and determining financial calculations and formulas to utilize. The foundation of the analysis rests on the determination of the benefits and the costs of the project. These costs may include staff and labor costs, transportation costs, equipment costs, repair costs, training costs, and overhead. For this project, the costs include clinic encounter costs, travel reimbursement savings, and staff salaries, staff training. Defining the necessary expenses may show a firm that they can avoid certain expenditures by choosing one project over another.

3.5 TASK FIVE: INCORPORATE THE ROI INTO A MULTI-ATTRIBUTE ANALYSIS

The ROI only evaluates the impact of Telehealth based on tangibles, such as costs; however, VISN1 expressed the importance of the intangible benefits of Telehealth. Telehealth was chosen to comply with one of the VA's main goals: to become an organization that can better serve Veterans. Due to this mission, the group wanted to evaluate the impact of Telehealth based on all aspects. In order to do this the group needed to use another analysis which would consider both tangibles and intangibles.

There are many different analyses which can be used to evaluate multiple attributes. The group considered the method of Linear Weighted Sum, the Analytic Hierarchy Process (AHP), and the Multi-Attribute Decision Making Analysis (MADMA).

The Linear Weighted Sum method measures the performance of an objective based on one or more different attributes. Attributes are not always measured on the same scale; therefore, they cannot be directly compared. This method converts these attributes into weights which can be compared to one another.

The Linear Weighted Sum method has six steps (Herwijnen, n.d.):

1. Identify the policy alternatives which are to be compared with each other.
2. Identify the effects or indicators relevant for the decision.
3. Assign values to each effect or indicator for all alternatives.
4. Standardization of the scores in order to make the criteria comparable with each other.
5. Weighting of criteria, in order to assign priorities to them.
6. A total score for each alternative is calculated by multiplying the standardized scores with its appropriate weight, followed by summing the weighted scores of all criteria.

There are three major disadvantages when using this method. The first is that there is room for bias when the user is choosing the weights for each criterion. This can greatly affect the results of the analysis. The second disadvantage is the standardization of the scores. Standardization can often dismiss information which may be considered valuable (Herwijnen, n.d.). The third disadvantage is that the attributes use must be independent of one another; therefore, there can be no interaction between them. This can often be difficult to do and limit the attributes considered.

The AHP is a method that allows users to assess multiple criteria against given criteria based on weight. The criteria may include quantitative as well as qualitative information. The method consists of four main steps (Knicker & Kasperczyk, n.d.):

1. Structuring a decision problem and selection criteria
2. Priority setting of the criteria by pairwise comparison (weighing)
3. Pairwise comparison of options on each criterion (scoring)

4. Obtaining an overall relative score for each option

For this method, there are also two major disadvantages. The first disadvantage is that the priority setting of criteria may be subjectively chosen. This is common in many multi-attribute methods. The most significant disadvantage is the use of pairwise comparisons. In a pairwise comparison, a nine point scale is used to score each criterion, one being equally good and nine being absolutely better (Knickel & Kasperczyk,). This method requires the user to decide on a score for each criterion. This can result in objective scores rather than calculated scores which can then lead influence the outcome of the analysis.

The MADMA is used to evaluate options such as designs, systems, products, and processes based on a variety of attributes. This method offers two different possibilities when determining the dimensionality of the problem: compensatory and non-compensatory. Compensatory models collapse information into a single dimension. This type of model uses a common scale and permits changes of one attribute to offset changes in another. The other method is a non-compensatory model. In this model, there are no trade-offs between attributes, “thus comparisons of alternatives must be judged on an attribute-by-attribute basis” (Sullivan, Wicks, & Koelling, 2012).

This method follows four steps:

1. Deciding on attributes
2. Non-dimensional scaling of attributes
3. Additive weighting technique
4. Calculating the final score

The main disadvantage of using this method is the subjectivity of weighing the attributes. The outcome of the MADMA is greatly influenced by the attributes used and the weight/rank assigned to each. These two variables greatly impact the outcome of the analysis. When choosing attributes, it is essential to include attributes which complement each option essential to the program being analyzed.

In order to complete the analysis, the group chose to use the MADMA to give a full evaluation on the overall value of the Telehealth program to the medical facilities. MADMA allows the user to use attributes which may be dependent on one another and also allows the user to calculate the score without a pairwise comparison.

The group decided to use a compensatory model when evaluating Telehealth due to the combination of attributes. The steps outlined in Figure 9 are specific to compensatory models.

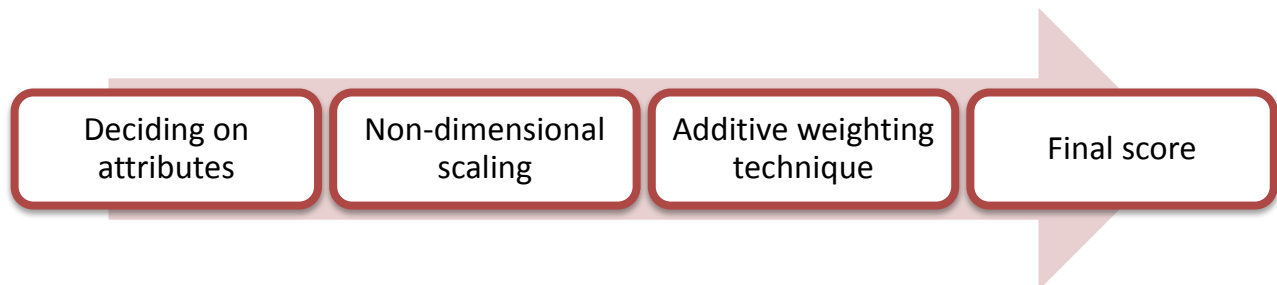


FIGURE 9: MULTI-ATTRIBUTE ANALYSIS STEPS

3.5.1 STEP ONE: DECIDING ON ATTRIBUTES

The attributes used to evaluate the options can be both tangible and intangible. Choosing the attributes is one of the most important steps when using this method. If too many attributes are chosen, the analysis will become unmanageable. On the other hand, if too few are chosen the results will be biased. There are four guidelines to follow when deciding on attributes (Sullivan et al., 2012):

1. Each attribute should distinguish at least two alternatives.
2. Each attribute is independent and captures a unique dimension of the decision problem.
3. The attributes are appropriate to select the best option.
4. The differences in values of each attribute are meaningful and will distinguish between alternatives.

Some common attributes are cost, quality, and flexibility; however, the choice of attributes is dependent on the decision maker as well as the situation.

3.5.2 STEP TWO: NONDIMENSIONAL SCALING

Once the attributes are chosen, a measurement scale must also be selected for each. Attributes such as cost are monetary whereas some intangible data will not directly translate into a value. In order to convert the attributes to non-dimensional values, a common scale must be used. The range and the respect to desirability must be the same. One example of a metric would be poor, fair, good, very good, and excellent. These would then correspond to a number value such as poor=1, fair=2, good=3, very good=4, and excellent=5.

When the most desirable values are larger, the following equation is used:

$$\text{Rating} = \frac{\text{Outcome being made dimensionless} - \text{worst outcome}}{\text{best outcome} - \text{worst outcome}}$$

When the most desirable values are the smaller, the equation below is used instead:

$$\text{Rating} = \frac{\text{Worst outcome} - \text{outcome being made dimensionless}}{\text{worst outcome} - \text{best outcome}}$$

In this case, the desired value is 5, which is equivalent to excellent; therefore, the first equation would be used.

Poor	= (1-1)/(5-1) = 0
Fair	= (2-1)/(5-1) = 0.25
Good	= (3-1)/(5-1) = 0.50
Very good	= (4-1)/(5-1) = 0.75
Excellent	= (5-1)/(5-1) = 1

This calculation is done for each attribute. These equations are also used when making monetary values dimensionless.

If the decision maker were to decide that each attribute was of equal importance, the score could be calculated from the sum of the nondimensional values of each alternative. The alternative with the highest score would then be the best choice. If, however, the decision maker feels that each

attribute is of a difference importance, an Additive Weighting Technique must be used (Sullivan et al., 2012).

3.5.3 STEP THREE: ADDITIVE WEIGHTING TECHNIQUE

The attributes first need to be ranked by importance. The decision maker can choose any scale to rank them. A smaller scale indicates a less significant difference in importance while a larger scale may display substantial differences. Once they are given a relative rank, the normalized rank then needs to be calculated. This is done by dividing the relative rank by the sum of all the relative ranks as follows:

$$\text{Normalized rank} = \frac{\text{relative rank}}{\text{total relative rank}}$$

Additive weighting is a common single dimensional method. It includes both performance ratings and weights of importance.

3.5.4 STEP FOUR: FINAL SCORE

In the last step, the score is calculated. A single attribute score is equal to the rate of an alternative in Step Two multiplied by the normalized rank in Step Three. The total score of an alternative is calculated by summing the individual attributes scores of that alternative. The best option will have the total highest score. (Sullivan et al., 2012)

This method is completely dependent on the decision maker. A decision maker may determine certain attributes to be more useful than others or weigh one attribute of different importance than another decision maker would. These differences could greatly affect the outcome of the analysis.

3.6 TASK SIX: DESIGN A PROCESS FOR FUTURE ANALYSES

Once the project team completed both data analyses for the Telehealth program, we designed the best practice to conduct future return on investment analyses and overall benefit analyses. This process should drive future Telehealth analyses within VISN1 as well as suggest future data collection methods. Additionally, this development will permit VISN1 to have a uniform process approach, simplifying and increasing the accuracy of evaluation criteria and analysis.

3.7 TASK SEVEN: REPORT FINDINGS TO VISN1 STAFF

To conclude, the WPI group presented the findings to the VISN1 Telehealth staff in December 2013. The team also distributed a report to the VISN1 Telehealth staff for a closer look at the team's analyses and findings. The goal of the distribution is to provide support for continued funding of the program by each medical facility.

4 ANALYSES, RESULTS, AND DISCUSSION

4.1 RETURN ON INVESTMENT

In order to conduct the return on investment, the team first analyzed the four tangible costs individually. These tangibles were analyzed per medical facility as well as for the overall VISN. After analyzing each tangible, the team calculated the return on investment for each medical facility and for the VISN as a whole.

4.1.1 ANALYSIS OF TANGIBLES

4.1.1.1 TANGIBLE: CLINIC ENCOUNTER COST ANALYSIS AND RESULTS

The first tangible item that the team must analyze in order to understand the costs and benefits of the Telehealth program is the difference in cost of a Telehealth encounter and a Non-Telehealth encounter. The team must understand this difference to assess the additional cost or savings that the Telehealth program brings to the individual medical facilities as well as VISN1. In order to assess this difference, the team compared the cost of each of the ten Telehealth clinics performed at both Medical Centers and CBOCs to a comparable type of encounter that does not utilize Telehealth.

The team first had to collect data per medical facility about each of the ten clinics for Telehealth and Non-Telehealth encounters. For each clinic type, the team collected the number of Telehealth and Non-Telehealth encounters in the last 365 days and the average cost of the encounter per medical facility. The number of Telehealth encounters from November 20, 2012 to November 20, 2013 can be found in Figure 10 and the number of Non-Telehealth encounters can be found in Figure 11. Tables depicting the actual numbers for each of the clinic types can be found in Appendix I. When looking at Non-Telehealth encounters, the team only reported the encounters and costs at each medical facility where there was a comparable Telehealth encounter and cost for that particular clinic type.

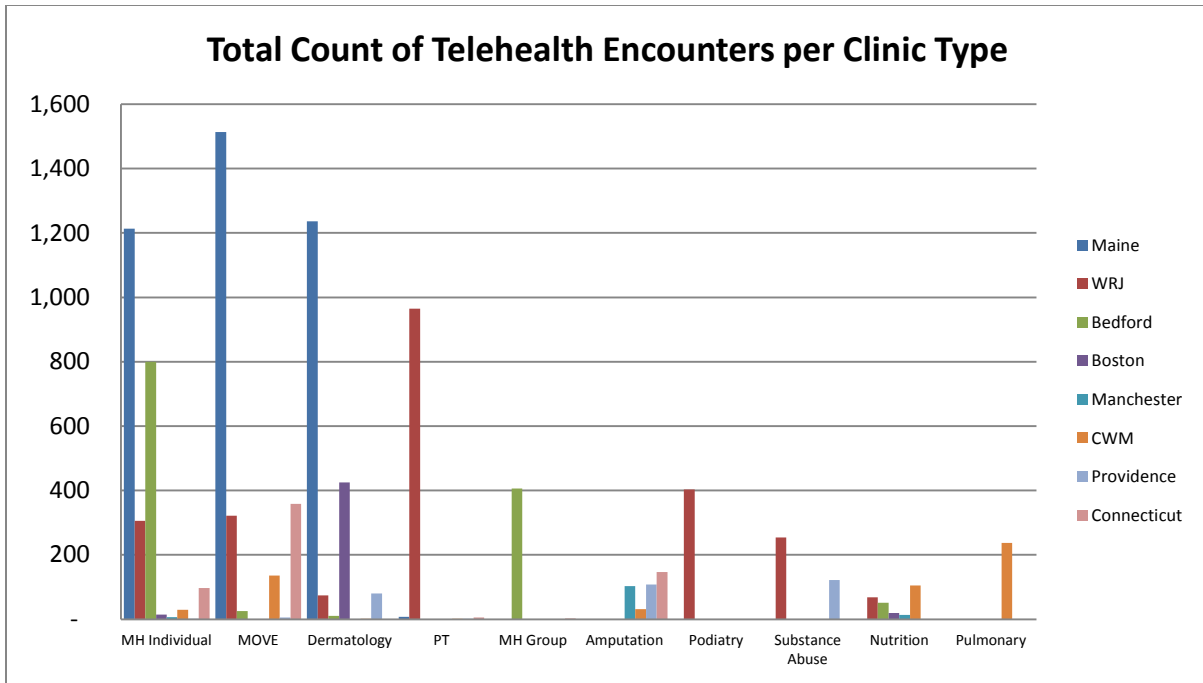


FIGURE 10: TOTAL COUNT OF TELEHEALTH ENCOUNTERS PER CLINIC TYPE

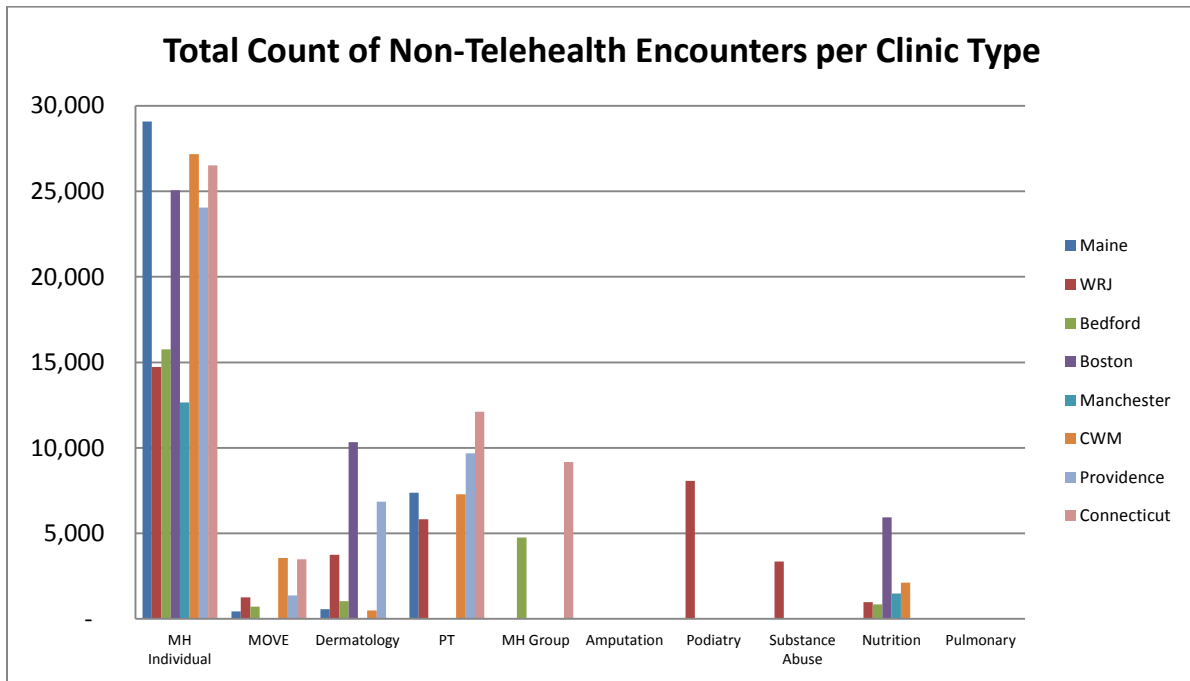


FIGURE 11: TOTAL COUNT OF NON-TELEHEALTH ENCOUNTERS PER CLINIC TYPE

A summary comparison of Telehealth versus non-Telehealth encounters across VISN1 can be found in Figure 12.

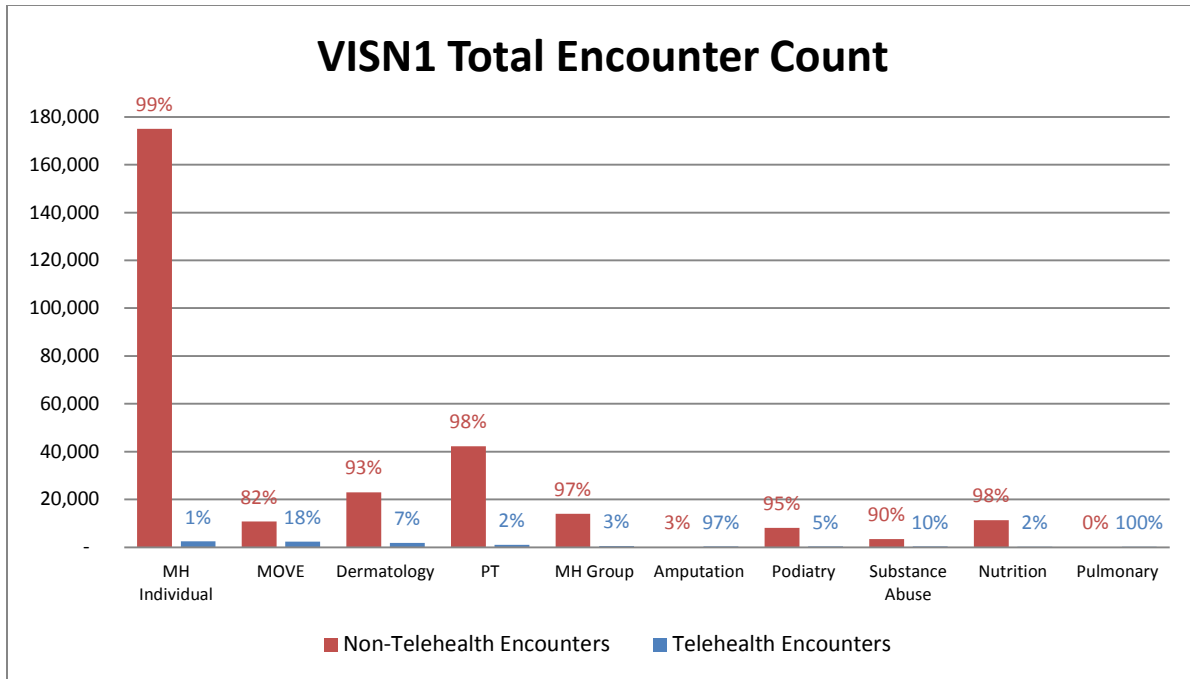


FIGURE 12: VISN1 TOTAL ENCOUNTER COUNT

For all clinic types except for Amputation and Pulmonary Function, non-Telehealth encounters make up the majority of encounters for that particular clinic type. For Amputation and Pulmonary Function, Telehealth encounters account for almost all of the encounters.

By using the SUMPRODUCT and SUM formulas in Microsoft Excel, the team found the weighted average cost for Telehealth and Non-Telehealth clinic encounters for each medical facility as follows:

Average cost of clinic encounter per medical facility

$$= \frac{\text{SUMPRODUCT}(\text{average cost per clinic encounter by secondary stop code; count of encounters})}{\text{SUM}(\text{count of encounters})}$$

This calculation was required as some medical facilities had multiple average costs for a particular clinic as that clinic type was classified further by a secondary clinic type. For each facility, the team calculated the SUMPRODUCT of the count of clinic encounters and average cost per clinic encounter per secondary clinic type; we then divided this result by the SUM of the Clinic Encounters. This calculation outputted the average cost of the clinic encounter for each medical facility. Results of this analysis for Telehealth encounters can be found in Figure 13 and for Non-Telehealth can be found in Figure 14. Tables depicting the actual numbers for each of the clinic types can be found in Appendix II.

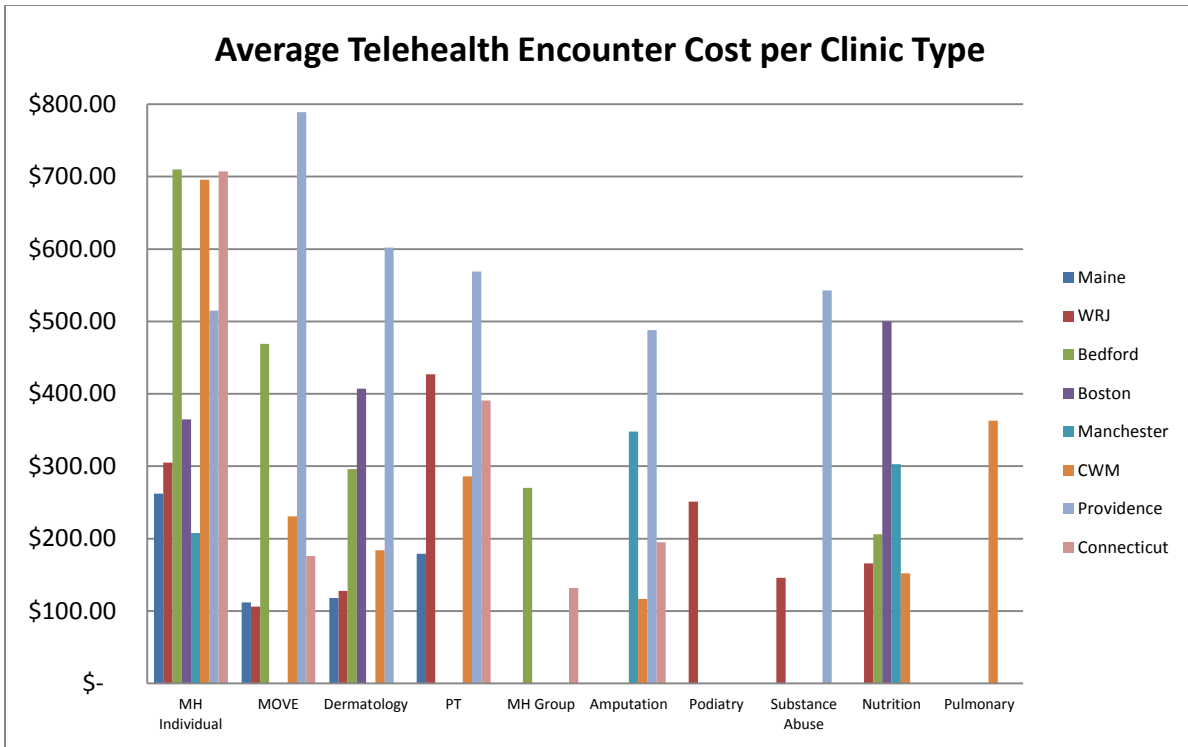


FIGURE 13: AVERAGE TELEHEALTH ENCOUNTER COST PER CLINIC TYPE

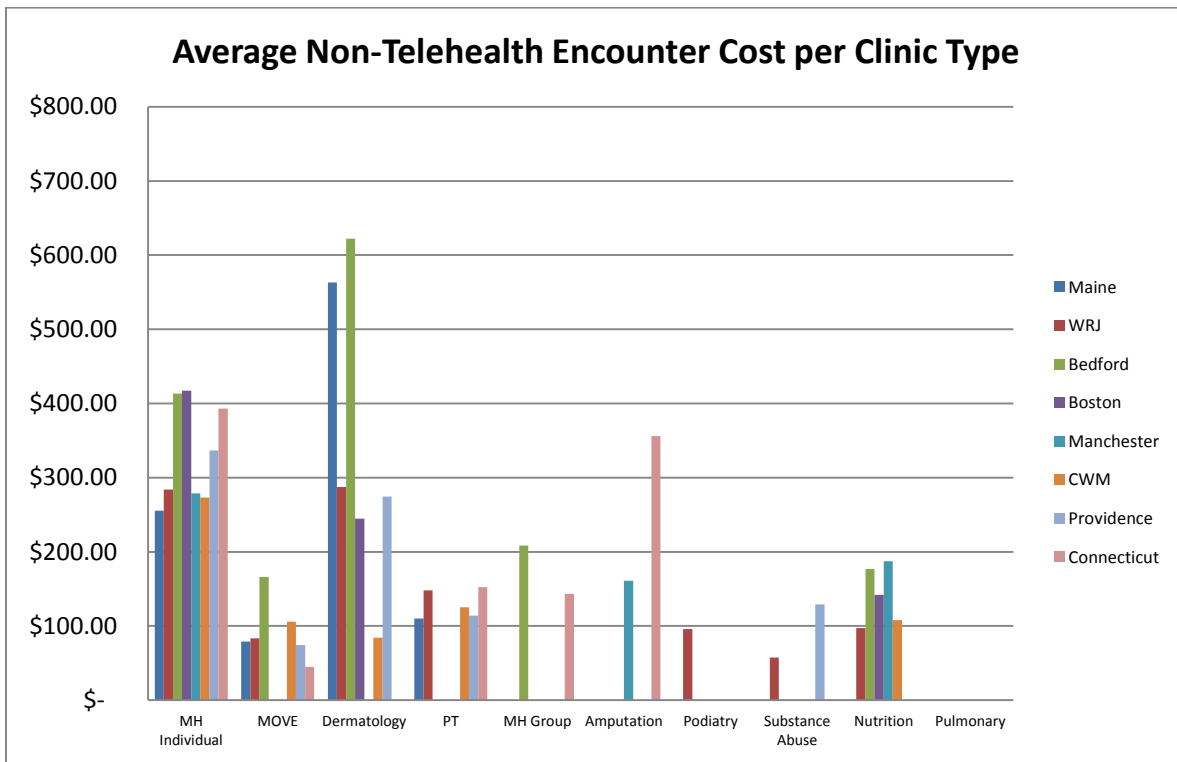


FIGURE 14: AVERAGE NON-TELEHEALTH ENCOUNTER COST PER CLINIC TYPE

The team then found an overall average Telehealth encounter cost for VISN1 and an overall average Non-Telehealth encounter cost for VISN1. The team found these values using the same method followed per medical facility calculation but adjusted the formula as follows:

$$\text{Average cost of clinic encounter across VISN1} = \frac{\text{SUMPRODUCT}(\text{average cost per clinic encounter by medical facility; count of encounters})}{\text{SUM}(\text{count of encounters})}$$

The results of the overall average Telehealth and Non-Telehealth encounter cost can be found in Figure 15. It is important to highlight that the average Telehealth encounter cost for an Amputation clinic is less expensive than a Non-Telehealth encounter. This finding highlights a potential cost savings opportunity if VISN1 is able to convert Non-Telehealth amputation encounters to Telehealth encounters.

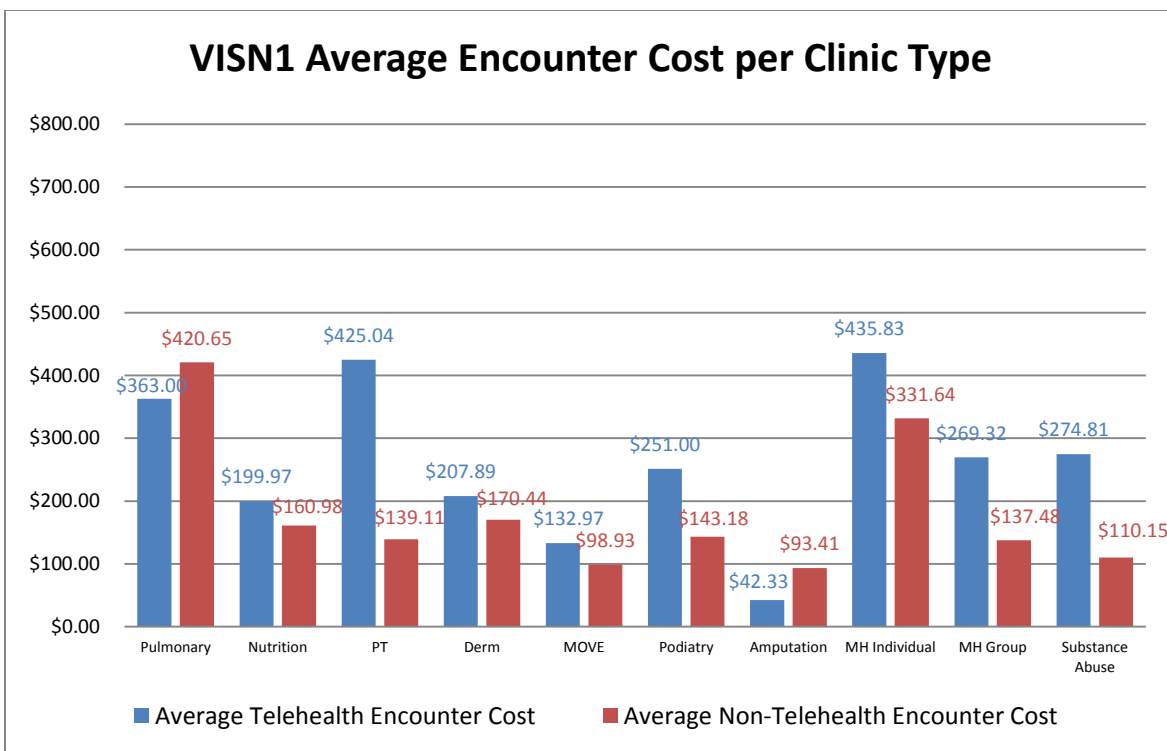


FIGURE 15: VISN1 AVERAGE ENCOUNTER COST PER CLINIC TYPE

For a more detailed visual comparison, the team broke down eight of the ten clinic types' encounter cost to compare the costs at each medical facility. The Pulmonary Function and Podiatry clinics were excluded as these clinics only have Telehealth encounters at the Central Western Massachusetts and White River Junction Medical Facilities respectively and cannot compare their costs across VISN1.

The first clinic type we analyzed further was the Mental Health for Individuals. This service is offered at all of the eight medical facilities as demonstrated in Figure 16. Bedford has the highest Telehealth encounter cost of \$710 whereas Manchester has the lowest encounter cost of \$208. In fact, Manchester's Telehealth encounters cost less than the Non-Telehealth encounters, indicating that this service has allowed a cost savings for the medical facility and offers a potential additional

cost savings opportunity should this medical facility be able to turn over some Non-Telehealth appointments to Telehealth appointments.

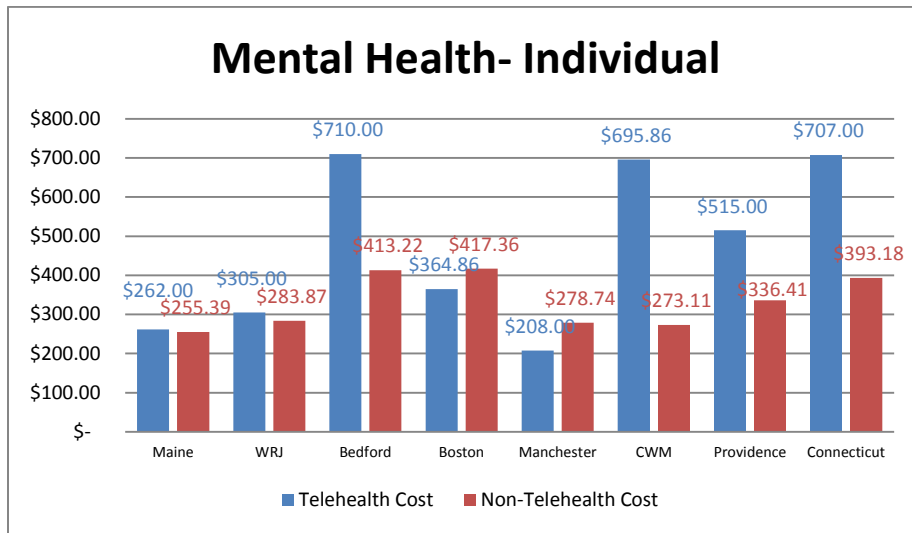


FIGURE 16: MENTAL HEALTH FOR INDIVIDUALS ENCOUNTER COSTS

The team next isolated the MOVE Program clinic encounter costs as demonstrated in Figure 17. All six of the medical facilities have higher Telehealth encounter costs than Non-Telehealth encounter costs, with Providence having the highest Telehealth encounter cost of \$789. White River Junction has the lowest encounter cost of \$106.

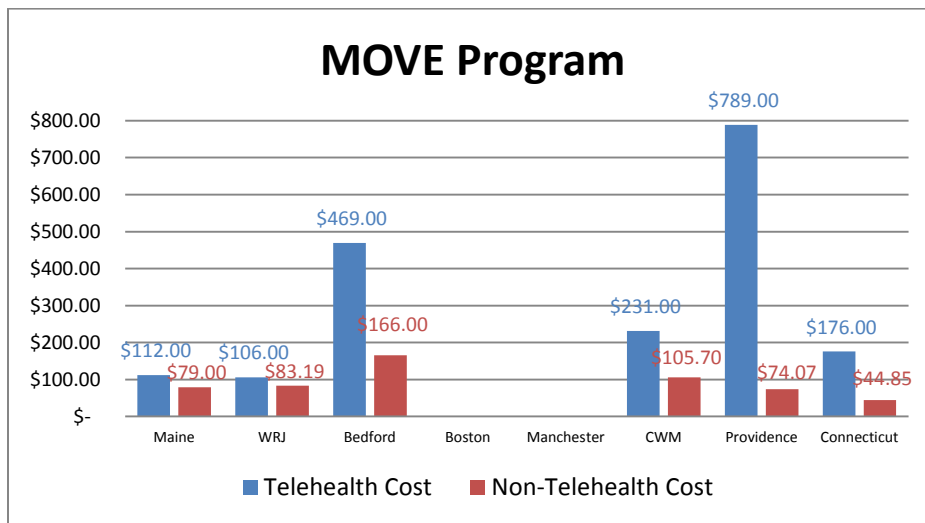


FIGURE 17: MOVE PROGRAM ENCOUNTER COSTS

Figure 18 illustrates the breakdown of encounter costs for the Dermatology clinic type. Out of the six medical facilities that offer this Telehealth service, Maine has the cheapest Telehealth encounter cost of \$118. Providence has the most expensive Telehealth encounter cost of \$602. Something that is important to note about this clinic type is that the Telehealth encounter at Maine, Bedford, and White Rive Junction is less expensive than the Non-Telehealth encounter. This observation demonstrates a cost savings due to the Telehealth program as well as an opportunity for additional

savings if these medical facilities be able to convert some Non-Telehealth appointments to Telehealth appointments.

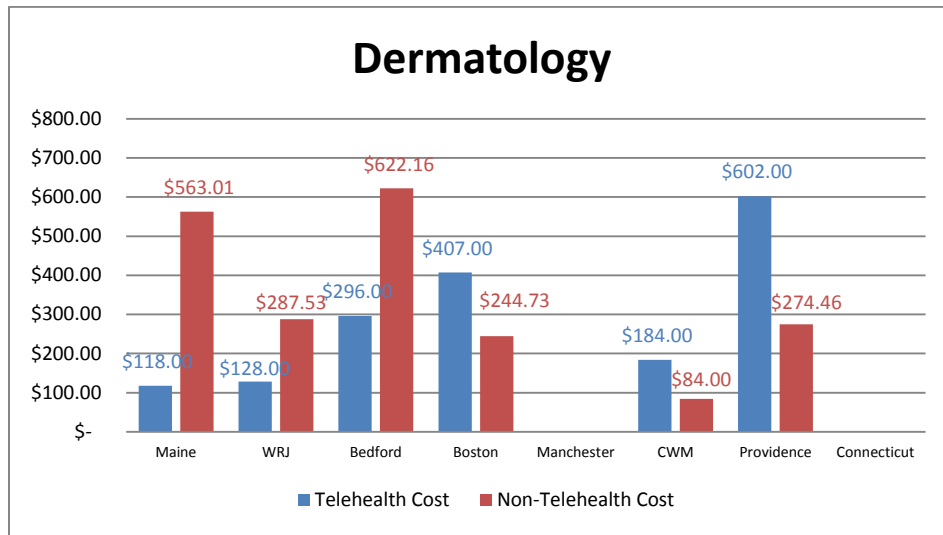


FIGURE 18: DERMATOLOGY ENCOUNTER COSTS

The next clinic type analyzed was Physical Therapy in Figure 19. Five of the eight medical facilities offer Physical Therapy Telehealth services. Providence has the highest Telehealth encounter cost of \$569; whereas, Maine has the lowest Telehealth encounter cost of \$179.00 per encounter.

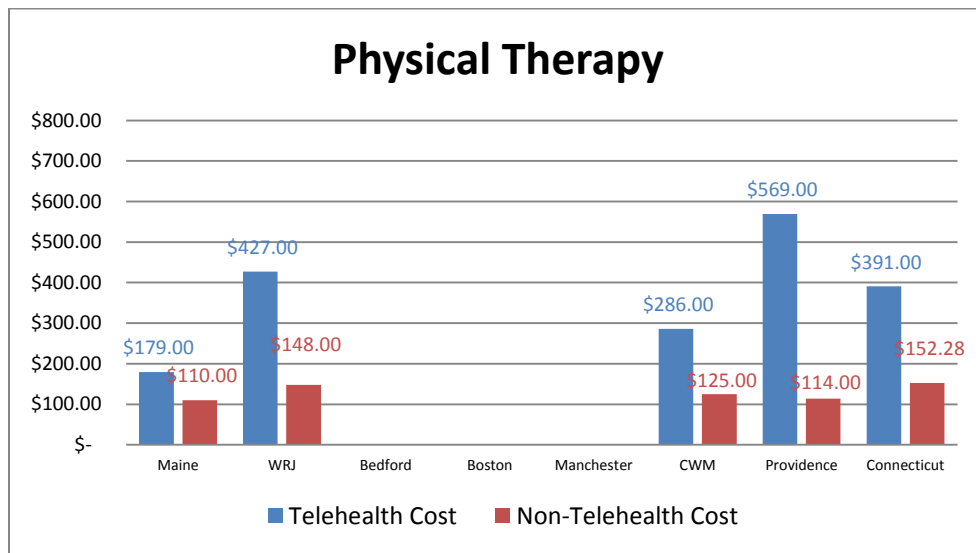


FIGURE 19: PHYSICAL THERAPY ENCOUNTER COSTS

Figure 20 illustrates the encounter costs associated with the Mental Health for Groups Telehealth and Non-Telehealth services. Only two of the eight medical facilities offer this service in VISN1. Connecticut actually offers a less expensive Telehealth encounter than Non-Telehealth encounter, indicating a cost savings due to the Telehealth program and opportunities for more savings if able to convert Non-Telehealth encounters to Telehealth encounters.

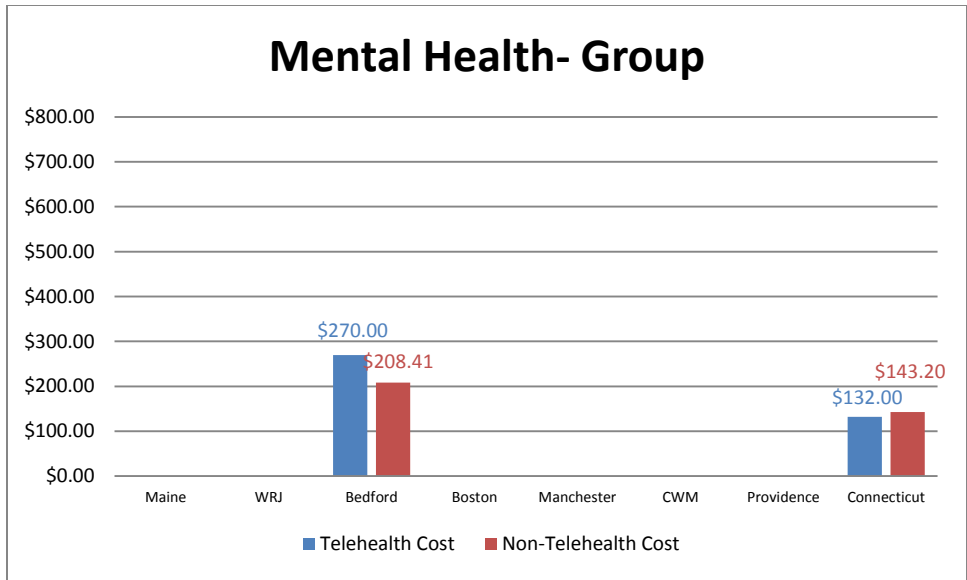


FIGURE 20: MENTAL HEALTH FOR GROUPS ENCOUNTER COSTS

Figure 21 illustrates the costs for Amputation Telehealth and Non-Telehealth clinic encounters. Only four of the eight medical facilities offer this service, where two of the medical facilities only offer Telehealth services opposed to both Telehealth and Non-Telehealth encounters. In addition, the Telehealth encounter cost at the Connecticut medical facility is less than the Non-Telehealth encounter cost, illustrating a savings due to Telehealth and a potential additional cost savings opportunity if more Non-Telehealth encounters are converted to Telehealth.

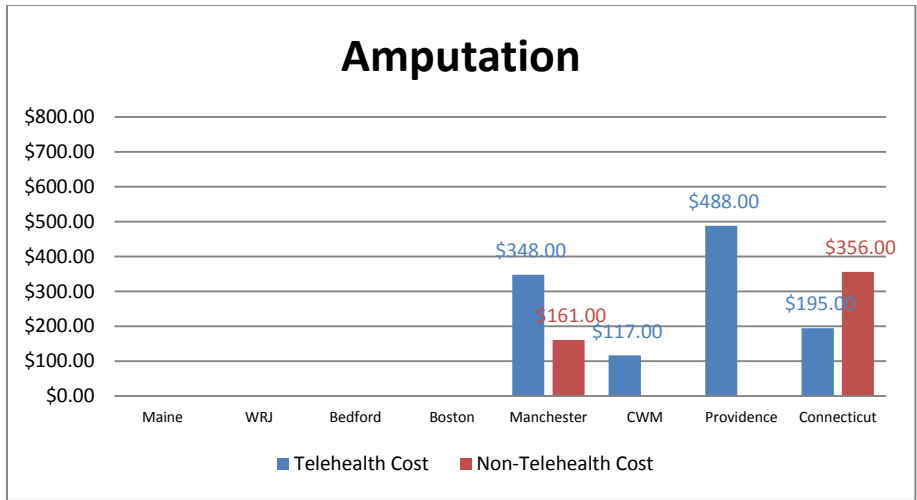


FIGURE 21: AMPUTATION ENCOUNTER COSTS

The next clinic type, which is Substance Abuse Disorder for Groups, is also offered at only two of the eight medical facilities within New England. As illustrated in Figure 22, both medical facilities have high Telehealth encounter costs than Non-Telehealth encounter costs. Providence, once again, has the highest Telehealth encounter cost of \$543.

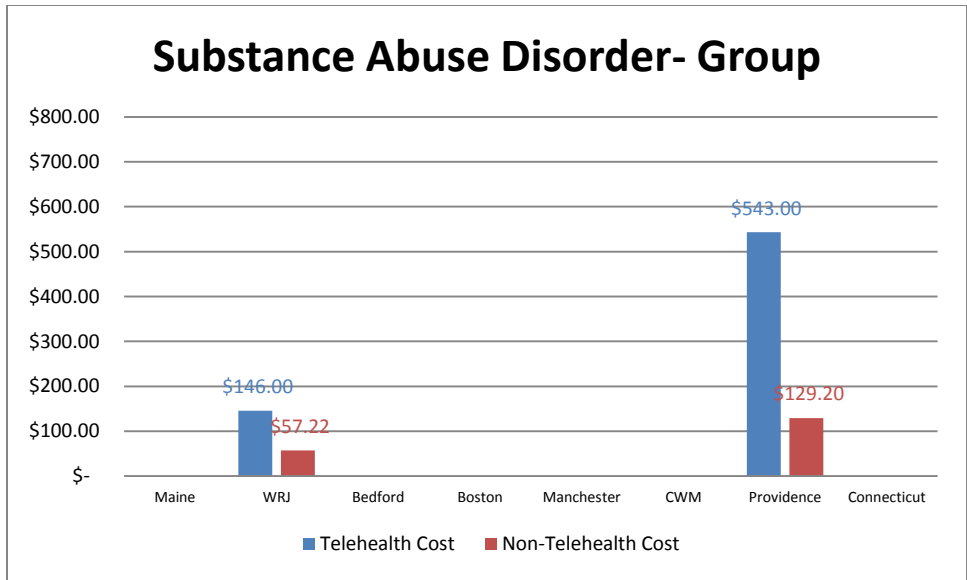


FIGURE 22: SUBSTANCE ABUSE DISORDER FOR GROUPS ENCOUNTER COST

The last clinic type we analyzed was the nutrition/dietetic testing clinic type. Results can be found in Figure 23. Five of the eight medical facilities offer this type of Telehealth service to Veterans. Boston Medical Facility has the highest Telehealth encounter cost of \$500; whereas, the Central Western Massachusetts Medical Facility has the lowest Telehealth encounter cost of \$152.

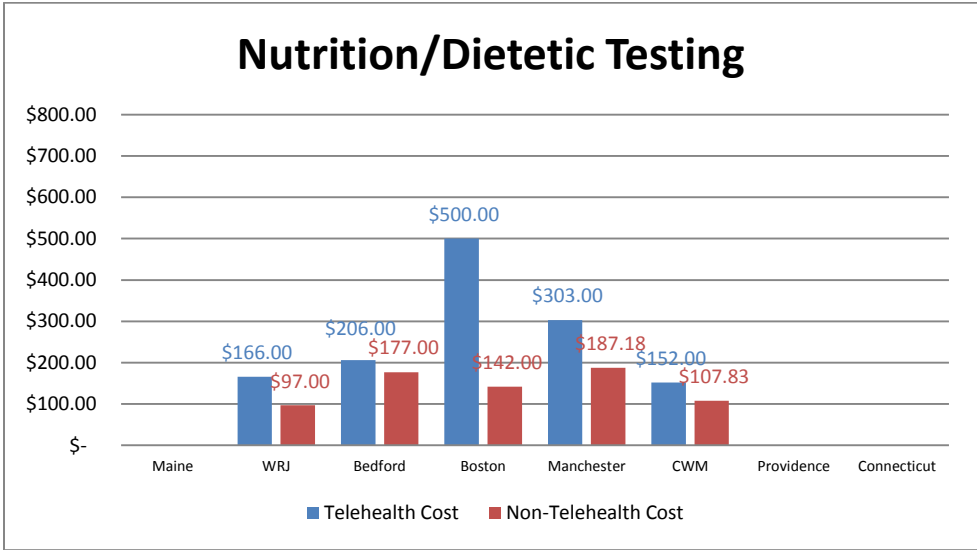


FIGURE 23: NUTRITION DIETETIC TESTING ENCOUNTER COSTS

Next, the team calculated the difference in average cost per encounter between a Telehealth and Non-Telehealth encounter. The team did this by subtracting the average cost of a Non-Telehealth encounter from the average cost of a Telehealth encounter for each clinic type. The formula used for each clinic at each medical facility is as follows:

$$\begin{aligned} & \textit{Difference in Average Encounter Cost} \\ & = \textit{Telehealth average encounter cost} - \textit{Nontelehealth average encounter cost} \end{aligned}$$

Results for this analysis can be found in Figure 24. Positive values indicate that Telehealth encounters for that particular clinic type at that particular medical facility are more expensive than Non-Telehealth encounters. It is important to notice that Pulmonary Function does not have a Non-Telehealth encounter cost; therefore, the cost of the Telehealth appointment was used as the difference in the average encounter cost. This is also the case for the Amputation clinic at the Central Western Massachusetts medical facility as well as the Providence medical facility.

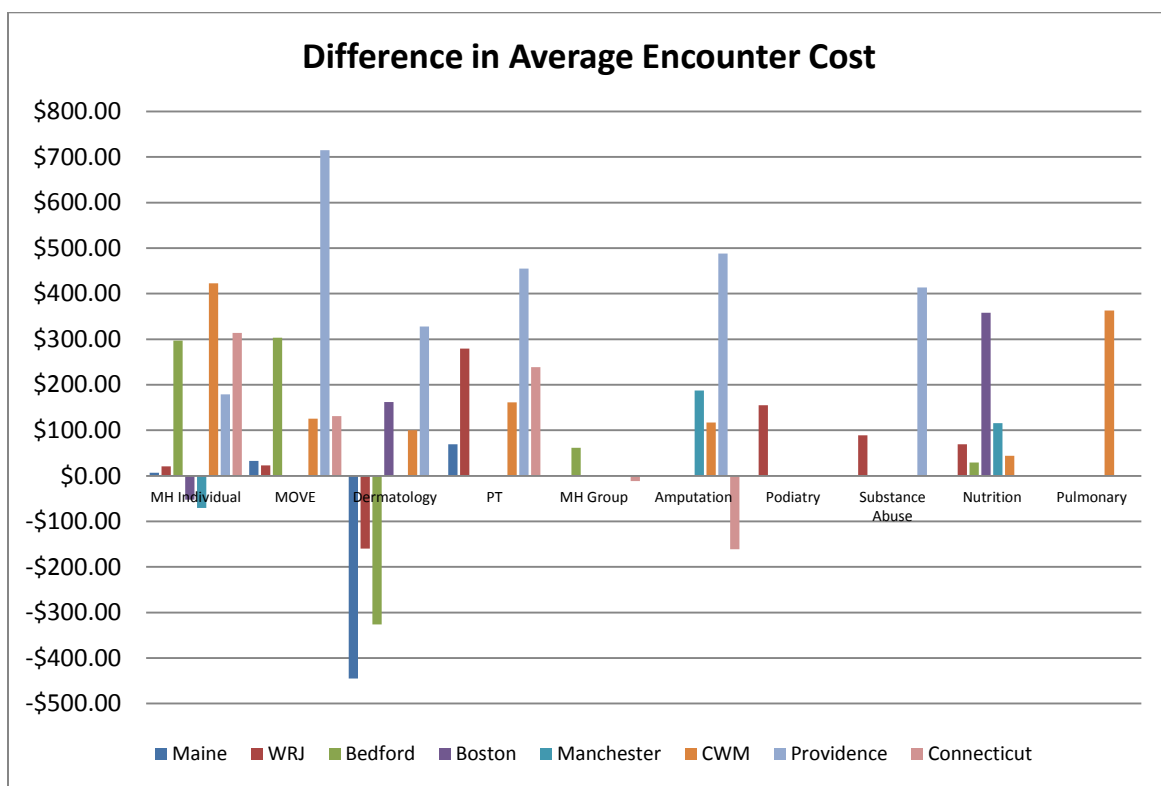


FIGURE 24: DIFFERENCE IN AVERAGE ENCOUNTER COST PER CLINIC TYPE

After analyzing each of the clinic types, finding an average encounter cost across VISN1, and finding the differences in average encounter cost per clinic type, the team then calculated the total additional annual cost or savings that a Telehealth encounter incurs per clinic type, per medical facility, and overall for VISN1. The formula used for this analysis per clinic type per medical facility is as follows:

$$\begin{aligned} & \textit{Total Cost (or Savings) due to Telehealth encounters} \\ & = \textit{Difference in Average Encocunter Cost} * \textit{Count of Encounters} \end{aligned}$$

The team calculated this cost by multiplying the difference in the average encounter cost per clinic type by the total count of Telehealth encounters in the past 365 days. The results of this analysis can be found in Figure 25.

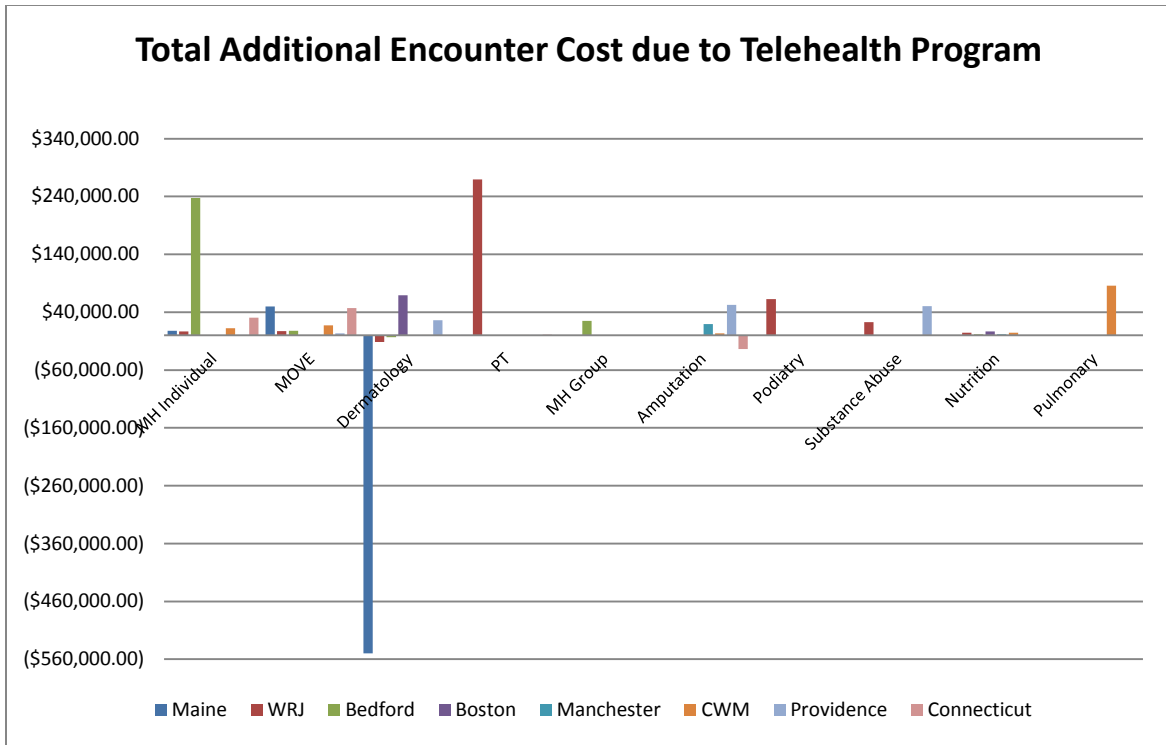


FIGURE 25: BREAKDOWN OF TOTAL ADDITIONAL ENCOUNTER COST DUE TO TELEHEALTH

The total annual cost per medical facility due to the Telehealth program is depicted in Figure 26.

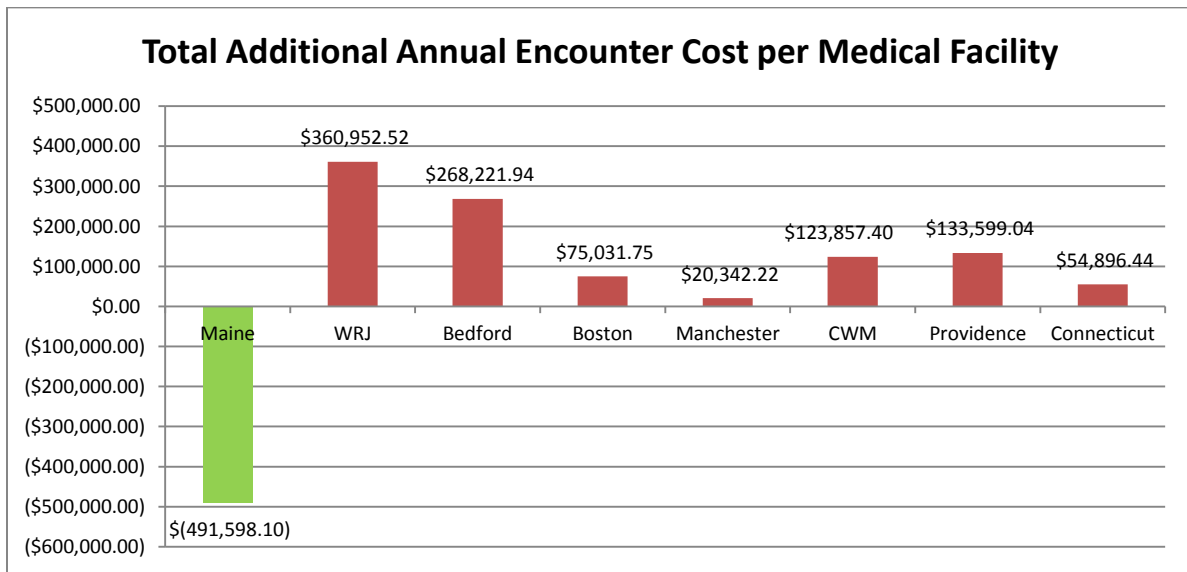


FIGURE 26: TOTAL ADDITIONAL ANNUAL ENCOUNTER COST PER MEDICAL FACILITY

A complete breakdown of the total annual cost per medical facility per clinic type can be found in Appendix III.

Based on FY13 average encounter costs and count, the additional annual encounter cost due to incorporation of Telehealth in VISN1 is \$545,303.21. As part of this cost, Pulmonary Function and Dermatology are the only Store and Forward Telehealth Technologies. Since there is no comparable Telehealth and Non-Telehealth encounters for the Pulmonary Function clinic, the Dermatology clinic's total annual cost across VISN1 of -\$383,800.81 is the only considerable Store and Forward cost in the VISN Telehealth cost. The remaining \$929,104.02 is attributed to the eight remaining CVT Telehealth programs.

Overall, Telehealth encounters cost more than Non-Telehealth encounters; however, there are a few select opportunities where medical facilities have been able to incur some savings due to integrating the Telehealth program into their services. For the medical facilities that have relatively high Telehealth encounter costs either compared to their counterparts or to their Non-Telehealth encounters, it is important that they try to investigate what is driving the high costs within the program at that medical facility. By identifying these drivers, the medical facility can then try to model the program after another program offered by other VISN1 medical facilities that have lower encounter costs for that particular clinic type. This modeling is especially important when those surrounding medical facilities have Telehealth encounter costs that are less than the Non-Telehealth encounter costs.

4.1.1.2 TANGIBLE: TRAVEL REIMBURSEMENT

VISN1 is responsible for reimbursing their patients for all mileage the patient drives to and from their encounter. They reimburse traveled mileage \$0.45/mile. As there are more CBOCs conveniently distributed throughout the New England area than there are medical centers, the patient is able to travel less miles to an encounter because of the use of Telehealth in the patient's local CBOC. Since the patient is traveling less miles, VISN1 has to reimburse the patients less money, thus resulting in cost savings for the organization.

In order to understand the cost savings that VISN1 experiences from reimbursing travel costs, the team worked with data from the BeneTravel database. This database has helped VISN1 to better track exact reimbursements to its Veterans. The database was implemented in June 2013, and the group was able to acquire data from this point through September 2013 to calculate the savings estimations.

Travel reimbursements were analyzed by taking one week out of each month that the BeneTravel database has been in place and applying that figure to the four weeks of each month.

The team was able to get a hold of the totals for both Non-Telehealth and Telehealth CVT and S&F encounters that occurred in FY13 from our VISN1 contacts. The data is broken down by each medical center and CBOC, and the Telehealth CVT and S&F modalities are recorded separately. This data allows the team to understand what portion of the total BeneTravel reimbursements that could be attributed to the CVT and S&F encounters occurring at CBOCs, assuming that encounters would have happened at Medical Centers prior to the institution of the technology. This subsection of encounters is thus where the travel reimbursement savings are realized.

Table 4 illustrates the comparison of the Maine medical facility's main medical center and associated travel reimbursements against its respective CBOC locations' collective costs.

TABLE 4: A COMPARISON OF THE MAINE MEDICAL CENTER AGAINST ITS RESPECTIVE CBOCS

	Maine VAMC		Maine CBOCs	
	# Encounters	Travel Reimbursement Costs	# Encounters	Travel Reimbursement Costs
June	4120	\$162,299.80	2016	\$58,592.16
July	4956	\$203,876.68	2188	\$66,028.60
August	4588	\$184,928.00	2052	\$60,765.52
September	5044	\$200,554.24	2460	\$72,669.20
Total	18708	\$751,658.72	8,716	\$258,055.48

Based on the above information, it is clear that the Maine medical center pays reimbursement to a much larger patient population of Veterans, while the eight CBOCs that belong to the Maine MC total less than half of the VAMC’s reimbursed encounters. Looking closer, however, the data can be broken down to reveal significant travel savings through utilization of the CBOC locations for Telehealth patients. To understand this, Table 5 notes the averages of the two types of facilities over the 4-month period.

TABLE 5: ANALYSIS OF ANNUAL TRAVEL REIMBURSEMENT SAVINGS IN MAINE CBOCS WITH TELEHEALTH

Total Maine CBOC Encounters	26,148
CBOC Telehealth Encounters Total - CVT and S&F	5,914
CBOC Total Cost of Encounters	\$774,166.44
MC Average Cost of Reimbursement	\$36.57
CBOC Average Cost of Reimbursement	\$26.58
MC vs. CBOC Difference in Travel Reimbursement	\$9.98
Savings incurred through Telehealth at CBOCs (total)	\$11,804.34

In Table 5, the Total Maine CBOC Encounters was calculated by assuming that the 8,716 appointments in Maine CBOCs from June through September have the same volume of demand for the other eight months of the year, thus multiplying that number of appointments by three. For the CBOC Telehealth Encounters Total – CVT and S&F, Maine’s BeneTravel data differentiated between Non-Telehealth and Telehealth-based appointments, thus making it easier to sum the total annual appointments at 5,914. The MC Average Cost of Reimbursement was done by looking at the Togus Medical Center’s recorded encounters which were reimbursed, and removing the outliers on the expensive and low-cost ends of the range of encounters through using three standard deviations from the mean. This resulted in the \$36.57 per encounter average. The CBOC Average Cost of Reimbursement was calculated in the same fashion as that of the MC Average Cost of Reimbursement, except this looked at the seven CBOCs’ data that the Maine medical facility had on file. Given that only about 20% of total CVT and S&F appointments in Maine are reimbursed, the total amount reimbursed would be 5,914 CVT and S&F appointments multiplied by the \$9.98 average reimbursement difference in medical center vs. CBOC encounter.

Therefore, in a given year of travel reimbursements for the Maine medical facility, at least \$11,804.34 can be expected in savings by utilizing the CBOCs in addition to the medical centers, given the same annual demand as that seen in the four month study period from June to September 2013.

Given the limited scope of the other seven medical facility’s data for travel reimbursements, in estimating the VISN1 travel reimbursement savings at the other seven sites’ CBOCs, the medical center versus CBOC cost difference of \$9.98 will be used as the standard. Additionally, utilizing the total Telehealth encounters that occurred at each medical center’s respective CBOCs, the group can approximate the savings experienced by sending patients to the nearest CBOC for Telehealth services instead of the nearest medical center.

Table 6 illustrates how these savings vary per medical facility for FY13 and the total savings that come of the Telehealth services.

TABLE 6: TRAVEL REIMBURSEMENT SAVINGS PER VISN1 CBOCS THAT UTILIZE TELEHEALTH

Cost Difference between CBOC and MC Travel Reimbursements		\$ 9.98	
	Total CBOC Telehealth Encounters	Approximate Total Savings	Mileage Saved
Boston	653	\$ 1,303.74	586.68
Bedford	1,671	\$ 3,336.21	1501.29
White River Junction	4,233	\$ 8,451.32	3803.09
Manchester	1,106	\$ 2,208.16	993.67
Providence	1,119	\$ 2,234.12	1005.35
Connecticut	6,346	\$ 12,669.99	5701.50
Central Western MA	1,583	\$ 3,160.51	1422.23
Maine	5,914	\$ 11,807.49	5313.37
Totals	22,625	\$ 45,171.54	20,327.19

Based on the results illustrated in Table 7, approximately \$45,171.54 was saved in FY13 by utilizing CBOCs for CVT and S&F encounters across VISN1’s eight medical facilities.

4.1.1.3 TANGIBLE: STAFF SALARY COSTS

Including the staff salary costs in the return on investment analysis is necessary, as staff salaries are one of the largest incurred costs of Telehealth. The team gathered data for the Telehealth Clinic Technician (TCT) and Facility Telehealth Coordinator (FTC) positions in order to evaluate the total staff costs for Telehealth. Table 7 illustrates the distribution of TCTs and FTCs throughout VISN1’s medical facilities.

TABLE 7: VISN1 STAFF DISTRIBUTION

Medical Facility	TCTs	FTCs
Maine	11.5	1
White River Junction	9	1
Bedford	5	1
Boston	10	1
Manchester	6	1
Central Western MA	7	1
Providence	5	1
Connecticut	10	1
Total VISN1 Staff	63.5	8

The team also considered the different salary levels for the Telehealth staff based on the average salary levels by medical facilities. Table 8 illustrates the salaries used for Facility Telehealth Coordinators and Telehealth Clinic Technicians for each medical facility as well as the VISN1 average salary for the FTC and TCT positions.

TABLE 8: TELEHEALTH STAFF SALARY LEVELS

Salary Level	TCT	FTC
Maine	\$ 49,450	\$ 81,326
WRJ	\$ 49,450	\$ 81,326
Bedford	\$ 54,059	\$ 88,906
Boston	\$ 54,059	\$ 88,906
Manchester	\$ 54,059	\$ 88,906
Central Western MA	\$ 49,450	\$ 81,326
Providence	\$ 54,059	\$ 88,906
Connecticut	\$ 55,757	\$ 91,699
Average VISN1 Salary	\$ 52,543	\$ 86,413

The difference in salary levels by medical facility is based solely on the cost of living in that particular area. For example, the salary level for a TCT within the Connecticut Medical Facility is higher than the salary level for a TCT within the Maine Medical Facility because it is more expensive to live in Connecticut than it is to live in Maine.

In order to calculate the annual salary cost per medical facility and the overall total salary cost, the team multiplied the number of TCTs at the respective medical facility by its respective average TCT salary level. This was then added to the average FTC salary cost for that particular medical facility, and the total salary cost per medical facility was calculated as illustrated in Figure 27.

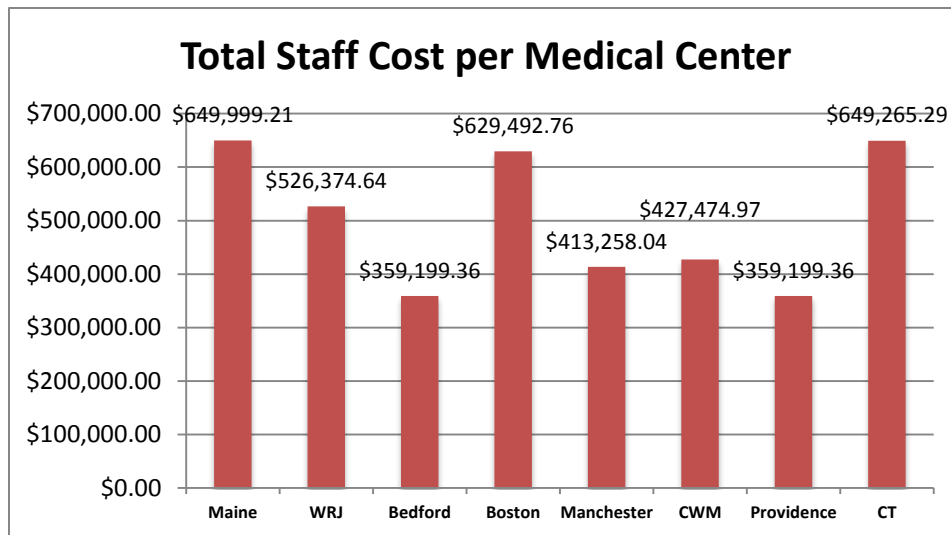


FIGURE 27: TOTAL ANNUAL STAFF COST PER MEDICAL FACILITY

By totaling the individual medical facilities annual salary costs, the team determined the VISN1 total annual salary cost of Telehealth staff to be **\$4,027,756.64**.

4.1.1.4 TANGIBLE: STAFF TRAINING COSTS

The training costs associated with new and replacement Telehealth Clinical Technicians must also be included in the return on investment analysis. By analyzing the staff attrition ratio along with training costs, the team can understand the cost incurred for ensured adequately trained staff to operate the Telehealth modalities.

TCTs complete a training program that lasts anywhere from three to six weeks. 40% of new TCTs complete the training in three weeks, 50% of TCTs complete the training in four weeks, and 10% of TCTs complete the training in six weeks. After the training is complete, the TCT is ready to see patients in his or her respective CBOC or medical center. While the TCTs are being trained, they are paid full salary but are not seeing patients. By using a triangular distribution calculation, the team found an average training time of 26.6 days. The team then calculated a daily pay rate for a TCT by medical facility based on the TCT staff salary average. In order to understand how this cost translates on an annual basis, the team considered the annual attrition rate for TCTs to account for employees that may leave during the year. The calculated annual attrition rate was approximately 15% for the 63.5 TCTs employed by VISN1. This translates to an average of 9.71 employees who leave or change positions within the VISN1 each year. The team decided to evenly distribute this number across the medical facilities to calculate the cost per facility, assigning 1.21 new employees to each medical facility every year.

By multiplying the daily pay rate by the average training time by the attrition rate for each medical facility, the team found the annual training cost per medical facility as shown in Figure 28.

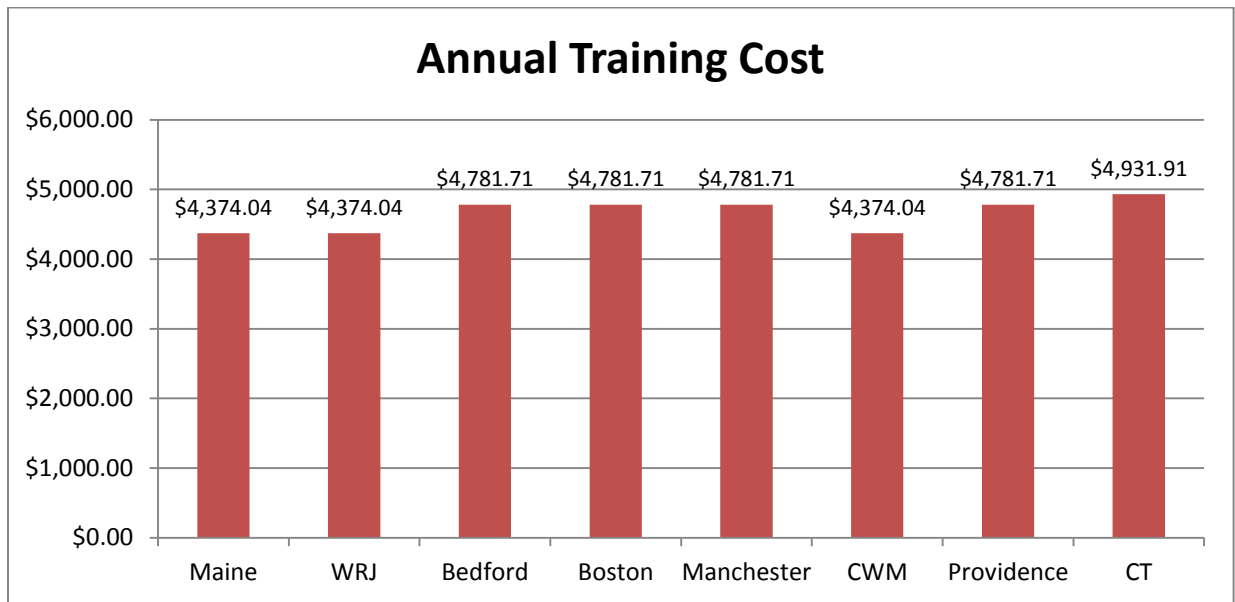


FIGURE 28: ANNUAL TRAINING COST PER MEDICAL FACILITY

Based on these results, the team found a total annual training cost for VISN1 Telehealth staff to be **\$37,180.88**.

4.1.2 COMPLETE THE RETURN ON INVESTMENT ANALYSIS

FY13 Return on Investment Analysis									
	VISN1	Maine	White River	Bedford	Boston	Manchester	Central Western	Providence	Connecticut
Telehealth Encounter Cost	\$545,303.21	\$491,598.10	\$360,952.52	\$268,221.94	\$75,031.75	\$20,342.22	\$123,857.40	\$133,599.04	\$54,896.44
Travel Reimbursement Savings	\$45,171.54	\$11,807.49	\$8,451.32	\$3,336.21	\$1,303.74	\$2,208.16	\$3,160.51	\$2,234.12	\$12,669.99
Staffing Cost	\$4,014,263.63	\$649,999.21	\$526,374.64	\$359,199.36	\$629,492.76	\$413,258.04	\$427,474.97	\$359,199.36	\$649,265.29
Staffing Training Cost	\$37,180.87	\$4,374.04	\$4,374.04	\$4,781.71	\$4,781.71	\$4,781.71	\$4,374.04	\$4,781.71	\$4,931.91
Total Annual Cost for Telehealth	\$4,551,576.17	\$150,967.66	\$883,249.88	\$628,866.80	\$708,002.48	\$436,173.81	\$552,545.90	\$495,345.99	\$696,423.65
Return on Investment	-99.02%	-23.07%	-99.05%	-99.47%	-99.82%	-99.50%	-99.43%	-99.55%	-98.21%

ROI Including 25% Conversion of Non-Telehealth Encounters to Telehealth Encounters									
	VISN1	Maine	White River	Bedford	Boston	Manchester	Central Western	Providence	Connecticut
Telehealth Encounter Cost	\$545,303.21	\$491,598.10	\$360,952.52	\$268,221.94	\$75,031.75	\$20,342.22	\$123,857.40	\$133,599.04	\$54,896.44
Travel Reimbursement Savings	\$45,171.54	\$11,807.49	\$8,451.32	\$3,336.21	\$1,303.74	\$2,208.16	\$3,160.51	\$2,234.12	\$12,669.99
Staffing Cost	\$4,014,263.63	\$649,999.21	\$526,374.64	\$359,199.36	\$629,492.76	\$413,258.04	\$427,474.97	\$359,199.36	\$649,265.29
Staffing Training Cost	\$37,180.87	\$4,374.04	\$4,374.04	\$4,781.71	\$4,781.71	\$4,781.71	\$4,374.04	\$4,781.71	\$4,931.91
Potential Savings	\$874,036.70	\$62,635.25	\$149,277.25	\$83,741.58	\$328,807.50	\$223,626.83			\$25,948.30
Total Annual Cost for Telehealth	\$3,677,539.47	\$88,332.41	\$733,972.63	\$545,125.22	\$379,194.98	\$212,546.99	\$552,545.90	\$495,345.99	\$670,475.35
Return on Investment	-80.00%	-13.50%	-82.31%	-86.23%	-53.46%	-48.48%	-99.43%	-99.55%	-94.55%

Based on the above final calculation of the ROI for Telehealth, we can see that the overall return on investment for VISN1 is negative. (Please note that all green values are negative and therefore gains from investment in the Telehealth program). This was expected as the only cost savings was accrued in travel reimbursement from the ease of access to CBOCs. The one exception to the cost savings is the encounter cost for the Maine medical facility. This was because the Telehealth Dermatology clinic encounters cost significantly less than Non-Telehealth encounters in this specific location; however, this was not the case at every other respective location. Some facilities did experience Telehealth encounters that were less expensive than the Non-Telehealth encounters; but no facility other than Maine incurred enough savings from these occurrences to be considered a gain from investment in the Telehealth program.

Based on the results from the first table, staff cost per medical facility is the highest cost at each medical facility and trumps any potential savings from the travel reimbursement savings, resulting in a very low return on investment. Because the results for the FY13 Return on Investment were poor for the majority of the medical facilities, the team conducted an additional analysis. The second analysis is used to portray the Return on Investment if 25% of the Non-Telehealth encounters were converted to Telehealth

encounters in areas where the Non-Telehealth encounter costs more. That analysis is seen in the second table.

The ROI percentage for FY13 as well as if the was calculated using the formula from our literature review shown below:

$$ROI = \frac{(Gain\ from\ Investment - Cost\ of\ Investment)}{Cost\ of\ Investment}$$

For FY13, the gain from the investment in Telehealth is classified as the travel reimbursement cost savings. The cost of investment is defined as the sum of Telehealth encounter cost, staff cost and training cost. The costs are then subtracted from the savings and divided by the costs.

For the analysis that considers the potential conversion of Non-Telehealth encounters to Telehealth, gains from investment were defined as the travel reimbursement savings as well as the potential savings due to instances of the less expensive cost of the Telehealth encounters.

This results in a return on investment percentage that we evaluated and showed in the above tables. The ROI analysis does not include the intangibles in the Multi-Attribute Decision Making Analysis in order to come up with a final recommendation.

4.2 MULTI-ATTRIBUTE DECISION MAKING ANALYSIS

4.2.1 ANALYSIS OF INTANGIBLES

The group was able to gather data from five previous case studies done on the implementation of Telehealth services. The studies focused on the use of Telehealth services specific to VISN1 such as dermatology, cardiology, mental health, and pulmonology. Each case study provided data to support a variety of benefits which are defined as intangibles. A detailed explanation of each study can be found in the literature review. Listed below in Table 9 is the outcome of each study, which will be used to calculate the multi-attribute analysis. Reference the Literature Review Section 2.4.3 for a more detailed description of each of the case studies.

TABLE 9: INTANGIBLE ASPECTS AND ASSOCIATED CASE STUDIES

Intangible	Case Study Used	References
Patient satisfaction	Case Study 1	Hsueh et al., 2012
Decrease in no shows	Case Study 2	Coakley et al., 2013
Decrease in wait time until encounter	Case Study 3	Neufeld, 2013
Decrease in unnecessary referrals	Case Study 4	Thijssing et al., 2013
Decrease in hospital admissions	Case Study 5	Godleski et al., 2012
Decrease in days of hospitalization	Case Study 5	Godleski et al., 2012

4.2.2 INCORPORATE ROI RESULTS WITH INTANGIBLES IN A MULTI-ATTRIBUTE ANALYSIS

In order to incorporate the results as well as the intangibles, the group chose to do a Multi-Attribute Decision Making Analysis. The purpose of the analysis was to decide on whether or not to continue

the use and funding of Telehealth within the VISN1. For this reason, the two options being compared were No Telehealth versus Telehealth.

4.2.2.1 STEP ONE: DECIDING ON ATTRIBUTES

The option of No Telehealth versus Telehealth was compared based on ten attributes which were chosen by the group. The attributes were chosen to encompass the ROI as well as the intangibles. Each attribute and the associated values are listed below in Table 10.

TABLE 10: ATTRIBUTES SELECTED FOR ANALYSIS

Attribute	No Telehealth	Telehealth
Patient satisfaction	34.00%	66.00%
Decrease in no shows	0%	60%
Decrease in wait time until encounter	0%	42.60%
Decrease in unnecessary referrals	0%	27.00%
Decrease in hospital admissions	0%	24.20%
Decrease in days of hospitalization	0%	26.60%
Cost—staff salary	\$0.00	\$4,027,756.64
Cost – staff training	\$0.00	\$37,180.88
Cost – travel reimbursement savings	\$0.00	\$45,171.54
Cost – additional annual encounter cost	\$0.00	\$545,303.21

In order to conduct the analysis appropriately, the team also had to select the least and most desirable values for each of the selected attributes. These values are outlined in Table 11.

TABLE 11: ATTRIBUTES SELECTED FOR ANALYSIS WITH LEAST AND MOST DESIRABLE VALUES

Attribute	Least Desirable	Most Desirable	Preferred
Patient satisfaction	0%	100%	Higher
Decrease in no shows	0%	100%	Higher
Decrease in wait time until encounter	0%	100%	Higher
Decrease in unnecessary referrals	0%	100%	Higher
Decrease in hospital admissions	0%	100%	Higher
Decrease in days of hospitalization	0%	100%	Higher
Cost—staff salary	\$4,274,137	\$0.00	Lower
Cost – staff training	\$44,278	\$0.00	Lower
Cost – travel reimbursement	\$0	\$92,601.66	Higher
Cost – additional annual encounter cost	\$1,135,252	\$0.00	Lower

Patient satisfaction, decrease in no shows, decrease in wait time until encounter, decrease in unnecessary referrals, decrease in hospital admissions, and decrease in days of hospitalization are intangibles which were derived from previous case studies. The least desirable and most desirable values for each of the intangibles are 0% and 100% respectively.

Costs such as staff salary, staff training, reimbursement savings, and additional annual encounter costs are tangibles which were taken from the ROI. The team had to assign the least and most desirable values for each of these tangibles in order to compare the actual values found in the return on investment analysis.

For staff salary, the team identified the most desirable value as \$0 as this would indicate that VISN1 did not have to hire any additional staff members to support the program. In order to find the least desirable value, the team calculated the total VISN1 annual staff salary if all Telehealth Clinical Technicians and Facility Telehealth Coordinators were paid the highest salary offered in each of their positions. The highest salaries, which were \$55,757 and \$91,699 respectively, were multiplied by the total number of staff members that support VISN1 Telehealth. This product was \$4,274,137, reflecting the least desirable value for this attribute.

For staff training, the team identified the most desirable values as \$0 as this would indicate that VISN1 did not have to train any additional staff members due to attrition. As this is not the case, the team calculated the least desirable value based on the longest expecting training time and the highest salary. The highest salary of \$55,757 only is paid to TCTs in one of the eight medical facilities, and the longest training time of six weeks only happens when training 10% of the Telehealth Clinical Technicians. These are the worst possible values to occur in terms of cost for VISN1, so the team used these values to find the least desirable value for staff training. By dividing the highest salary offered to TCTs throughout the VISN1 by 365, the team was able to find the daily rate of pay to consider for training. The longest expected training time of six weeks was then multiplied by the daily pay rate to get the least desirable value for training per TCT to be on-boarded. This value was then multiplied by the annual attrition rate to calculate the annual training cost for all TCTs to be hired by VISN1 to support the Telehealth program and replace the TCTs that leave.

For travel reimbursement costs, the team identified the least desirable value as \$0. If the Telehealth program was not in place, VISN1 would not be incurring any savings as all Veterans would still be traveling to medical centers to see specialists. With CBOCs that support Telehealth, Veterans do not have to travel as far and can travel to CBOCs rather than medical centers to see their specialist. As a result, the worst case scenario with travel reimbursements for the Telehealth program would be \$0 saved. In order to calculate the most desirable value, the team considered the potential 25% conversion of Non-Telehealth encounters to Telehealth encounters when the Telehealth encounter costs less. This conversion of encounters is explained more in the Recommendations section of this report; however, the conversion translates to travel reimbursements as well. With more Veterans traveling to CBOCs for the Telehealth encounters rather than the Non-Telehealth encounters, there would be additional travel reimbursement savings experienced by VISN1. The team considered this value in the most desirable value for travel reimbursement by increasing the actual VISN1 reimbursement for FY13 by 25% and also by assuming that 100% of all Telehealth appointments would be reimbursed.

For additional encounter cost, the team identified the most desirable value as \$0 as this would indicate that Telehealth encounters cost the same as Non-Telehealth encounters. In order to find the worst case scenario cost, the team did not consider any clinics that had less expensive Telehealth encounters. With less expensive Telehealth encounters, they incurred a savings and took away from the total additional cost due to the Telehealth program. The team excluded annual costs

of any clinic types that had a negative value and totaled to remaining annual costs per medical facility per clinic to find the least desirable value for the analysis.

4.2.2.2 STEP TWO: NONDIMENSIONAL SCALING

Due to the fact that each attribute uses a different metric, the values must then be made dimensionless in order to properly compare each attribute. This is done using the equations below.

When the most desirable values are larger, the following equation is used:

$$\text{Rating} = \frac{\text{Outcome being made dimensionless} - \text{worst outcome}}{\text{best outcome} - \text{worst outcome}}$$

When the most desirable values are the smaller, the equation below is used instead:

$$\text{Rating} = \frac{\text{Worst outcome} - \text{outcome being made dimensionless}}{\text{worst outcome} - \text{best outcome}}$$

The team used these formulas for each of the attributes of this analysis as seen in Table 12 below.

TABLE 12: NON-DIMENSIONAL SCALING OF ATTRIBUTES

Attribute	No Telehealth Non-Dimensional Rate	Telehealth Non-Dimensional Rate
Patient satisfaction	0.34	0.66
Decrease in no shows	0.00	0.60
Decrease in wait time until encounter	0.00	0.43
Decrease in unnecessary referrals	0.00	0.27
Decrease in hospital admissions	0.00	0.24
Decrease in days of hospitalization	0.00	0.27
Cost—staff salary	1.00	0.06
Cost – staff training	1.00	0.16
Cost – travel reimbursement savings	0.00	0.49
Cost – additional annual encounter cost	1.00	0.52

In this case the group is only analyzing two options, meaning that when using the equations the preferred option will receive a non-dimensional rate of 1 and the un-preferred option will receive a rate of 0.

4.2.2.3 STEP THREE: ADDITIVE WEIGHTING TECHNIQUE

Next the stakeholders at the VA were asked to rank each attribute based on importance. The VA chose to rank on a scale of one to ten and expressed that the costs were not as important as the intangibles. The ranks provided in Table 13 are the relative ranks which were then calculated into normalized ranks.

TABLE 13: ADDITIVE WEIGHTING OF ATTRIBUTES

Attribute	Relative Rank	Normalized Rank
Patient satisfaction	9	0.17
Decrease in no shows	5	0.09
Decrease in wait time until encounter	10	0.19
Decrease in unnecessary referrals	6	0.11
Decrease in hospital admissions	8	0.15
Decrease in days of hospitalization	8	0.15
Cost—staff salary	2	0.04
Cost – staff training	2	0.04
Cost – travel reimbursement savings	2	0.04
Cost—additional annual encounter cost	2	0.04
Total	54	1.00

4.2.2.4 STEP FOUR: FINAL SCORE

The final step of the MADMA is to calculate the score of each option. This is done by multiplying the normalized rank by the non-dimensional rate. The score for each attribute is then totaled and the option with the highest overall total would be the best option. The team did this for each aspect of this analysis as seen in Table 14.

TABLE 14: FINAL SCORE OF ATTRIBUTES

Attribute	Normalized Rank	No Telehealth		Telehealth	
		Rate	Score	Rate	Score
Patient satisfaction	0.17	0.34	0.06	0.66	0.11
Decrease in no shows	0.09	0.00	0.00	0.60	0.06
Decrease in wait time until encounter	0.19	0.00	0.00	0.43	0.08
Decrease in unnecessary referrals	0.11	0.00	0.00	0.27	0.03
Decrease in hospital admissions	0.15	0.00	0.00	0.24	0.04
Decrease in days of hospitalization	0.15	0.00	0.00	0.27	0.04
Cost—staff salary	0.04	1.00	0.04	0.06	0.00
Cost – staff training	0.04	1.00	0.04	0.16	0.01
Cost – travel reimbursement savings	0.04	0.00	0.00	0.49	0.02
Cost—additional annual encounter cost	0.04	1.00	0.04	0.52	0.02
Total	1.00		0.17		0.40

In this case the group was able to conclude that using Telehealth is the better option. Telehealth scored 0.40 while No Telehealth scored 0.17.

As previously discussed there are limitations and disadvantages to each analysis. When using the MADMP, one of the disadvantages to keep in mind is the importance of attribute ranking. If the ranks are chosen and there is a bias towards specific attributes, it can greatly influence the outcome. In order to compensate for this shortcoming, the group completed an evaluation of assigned rankings.

4.2.2.5 EVALUATION OF ASSIGNED RANKINGS

In this project, the intangible attributes scored in favor of Telehealth while the majority of the tangibles did not. When stakeholders were asked to rank the attributes based on importance, they chose to rank the intangibles higher than the tangibles. They did this because they believed these attributes were more valuable when assessing Telehealth; however, these ranks influenced the final score.

To examine the effect of the ranks on the final score, the group adjusted the ranks accordingly. The group ranked each attribute the same and revealed that Telehealth still received a higher score, this is shown in Table 15 and Table 16.

TABLE 15: EXAMPLE OF EQUIVALENT RANKS

Attribute	Relative Rank	Normalized Rank
Patient satisfaction	5	0.10
Decrease in no shows	5	0.10
Decrease in wait time until encounter	5	0.10
Decrease in unnecessary referrals	5	0.10
Decrease in hospital admissions	5	0.10
Decrease in days of hospitalization	5	0.10
Cost—staff salary	5	0.10
Cost – staff training	5	0.10
Cost – travel reimbursement savings	5	0.10
Cost—additional annual encounter cost	5	0.10
Total	50	1.00

TABLE 16: EXAMPLE OF FINAL SCORE OF EQUIVALENT RANKS

Attribute	Normalized Rank	No Telehealth		Telehealth	
		Rate	Score	Rate	Score
Patient satisfaction	0.10	0.34	0.03	0.66	0.07
Decrease in no shows	0.10	0.00	0.00	0.60	0.06
Decrease in wait time until encounter	0.10	0.00	0.00	0.43	0.04
Decrease in unnecessary referrals	0.10	0.00	0.00	0.27	0.03
Decrease in hospital admissions	0.10	0.00	0.00	0.24	0.02
Decrease in days of hospitalization	0.10	0.00	0.00	0.27	0.03
Cost—staff salary	0.10	1.00	0.10	0.06	0.01
Cost – staff training	0.10	1.00	0.10	0.16	0.02
Cost – travel reimbursement savings	0.10	0.00	0.00	0.49	0.05
Cost—additional annual encounter cost	0.10	1.00	0.10	0.52	0.05
Total	1.00		0.33		0.40

The score for No Telehealth was only greater than Telehealth when each tangible was ranked higher than each intangible. After experimenting with the ranks, the group concluded that even had we not weighed the attributes, the benefits of Telehealth would still have outweighed the costs.

5 CONCLUSION AND RECOMMENDATIONS

5.1 ACHIEVEMENTS OF THE PROJECT

5.1.1 OVERVIEW OF ROI ANALYSIS

The team conducted a return on investment analysis based on the four identified tangibles of Telehealth encounter cost, travel reimbursement savings, staff salary cost, and staff training cost. These tangibles are the only hard costs considered in this analysis.

In seven out of the eight medical facilities, the overall Telehealth encounter costs more than Non-Telehealth encounters, thus is a cost of investment. In the Maine medical facility, the Dermatology Telehealth clinic encounters cost, on average, \$445 less than Non-Telehealth encounters. After factoring in the costs and counts of the other three clinics within the Maine medical facility, the savings from the Telehealth Dermatology encounters outweigh the costs. As a result, the Maine medical facility experiences a gain from investment based on the Telehealth encounter cost.

Travel reimbursement savings is considered when Veterans, who previously would travel to medical centers for encounters, now travel to closer CBOCs because Telehealth enables the Veterans to see their specialist without as much travel. Maine was the only facility that provided the team with a comprehensive data set of reimbursements, so assumptions had to be made about the other seven facilities following the process outlined in the analysis section. At all facilities, a savings is experienced, and the travel reimbursement savings is characterized as a gain from investment.

Staff salary and staff training costs were the final two tangibles considered in the analysis. In order to support the Telehealth program, additional staff had to be hired for each medical facility. There were a total of 63.5 Telehealth Clinical Technicians and 8 Facility Telehealth Coordinators hired. Based on the average salaries per medical facility and the breakdown of TCTs assigned to each facility, the team calculated the total cost of staffing per medical facility as well as for VISN1. This is classified as a cost of investment. In order to quantify the staff training costs, the team considered the annual attrition rates, average training time, and average salary cost per medical facility to get a total annual training cost. Training is also classified as a cost of investment.

After each of these individual analyses were calculated, the team summed all tangibles for a total cost of investment of \$4,551,576.17. The gain from investment was classified by the travel reimbursement savings only, which totaled \$45,171.54. The team then calculated the return on investment following the formula described in the Literature Review and Analysis chapters of the report. The FY13 Return on Investment Analysis, for all medical facilities as well as for the VISN was negative; and all were very poor except for Maine's ROI result. One observation as to why this may be is because of the staffing costs; these salaries contribute to the majority of the cost of this program and thus cause the return on the investment calculation to be very low.

To show an opportunity for improvement, the team conducted an additional return on investment analysis. As described in the Recommendations section, converting 25% of encounters when Non-Telehealth costs less than Telehealth could incur a savings for six out of the eight medical facilities. The second return on investment analysis considers these potential savings, classifies the savings as a gain from investment, and significantly increases the return on investment. In addition,

converting these encounters further supports the Department of Veterans Affairs' initiative of increasing Veteran enrollment in Telehealth services.

5.1.2 OVERVIEW OF THE MULTI-ATTRIBUTE ANALYSIS

After performing the return on investment, the group was able to conclude that Telehealth was not saving VISN1 money and rather that VISN1 incurs significant due to its integration. Despite this finding, the ROI only evaluates the impact of Telehealth based on hard costs. The group wanted to evaluate the impact of Telehealth based on all aspects, which is why the team completed the MADMA. This analysis allowed the group to consider benefits of Telehealth that are intangible such as patient satisfaction, decrease in no shows, decrease in wait time until encounter, decrease in unnecessary referrals, decrease in hospital admissions, and decrease in days of hospitalization.

As discussed in the literature review, one of the VA's main goals is to become an organization that can better serve Veterans. VISN1 expressed the importance of the intangibles, which is why the team chose to incorporate them into the evaluation of Telehealth. The MADMA allowed the group to analyze Telehealth based on both tangibles and intangibles. After examining the ranks, the team concluded that the intangible benefits outweigh the cost of Telehealth; therefore, medical facilities should continue funding the Telehealth program.

5.2 RECOMMENDATIONS

Although Telehealth utilizes an advanced technology, it does offer some potential savings for each medical facility in terms of costs per encounter. For example, in the Maine medical facility, a Telehealth encounter costs less than a Non-Telehealth encounter for the Dermatology clinic. Because the use of Telehealth in these instances incur a cost savings for the medical facility, the individual medical facilities should target the clinics that have less expensive Telehealth encounters when trying to expand the Telehealth program.

Table 20 illustrates the costs savings if the medical facility converted only 25% of the total count of Non-Telehealth encounters for a particular clinic. These savings are estimates based on the number of Non-Telehealth encounters in the past 365 days.

TABLE 17: POTENTIAL SAVINGS IF CONVERTED 25% NON-TELEHEALTH ENCOUNTERS TO TELEHEALTH

	Maine	WRJ	Bedford	Boston	Manchester	CWM	Providence	Connecticut
<i>MH Individual</i>				-\$328,807.50	-\$223,626.83	<i>potential</i>	<i>potential</i>	
<i>MOVE</i>								
<i>Dermatology</i>	-\$62,635.25	-\$149,277.25	-\$83,741.58			<i>potential</i>	<i>potential</i>	
<i>PT</i>								
<i>MH Group</i>								-\$25,706.80
<i>Amputation</i>								-\$241.50
<i>Podiatry</i>								
<i>Substance Abuse</i>								
<i>Nutrition</i>								
<i>Pulmonary</i>								
Total Cost	-\$62,635.25	-\$149,277.25	-\$83,741.58	-\$328,807.50	-\$223,626.83	\$0.00	\$0.00	-\$25,948.30
Total Potential Savings for VISN1 if Convert 25% of Non-Telehealth Encounters to Telehealth:							-\$874,036.70	

The cells that contain “potential” indicate potential savings for some medical facilities. Specifically, if the Central Western MA and Providence medical facilities modeled their Telehealth programs for Dermatology or Mental Health for Individuals clinic types like the programs at other VISN1 medical facilities, Central Western MA and Providence could incur potential savings for their medical facilities.

In addition to cost savings, the team recommends implementing data collection methods that can specifically evaluate Telehealth. One useful recommendation would be time studies that relate to reduced travel for providers. Prior to Telehealth, many providers would have to travel from one building to another or even from one medical center to another in the case of large medical facilities. Because these Telehealth modalities enable patients to be seen by a specialist via video conferencing, the specialist can see his patients all from a video conferencing technology service on his office computer. This adaptation could potential save significant travel over time as the time it takes a specialist to get from one location to another is non-value added.

Another suggestion relates to development of better records of patient travel reimbursements. The team suggests linking the individual reimbursements to a particular encounter, type of encounter that occurred, and the patient that was reimbursed. This improvement would enable future analyses to focus on the encounters and associated reimbursements that can be attributed to Telehealth. Once the Telehealth reimbursements are identified, future analyses can calculate how much savings a medical facility incurred due to travel to a CBOC rather than to the medical center. Although Telehealth does still occur at medical centers, the increased use of Telehealth in CBOCs is an important metric to consider when evaluating this program.

The team also has a few recommendations for future collaboration with Worcester Polytechnic Institute Project Teams. Firstly, it would be useful to grant the team access to data sets as well as information that can only be exclusively offered through VISN1. Although the team understands issues with patient confidentiality and other government restrictions, the delay in receipt of any data posed a significant hindrance to our project. Had the team had access to data sets, the team would have been able to pull the information that we found applicable to our study with minimal

guidance. Additionally, realistic expectations should be set at the beginning of the project by both parties. Some of the tangibles and intangibles that we would have liked to see in the analysis (such as fee care and increased access to care) were either unavailable or the team had to use studies of other programs because such studies had yet to be done in VISN1 and its associated Telehealth program. A lot of time was spent depending on information that was unavailable, and the team believes that this time could have been used more effectively to improve upon the data that was available.

5.3 REFLECTIONS

5.3.1 THE DESIGN COMPONENT

Upon completion of the VISN1 Telehealth program analysis, the group identified all of the necessary tasks in order to properly complete the analysis for future Telehealth program assessments. Based on our experiences, the group identified areas in order to have a desired analysis. The recommended process follows similar tasks to the ones taken by the group but includes additional data that was unavailable within the project's time frame. The following are the five tasks:

1. Understand the history of the VHA, Telehealth program, and implications of the Telehealth program to VISN1's operational cost and develop the project's scope.
2. Identify the program's tangible versus intangible costs and its overall implication to VISN1 operations.
3. Collect all data required to complete the analyses.
4. Complete the Return on Investment analysis.
5. Incorporate the ROI calculation into a Multi-Attribute Decision Making Analysis

The most significant difference between the desired process and the process used by the group is the access to and availability of data.

5.3.1.1 TASK ONE: UNDERSTAND HISTORY AND DEVELOP PROJECT SCOPE

The first necessary task for a desired Telehealth ROI is to gather background knowledge and determine the scope. Our scope included the ten different Telehealth encounter types at the eight individual medical facilities that comprise VISN1. We suggest continuing this scope; however, additional Telehealth modalities can be looked at if desired. Defining the scope will preemptively determine the final result of the return on investment.

5.3.1.2 TASK TWO: IDENTIFYING TANGIBLE AND INTANGIBLE COSTS

The next task used in the desired ROI is to determine the tangible and intangible attributes incurred by the project. The tangible data included clinic encounter costs, travel reimbursement savings, staff salary, and staff training costs.

In a desired ROI analysis, the team would have also liked to consider the benefits of sharing specialists between medical centers, CBOCs, and potentially medical facilities. Telehealth enables one specialist to see patients in a variety of locations without travel; therefore, the team would like to have had data on the salary savings incurred from avoiding staffing multiple locations with multiple specialists. When considered, this reduction in the number of specialists required on staff

as well as the increased access of patients to see a specialist would be a gain from investment in the program.

Additionally, the team would have also liked to study the avoidance of fee care encounters due to the integration of Telehealth. Although this metric is difficult to measure, it would give significant insight into if Veterans are now utilizing Telehealth services at local CBOCs to see a specialist rather than seeing a local private provider. When seeing a private provider, VISN1 has to reimburse the private provider for the encounter at a typically higher cost than the cost of an encounter within VHA services. When considered, this avoidance would be a gain from investment of the Telehealth program.

When accurate data is available, intangible data can often be converted into monetary values as well. Our group was unable to gather such data as there were no previous studies done within the VISN1 and because the group was unable to perform studies of our own. As a result, the group used studies completed outside of the VA in order to gather appropriate data.

The studies completed outside of the VA evaluated patient satisfaction, decrease in no-shows, decrease in wait time until encounter, decrease in unnecessary referrals, decrease in hospital admissions, and decrease in days of hospitalization. In a recommended solution with accurate data, the group would have converted these studies into cost savings.

Other studies the group believed to be valuable were studies pertaining to a decrease in patient encounter time, decrease in provider travel time, decrease in hospital readmission, and staff satisfaction. A decrease in patient encounter time could lead to providers being able to see more patients within a given time frame. A decrease in provider travel time, either from one building to another or from one facility to another, would also increase the number of patients that could be seen within a given time frame as well as increase the provider's utilization and value-added time by seeing more patients. Decrease in hospital readmissions is also important to consider as hospital admissions can sometimes be unavoidable due to a patient's diagnosis. By tracking the hospital readmissions, it provides a better metric regarding the effectiveness of the initial Telehealth consultation coupled with the treatment prescribed during the initial hospital admission. Lastly, the staff's satisfaction with the Telehealth program is also important to consider as TCTs, FTCs, and providers need to be able to efficiently and effectively utilize the service for the patient-provider encounters to occur. Without staff members who are satisfied with the program, there could be issues with patient service and overall operability of the program in the medical facilities.

The need for all of these intangibles is outlined in Table 21 as the team's opinion of the best conversion of the intangible aspect to a tangible cost.

TABLE 18: CONVERSION OF INTANGIBLES TO TANGIBLE COSTS

Intangible	Conversion to Tangible
Patient satisfaction	Increase in Veterans utilizing VA care
Decrease in no shows	Increase in utilization of provider's time
Decrease in wait time until encounter	Increase in utilization of provider's time and increase of patient encounters
Decrease in unnecessary referrals	Decrease in unnecessary patient encounters
Decrease in hospital admissions	Decrease money spent on patient encounters
Decrease in days of hospitalization	Decrease money spent on patient encounters
Decrease in patient encounter time	Opportunity for more patient encounters
Decrease in provider travel time	Increase in utilization of provider's time and increase of patient encounters
Decrease in hospital readmissions	Decrease money spent on patient encounters and decrease in premature discharges
Staff satisfaction	Decrease in staff attrition rates

It would be effective for future calculations if these studies were conducted within VISN1, and the appropriate data was collected and converted to tangibles. Converting intangibles to tangible data would result in a more appropriate evaluation of Telehealth.

5.3.1.3 TASK THREE: COLLECT DATA REQUIRED TO COMPLETE THE ANALYSES

If the group were given the proper resources to collect the appropriate data, the other intangibles could also have been analyzed and converted to monetary values. The table below displays the data necessary to complete each analysis.

TABLE 19: DATA NEEDED FOR INTANGIBLES CONVERSION TO TANGIBLE COSTS

Intangible	Data Needed
Patient satisfaction	Feedback from patients before and after a Telehealth encounter
Decrease in no shows	Count of no shows before and after Telehealth
Decrease in wait time until encounter	Time between the patients' call and actual encounter
Decrease in unnecessary referrals	Count of referrals before and after Telehealth
Decrease in hospital admissions	Count of hospital admissions before and after Telehealth
Decrease in days of hospitalization	Count of days of hospitalization before and after Telehealth
Decrease in patient encounter time	Time studies of length of patient encounters
Decrease in provider travel time	Time studies of provider travel time from one building and/or room to another building and/or room for patient encounters
Decrease in hospital readmissions	Count of hospital readmissions before and after Telehealth
Staff satisfaction	Feedback from staff who have worked with and without Telehealth within the VHA

In a desired process this data would be collected to complete a thorough evaluation of Telehealth.

5.3.1.4 TASK FOUR: COMPLETE THE RETURN ON INVESTMENT ANALYSIS

After converting the intangible values to tangible costs, these values can be considered cost savings. Those intangibles that cannot be converted to tangible costs for whatever reason will be considered in the multi-attribute analysis. In order to calculate the return on investment, all of these cost savings, or gains from investment, should be subtracted from the total cost of investment and then divided by the total cost of investment. This calculation results in the final return on investment of Telehealth.

5.3.1.5 TASK FIVE: INCORPORATE THE ROI INTO A MULTI-ATTRIBUTE ANALYSIS

The attributes which were unable to be converted to tangible costs would then require the use of a multi-attribute analysis. The same multi-attribute analysis followed by the team for this project should be used for the desired analysis. This process requires the comparison of two alternatives. In order to do this, the decision makers must follow the multi-attribute steps of incorporating the ROI's results into the multi-attribute analysis, choosing the least and most desirable values for each attribute, converting each of the attributes to non-dimensional rates, ranking all tangible and intangible attributes based on importance to the stakeholders, normalizing all attributes, and calculating the score per attribute based on the rank and rate, and summing the scores for each alternative to determine the outcome. The outcome then will give an accurate recommendation to the decision makers that includes all tangible and intangible aspects of the program.

A complete overview of the desired analysis process described in the previous tasks can be found in Figure 29.

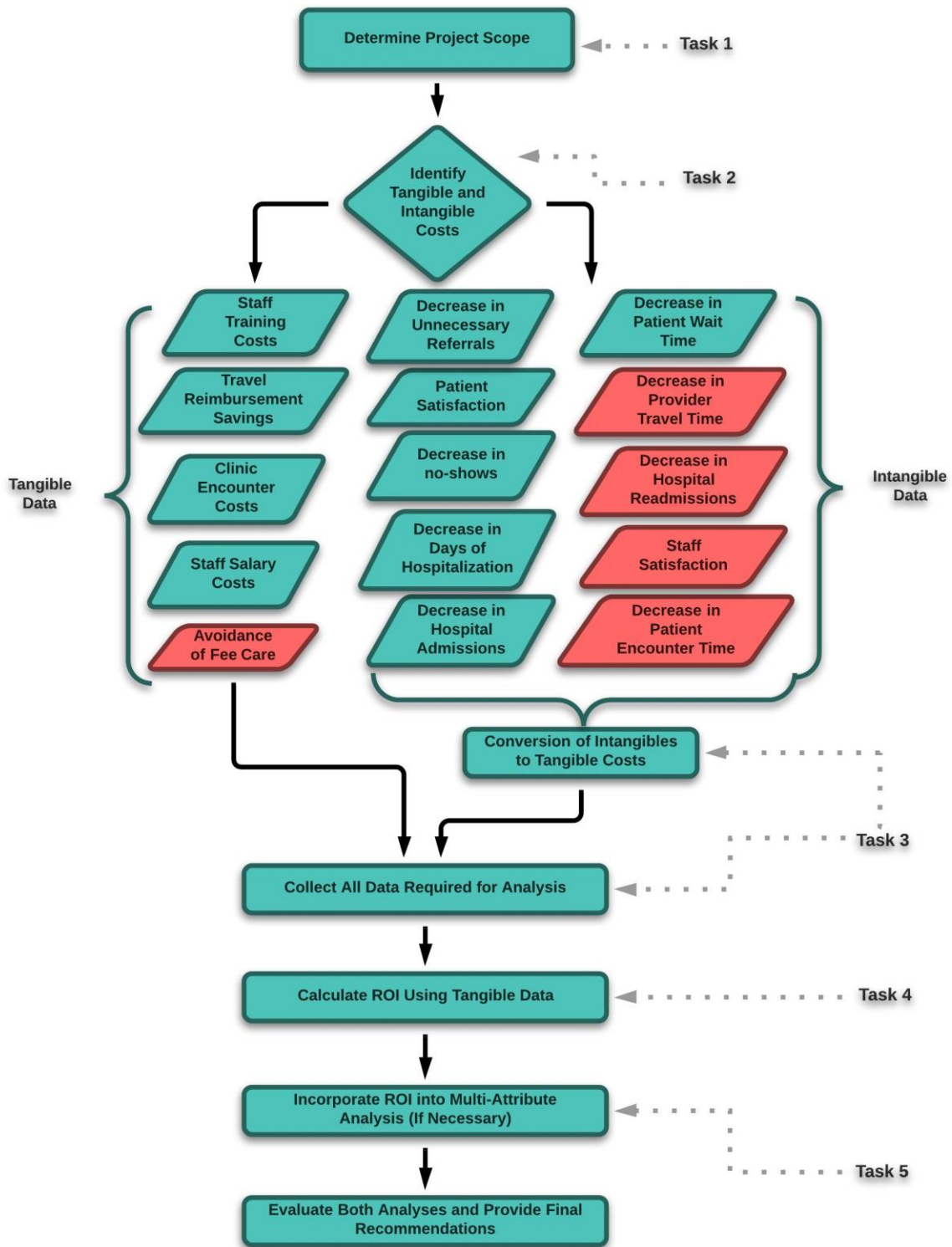


FIGURE 29: RECOMMENDED ANALYSIS PROCESS FOR TELEHEALTH PROGRAM

5.3.2 ASSUMPTIONS OF THE PROJECT

Given the constraints on our exposure to VISN1 Telehealth data, there were several assumptions that the project team needed to make in order to justify our financial and qualitative conclusions. They come in the form of sunk costs and regular demand of Telehealth encounters.

First, at the beginning of our project's schedule, it was thought that the Telehealth carts and their equipment maintenance would be a cost imposed upon each medical facility once the VERA and VHA Transformation Initiatives funding finished on Telehealth. Despite this initial assumption, after discussions with VISN1 staff, the team discovered that the central office will continue to fund these supplies. As a result, it was excluded from the financial costs to continue the program.

Second, the VISN1 Telehealth staff that are already hired have already been trained on the technologies, and their training cost will not be recurring in the future. As a result, their training cost is irrelevant to our ROI and can be considered a sunk cost.

Third, the staffing and training costs will continue and potentially increase in Telehealth's future years. Our ROI results assume that this point in time defines the lowest demand of encounters that Telehealth will receive, as the VISN1 is attempting to grow the program. This assumption translates to the current staff, the salaries that they receive, the training costs incurred, and the attrition rate experienced to continue at a minimum in future years to come.

Fourth, the travel reimbursement data has one week per month from June to September 2013 that the group was able to analyze, given the infancy of the BeneTravel database. As a result, it is assumed that the demand and types of encounters in this data set are representative of the subsequent nine weeks of those four months for which data is not present. Additionally, to forecast a year's worth of cost, this four month assumption is translated onto an annual cost assumption. Lastly, this data was only present for the Maine Medical Facility, which is one of the eight medical facilities to be considered in travel reimbursements in the VISN1. Given that the other seven medical facilities did not provide data as thorough as Maine's, the figures from the Maine Medical Facility were used as numbers from which to base other medical facilities' travel reimbursement savings.

5.3.3 ALTERNATIVES AND CONSTRAINTS

The group was able to determine alternative methods in order to overcome the constraints experienced throughout the project. One of the greatest constraints was that the group was unable to collect any of the data ourselves. Due to privacy disclosure issues, the team did not have access to any database and, therefore, relied heavily on the efforts of the contacts within VISN1. This resulted in a lack of information as well as a time issue. The group often received incorrect or incomplete sets of data. These issues greatly impacted the team's data analysis.

One piece of data which was impacted due to lack of information was the travel reimbursements analysis. The group had planned to receive zip codes in order to accurately calculate the savings of using a Telehealth encounter at a CBOC rather than a face-to-face encounter at a medical center. The group also requested data in order to connect the travel reimbursement to a specific clinic type. Despite these requests, the group only received reimbursement costs for one medical facility as previously explained; and we were forced to make assumptions to connect the data.

Another major constraint was that VISN1 did not have available case studies pertaining to the benefits of Telehealth. The group was also not given the resources to develop the case studies on our own. To overcome this limitation, the group researched previous case studies done outside of the VA. In an effort to appropriately relate the case study to the project, the group only used case studies done on Telehealth services which are offered with VISN1. Although these were not parallel to the situation the group was able to form assumptions as to the results of the case study.

Another limitation of these studies was that the group was not able to find a study pertaining to each benefit. One such benefit was time savings in patient encounters or provider travel from one patient encounter to the next. The group was unable to find a previous time study in either area and was unable to perform one. A time savings could have potentially led to a cost savings as well. Due to these constraints, there was data which was either left out of the analysis that would have provided an additional gain from investment due to the Telehealth program.

One of the most significant constraints experienced in the ROI was the lack of information on fee care, or encounters that registered Veterans are choosing to use as their private healthcare service as opposed to the VISN1 services in place. By understanding how much the VISN1 has paid in the last two years for the top ten clinic types to private healthcare providers as reimbursements for their registered Veterans, an additional potential savings could have been included in our analysis. This information could have also been used to understand if the VISN1 would subsequently be paying more in travel reimbursements as a result of the Telehealth services at CBOCs, since many Veterans choose fee care providers on the basis of proximity to their homes and the increased availability for encounters.

5.3.4 NEED FOR LIFE-LONG LEARNING

5.3.4.1 KELSEY'S REFLECTION

Although this project had many restrictions and constraints due to time and available data, it has impacted my future learning in a few important ways. I learned the importance of looking at all aspects of a project, including those that may not be as obvious. For instance, the team considered both tangible and intangible aspects of the project in order to include all possible areas that Telehealth could have an impact. In order to identify these aspects, the team had to have a thorough understanding of the program and its application in VISN1, have many discussions with stakeholders who work with the program regularly, and come up with creative ways to represent as many benefits as possible in the analysis. Telehealth had many benefits, such as increased access of care and efficiency of care, that were certainly not quantifiable but that were important to consider in the analysis. Their incorporation into the multi-attribute analyses added more depth to the project and provided a better overview of the program's impact. This is important when conducting future analyses as not all benefits of a particular investment may be easily identifiable on the surface. Creativity and making the most of the data that is on hand is essential in instances such as these.

Additionally, clear communications of timelines and expectations should be kept throughout the project in order to make sure all parties involved are on track. Much of the project was delayed and altered due to delays in data receipt or unavailability of data. Although this was frustrating, this could have been avoided if clear communication occurred on a consistent basis to maintain proactive approach.

Because of the delays and changes to the project along the way, I learned how important flexibility is when working with a third party to collect the desired data. A lot of communication was required back and forth to make sure the data met the team's expectations. The team had to plan time into the project schedule to ask questions of the parties who were collecting the data to allow time for the parties to make any changes to the data so the data would meet the team's expectations. Again, this was another area that required a lot of patience; however, the communication was essential to make sure the analyses met the stakeholders' expectations.

Although this project did not meet all of my initial expectations, I did learn a significant amount about how to identify value-added aspects of a program as well as how to successfully manage a project in terms of clear communication and scheduling adjustments.

5.3.4.2 MADDY'S REFLECTION

Throughout the completion of this project, I was able to improve upon my skills as well as learn new ones. I used skills such as teamwork, time management, flexibility, application of knowledge, and research skills. In a group of four, teamwork is essential. The group evaluated each member's strengths and weaknesses in order to utilize our skills effectively. This is the first project in which I have participated where I truly felt each member each member equally contributed. We collaborated to accomplish the goal of the project.

The majority of MQP's are done in three terms; however, our group only had two terms. This made time management essential. As a group of students in their senior year of college, our schedules were also very busy. Before we started the project we created a timeline with dates for each milestone in the project. This was used to keep the project on track.

Working at such a fast pace as well as with so many different people required flexibility. The group has four main points of contact within the VA. Each had a different background and offered something different to the group. This often led to a difference of opinion. Flexibility was necessary for each member involved in the project.

This project provided me the opportunity to apply our knowledge in a real life situation. The group was able to complete an ROI as well as a multi-attribute analysis, both skills we learned in the classroom. These methods were relevant to our project and allowed us to use our creativity to accomplish the goal. Due to the lack of case studies done by the VA the group needed to find creative ways to include tangibles into the analysis. To do this we researched previous studies done. We needed to find studies specific to VISN 1 Telehealth services which really limited our resources. By searching for such a topic I felt as though my research skills were improved upon.

This project was a great experience and allowed me to expand my teamwork skills, time management, flexibility, application of knowledge, and research skills.

5.3.4.3 ADAM'S REFLECTION

This project was a good example of making the most out of a situation which had different expectations and results. From August through November, the variables of our data analysis, and the conditions with which we approached them in the ROI, changed considerably. While these adaptations were a combination of data being unavailable and a better understanding of what the data entailed, the final financial result was certainly not what I had in mind. I thought that without a doubt, Telehealth would be providing considerable returns to the investment, which was not the

case. Part of this result was due to our inability to acquire thorough data on fee basis care, travel reimbursements, and time studies. Nevertheless, the 2013 cost of Telehealth compared to the annual budget of the VISN1 and its respective facilities was reasonable enough to be considered for continuation of funding.

In the duration of this project, I was able to understand how to articulate deliverables, questions, and progress reports to a third party sponsor. This was a big difference in the project sponsor and environment than my Interactive Qualifying Project, which was set in an informal settlement in South Africa. Here, quick analysis turnarounds, delegation of project work, and channeling our effort into the most important aspects of the Telehealth system were critical to finish on time. Only using the top ten types of Telehealth appointments, zooming in on one full year of data, and identifying assumptions with which to base ROI came as big surprises to me. I have been used to projects where every detail of a new process or solution has to be scrutinized in heavy detail. Here, time was of the essence, and it was more important to encompass the large majority of Telehealth activity in a set time frame, as opposed to starting from the beginning of the program's inception and gathering every instance of Telehealth activity.

Working with adaptable expectations and focusing on the big picture of a project's impact will certainly be important moving forward into real world business projects.

5.3.4.4 MIKE'S REFLECTION

For me, this project helped put WPI's motto "*Lehr Un Kunst*" into realization. Taking everything I have learned in the classroom as an industrial engineer and applying it to a real world situation is something I will take with me for the rest of my career. I am extremely grateful for the team I worked with, as they allowed me to stretch my critical thinking and problem solving skill set. We had many creative ideas for quantifying intangible data for this project but often times could not incorporate them due to constraints set by the VA.

The literary review for the project was extremely eye opening for me, having no experience in the healthcare field. This review required the group to collect information on the Department of Veterans Affairs as well as the medical facilities that comprise VISN1. We also needed an in depth understanding of how each Telehealth modality worked. I enjoyed the on site visits to the medical facility in Bedford MA, as we were able to see this technology in action. We observed a demonstration of the Telehealth CVT technology, which allowed for a better understanding of the quantifiable data we received from our contacts at the VA.

I also learned how important quantifiable data is in relation to calculating an ROI. Data studies are crucial when calculating the returns and costs of a project. We obtained many for Telehealth, but one important aspect that was lacking were time studies. Time studies for appointments, providers, and patients could have served as a major return for Telehealth in VISN1. In the future these studies should be conducted in order to show the time saved in each area by utilizing Telehealth.

Communication with project sponsors was crucial in this project and was essential in order to ensure the data gathered met the team's expectations. We needed to ensure the data met the stakeholder's ideals and would be valid when giving the final presentation.

Although this project was a challenge in terms of data collection, our team successfully constructed a valuable ROI for Telehealth and designed a process that the VA can use for future investment

calculations. I will take the knowledge gained from this project such as communication, financial evaluation, recommendations, and critical thinking and apply it to my career path.

6 APPENDICIES

6.1 APPENDIX I

The following tables illustrate the results of the total number of encounters that occurred in the past 365 days per clinic type at each medical facility. The process used to find these values can be found in Section 4.1.1.1.

6.1.1 NUMBER OF ENCOUNTERS FOR TELEHEALTH CLINIC PER MEDICAL FACILITY

	Maine	WRJ	Bedford	Boston	Manchester	CWM	Providence	Connecticut
<i>MH Individual</i>	1213	306	800	14	6	29	1	97
<i>MOVE</i>	1,513	322	25			136	5	358
<i>Dermatology</i>	1,236	74	10	425		1	80	
<i>PT</i>	7	965				1	1	5
<i>MH Group</i>			406					2
<i>Amputation</i>					103	31	108	147
<i>Podiatry</i>		403						
<i>Substance Abuse</i>		254					122	
<i>Nutrition</i>		68	51	19	13	105		
<i>Pulmonary</i>						237		

6.1.2 NUMBER OF ENCOUNTERS FOR NON-TELEHEALTH CLINIC PER MEDICAL FACILITY

	Maine	WRJ	Bedford	Boston	Manchester	CWM	Providence	Connecticut
<i>MH Individual</i>	29,088	14,735	15,767	25,052	12,645	27,166	24,042	26,524
<i>MOVE</i>	441	1,258	712			3,565	1,363	3,487
<i>Dermatology</i>	563	3,743	1,027	10,338		492	6,861	
<i>PT</i>	7,374	5,829				7,279	9,672	12,103
<i>MH Group</i>			4,750					9,181
<i>Amputation</i>					8			6
<i>Podiatry</i>		8,060						
<i>Substance Abuse</i>		3,353						
<i>Nutrition</i>		981	851	5,929	1,482	2,119		
<i>Pulmonary</i>								

6.2 APPENDIX II

The following tables illustrate the results of the average encounter cost per clinic type for both Telehealth and Non-Telehealth encounters at each medical facility. The process used to find these values can be found in Section 4.1.1.1.

6.2.1 AVERAGE TELEHEALTH ENCOUNTER COST PER CLINIC TYPE

	Maine	WRJ	Bedford	Boston	Manchester	CWM	Providence	Connecticut
<i>MH Individual</i>	\$ 262.00	\$ 305.00	\$ 710.00	\$ 364.86	\$ 208.00	\$ 695.86	\$ 515.00	\$ 707.00
<i>MOVE</i>	\$ 112.00	\$ 106.00	\$ 469.00			\$ 231.00	\$ 789.00	\$ 176.00
<i>Dermatology</i>	\$ 118.00	\$ 128.00	\$ 296.00	\$ 407.00		\$ 184.00	\$ 602.00	
<i>PT</i>	\$ 179.00	\$ 427.00				\$ 286.00	\$ 569.00	\$ 391.00
<i>MH Group</i>			\$ 270.00					\$ 132.00
<i>Amputation</i>					\$ 348.00	\$ 117.00	\$ 488.00	\$ 195.00
<i>Podiatry</i>		\$ 251.00						
<i>Substance Abuse</i>		\$ 146.00					\$ 543.00	
<i>Nutrition</i>		\$ 166.00	\$ 206.00	\$ 500.00	\$ 303.00	\$ 152.00		
<i>Pulmonary</i>						\$ 363.00		

6.2.2 AVERAGE NON-TELEHEALTH ENCOUNTER COST PER CLINIC TYPE

	Maine	WRJ	Bedford	Boston	Manchester	CWM	Providence	Connecticut
<i>MH Individual</i>	\$ 255.39	\$ 283.87	\$ 413.22	\$ 417.36	\$ 278.74	\$ 273.11	\$ 336.41	\$ 393.18
<i>MOVE</i>	\$ 79.00	\$ 83.19	\$ 166.00			\$ 105.70	\$ 74.07	\$ 44.85
<i>Dermatology</i>	\$ 563.01	\$ 287.53	\$ 622.16	\$ 244.73		\$ 84.00	\$ 274.46	
<i>PT</i>	\$ 110.00	\$ 148.00				\$ 125.00	\$ 114.00	\$ 152.28
<i>MH Group</i>			\$ 208.41					\$ 143.20
<i>Amputation</i>					\$ 161.00			\$ 356.00
<i>Podiatry</i>		\$ 95.98						
<i>Substance Abuse</i>		\$ 57.22					\$ 129.20	
<i>Nutrition</i>		\$ 97.00	\$ 177.00	\$ 142.00	\$ 187.18	\$ 107.83		
<i>Pulmonary</i>								

6.3 APPENDIX III

The following tables illustrate the results of the total annual cost per medical facility per clinic type. The process used to find these values can be found in Section 4.1.1.1.

	Maine	WRJ	Bedford	Boston	Manchester	CWM	Providence	Connecticut
<i>MH Individual</i>	\$8,023.07	\$6,464.27	\$237,424.00	-\$735.00	-\$424.44	\$12,259.75	\$178.59	\$30,440.54
<i>MOVE</i>	\$49,929.00	\$7,345.59	\$7,575.00			\$17,040.80	\$3,574.65	\$46,951.70
<i>Dermatology</i>	-\$550,033.17	-\$11,804.99	-\$3,261.60	\$68,964.75		\$100.00	\$26,203.20	\$0.00
<i>PT</i>	\$483.00	\$269,235.00				\$161.00	\$455.00	\$1,193.60
<i>MH Group</i>			\$25,005.54					-\$22.40
<i>Amputation</i>					\$19,261.00	\$3,627.00	\$52,704.00	-\$23,667.00
<i>Podiatry</i>		\$62,471.15						
<i>Substance Abuse</i>		\$22,549.49					\$50,483.60	
<i>Nutrition</i>		\$4,692.00	\$1,479.00	\$6,802.00	\$1,505.66	\$4,637.85		
<i>Pulmonary</i>						\$86,031.00		
Total Cost	-\$491,598.10	\$360,952.52	\$268,221.94	\$75,031.75	\$20,342.22	\$123,857.40	\$133,599.04	\$54,896.44
Total Additional VISN1 Annual Cost due to Telehealth Encounters:								\$545,303.21

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