
Telehealth in Rural Pennsylvania

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EXECUTIVE SUMMARY

Improving the quality of healthcare while lowering costs and increasing access in rural Pennsylvania counties is challenging. Telehealth, which is the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, and public health and health administration, has been proposed as a possible solution to meeting these challenges. This research, conducted in 2012 and 2013, set out to describe how and to what extent telehealth is being implemented in rural Pennsylvania.

Overall, the goals of the research were to: provide an overview of telehealth, including an assessment of its economic impact; describe telehealth implementation in rural counties; and identify obstacles preventing its wider implementation.

For the study, the research team conducted: a multi-phase search of the literature, reviewing more than 400 articles; an open survey of 190 healthcare professionals including physicians, nurses, nurse practitioners, physician assistants, technical support staff, information technology staff, clerks and administrators; a controlled random sample survey of 323 Pennsylvania physicians; and 171 interviews with 75 hospital staff in rural Pennsylvania counties.

It should be noted that, when the research began in March 2012, the Patient Protection and Affordable Care Act (PPACA), was in limbo, and several major changes were made to regulations regarding telehealth at both the federal and state levels.

Defining Telehealth

Telehealth is an umbrella term that includes a variety of electronic information and telecommunications technologies including telemedicine, which may also include teleradiology, teleburn, and telestroke, telepsychiatry, telecare, mHealth, and eHealth, which is for mobile healthcare and electronic healthcare, electronic health records, and medical education for both patients and providers.

This study included the following in its definition of telehealth:

- Live real-time videoconferencing (either clinical or educational);
- Live real-time remote monitoring;
- Online video recording (either clinical or educational);
- Online diagnostic scans (such as radiology);
- Online remote monitoring (stored);
- Electronic health records;
- Diagnostic decision support systems; and
- Web-based discussion boards.

Research Results

Telehealth Uses

According to the research results, the most common type of telehealth in use was electronic health records (EHR), with almost 63 percent of physicians from the random controlled sample reporting using EHR. Twenty-eight percent reported using live videoconferencing, 26 percent reported using recorded videos over the Internet, and 20 percent used diagnostic remote monitoring. There was no significant difference in responses from physicians from rural or urban counties.

Almost half the respondents didn't know what other specialties in their facilities used telehealth, but those that did respond indicated that radiology was the biggest user, followed closely by family medicine, emergency medicine, and internal medicine.

There was no significant difference in whether or not a physician was likely to use telehealth based on any of the factors tested, including rural or urban location, physician age, type of facility, or physician specialty.

The quality of telehealth was assessed to be relatively poor, with the large majority of respondents who answered the question (58) reporting no training, no technical support, unreliable infrastructure, and lower quality than a traditional healthcare treatment. Most respondents (93) reported a very low patient satisfaction rate (less than 20 percent were satisfied).

According to the literature review of best practices, the "sweet spots" for telehealth use were: chronic disease health management, medical and health educational purposes, and professional collaboration. Results from the random controlled physician sample indicated that less than one quarter of respondents used telehealth for those purposes.

Telehealth Impacts

The portion of the research devoted to assessing the impact of telehealth on healthcare was difficult, because it is not the technology itself that saves money, but the use to which it is put. To make sense of the numbers, the research team started with a baseline of healthcare cost estimates from the Urban Institute, which estimated the cost of healthcare if federal healthcare reform fails. According to those estimates, the current average cost per person of \$8,233 would increase to \$25,541 per person within 20 years.

The research team started with the current numbers and dollars for various aspects of healthcare. Based upon the additional research found, the team identified several value-added activities that research has shown to impact healthcare costs, and estimated the cost impacts for the different value-added activities for the 1st year, the 5th year, and the 20th year after implementation.

The research team estimated the cost impacts for these value-added activities that are part of healthcare reform, assessing costs and savings as if they were implemented separately, without any combined effect. It also analyzed the cost impacts for the contributory effects of a combination of all the value-added activities, which included the following:

- elimination of administrative waste and overtreatment;
- implementation of wellness and prevention programs;
- integration of EHR (a single national electronic health record system);
- implementation of videoconferencing and remote monitoring; and
- a combination of all of the above.

The results showed that simple telehealth videoconferencing and remote monitoring implementation would save very little in Pennsylvania: \$316 billion if implemented versus \$324 billion if not implemented, which is less than \$8 billion in annual savings in the 20th year assuming that no other changes were made. EHR would provide a slight annual savings in the 20th year, as Pennsylvania healthcare costs would be \$274 billion versus \$324 billion.

According to the research findings, for telehealth to impact healthcare, policy changes regarding telehealth would need to be balanced to support the optimal use of the technology. Telehealth should be used for high volume prevention activities, such as behavioral medicine and healthy lifestyle support, and not just high-cost clinical procedures.

Typically, effective lifestyle changes require behavioral therapy, personal coaching, physical therapy, group sessions, nutrition education, and a great deal of support: services that are very expensive. Telehealth can be used to make health and wellness activities more financially feasible and more widely available. The use of telehealth for prevention programs will lead to a decrease in chronic conditions in future years, and healthcare costs will go down. Especially important is using telehealth to enable seniors to stay in their own homes and delay or avoid hospitals and nursing homes.

If prevention and wellness programs were implemented using telehealth, the 20th year costs of Pennsylvania healthcare would be about \$130 billion, a savings of \$194 billion.

The obstacles to using telehealth effectively are many, starting with the lack of reimbursement caused by a restrictive definition of telehealth. Telehealth is regulated as if it were a new treatment instead of just another method of providing healthcare services. The lack of reimbursement for services delivered using technology discourages not only telehealth use, but also the development of the telehealth industry in the United States. Few health insurance companies cover telehealth, and the reimbursement that Medicare and Medicaid offer is restricted by a complex set of rules. Medicare only reimburses services from a doctor's office to a hospital rather than from the home of the patient, and only in rural areas where there is a physician shortage.

Another obstacle is current licensing requirements that discourage telehealth. Currently, medical personnel (physicians, physician assistants, nurses, nurse practitioners, psychologist, social workers, etc.) are licensed by the state where they practice. A Pennsylvania resident who travels to Maryland or New Jersey to get medical care is not breaking any state laws or regulations. However, a Pennsylvania resident is not allowed to speak over a videoconferencing link with the doctor in another state because the doctor would need to be licensed in Pennsylvania. Each state has its own medical and nursing associations, which sets standards for physicians and nurses. Since state standards are different, a physician or a nurse must be licensed in each state in which they might have a patient. If a physician or nurse provides services to someone physically in another state, they could be prosecuted and might lose their license in their own state. This restriction severely curtails the ability of physicians and nurses to provide telehealth services (D. C. Baker and Bufka, 2011; Hughes, et al., 2010; Newman and McMahon, 2011; Schopp, et al., 2006).

Many states have expedited licensing process for cross-state medical licensing, but not all. State medical boards have the responsibility to safeguard the people who live in their state from unlicensed or fraudulent practitioners. In some states, like Pennsylvania, there is an exception for consultative medical practices, though there is some confusion over whether its purpose was for occasional consults or if it can be used for a physician or nurse to regularly schedule appointments with patients. But even this exception requires an excessive amount time and resources to complete the paperwork (Wakefield, 2010).

Additional obstacles to using telehealth effectively are the lack of broadband access in rural counties and hard-to-use devices.

Policy Considerations

In general, the policy considerations of the research are as follows:

- Define telehealth as a method of providing face-to-face healthcare, not a treatment, and remove all restrictions on use and location.
- Accept the location of the provider as the jurisdiction for licensing requirements; there is no need to get recertified in every location where potential patients live.
- Continue efforts to establish high speed broadband throughout Pennsylvania, especially in rural counties.
- Implement regulations that will encourage the use of telehealth in prevention activities and healthy living/wellness maintenance.
- Implement regulations that will encourage the use of telehealth in remote monitoring, which can help in establishing guidelines for avoiding overtreatment and managing near-end-of-life practices more effectively for seniors.
- Eliminate the barriers between behavioral and medical healthcare so that medical doctors can oversee lifestyle activities implemented through telehealth.
- Continue to lead state efforts, and cooperate with national efforts, to simplify and standardize healthcare systems and create a single electronic health record exchange.

The combined impact of all of these changes on healthcare in Pennsylvania would result in annual costs savings of \$70 billion in the 5th year, increasing each year so that by the 20th year, the annual savings would be more than \$215 billion.

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INTRODUCTION

Pennsylvania is very diverse, and there are major challenges to equitable healthcare availability in rural areas (Norton Ch Fau - McManus and McManus, 1989; *Rural Behavioral Health Programs and Promising Practices*, 2011). While Pennsylvania is beset with the nation-wide problems of rising healthcare costs as the population ages and increased chronic health problems, it is especially hard hit for the more than 3.4 million residents living in rural areas.

There is also a disparity in acute-care hospitals. Among urban counties, there are 2.8 hospital beds for every 1,000 urban residents (a ratio of .28 percent beds to heads). But in rural counties, the ratio is only .23 percent beds to heads. In seven rural counties, there were no hospitals at all (*2009 Pulse of Pennsylvania's Physician and Physician Assistant Workforce: A Report on the 2008 Survey of Physicians and Physician Assistants*, 2009). Furthermore, Pennsylvania is known for a lack of affordable malpractice insurance, which makes setting up a primary care practice in PA unattractive (Bovbjerg and Bartow, 2003).

Additionally, surveys show that rural Pennsylvanians are not taking care of themselves as well as their urban counterparts. Fewer rural residents exercise frequently, more than a third are overweight, and almost two-thirds are at risk for their sedentary lifestyle. They are in poorer physical condition, have more health risks, and are more likely to lack health insurance. The wage gap between higher income urban and lower income rural PA is getting wider; it has doubled in the last 30 years. (*Status Check Pennsylvania Rural Health Care*, 2010)

The healthcare system has changed drastically over the past few decades. Changes discussed here include a trend toward for-profit industry, a focus on diagnosis, a movement to facility based (rather than home based) care, a third-party payment system through health insurance as an employee benefit, the growth of healthcare networks and specialists, and a decrease in independent general practitioner physician offices. Higher prices of healthcare have caused a change in attitude about the doctor-patient relationship, and a growing insistence that patients be included in decision making and that financial factors be considered. People's health itself has also changed; people are living longer, and their needs have switched from event-based injury treatments to wellness maintenance caused by ongoing chronic diseases and conditions, often related to a sedentary lifestyle.

Healthcare is relying more upon facility-based healthcare (Naveh, 2007). Hospital emergency rooms are expensive, but are often used for less-than-life threatening treatment as doctors become less available (especially for those on Medicare or Medical Assistance) (Lewis, 2012). The days of having a family doctor who took care of everyone in the family for all health issues are gone. Now each patient needs a pediatrician, an internist, a psychiatrist, a geriatric specialist, etc - and that is even before any health conditions are diagnosed (Pitts, Carrier, Rich, and Kellermann, 2010). The number of specialists has exploded, due in part to the payment structure that focuses on diagnoses and pays higher fees for treatments by specialists. (Emery, 2012)

The mixture of for-profit hospitals in what was traditionally a non-profit industry has caused many changes (Reports, 2012). Furthermore, what once was dominated by independent physicians with "privileges" at various hospitals has grown into a healthcare network of various levels of care from primary care physicians, specialists, inpatient, outpatient, and rehabilitation services (Carroll, 2011). The paradigm of the know-all doctor has given way to viewing the patient as a customer traveling through the labyrinth of services on the path to better health (Rodak, 2012).

The healthcare system is about to change drastically again. Current laws have caused changes (most notably the *Patient Protection And Affordable Care Act* [PPACA Public Law 111–148] and *Health Care and Education Reconciliation Act of 2010* [HCERA Public Law 111–152]). Some believe that the new legislation will impact rural areas even more than urban (Kessler, 2012). Payment systems are moving away from fee-for-services, which some say encourages over-treatment and discourage quality of care, to fee-for-performance (which hopes to encourage prevention and quality of care). (Killingsworth, 2011; Pearce, 2012; Vassilaros, 2012)

Against this backdrop of change, new technologies are being implemented, known collectively as telehealth.

What Is Telehealth and Need for Project

Telehealth is the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration. Technologies include videoconferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications (CMS, 2008; HHS, 2012). Some laud telehealth as the great savior; the technology that can bring down costs and raise quality for healthcare, especially for difficult access areas such as rural Pennsylvania (L. C. Baker, Johnson, Macaulay, and Bernbaum, 2011; Finkelstein, Speedie, and Potthoff, 2006; Noel, Vogel, Erdos, Cornwall, and Levin, 2004; Singh, Mathiassen, Stachura, and Astapova, 2010; Wicklund, 2011). Others are not so sure, and point to the mixed research results (Davalos, French, Burdick, and Simmons, 2009; Wicklund, 2012).

In 2011 and 2012, due in part to the lifting of several restrictions on telehealth in the United States from the Centers for Medicare and Medicaid Services (CMS), the amount of healthcare services and monitoring follow up services provided through telehealth has grown (Manos, 2012). The United States is beginning to catch up to other countries where telehealth is already more of a standard (*Handbook of Research on Developments in e-Health and Telemedicine: Technological and Social Perspectives*, 2009).

One of the greatest promises of telehealth is the potential to equalize access and lower costs for rural areas. Knowing what telehealth practices are currently being used in rural Pennsylvania, and how well they are being used, is essential to understanding its benefit, if any. It is critical for policy makers to understand the barriers and best practices for telehealth in Pennsylvania rural counties so that it can fulfill its promise, if possible.

Search of the Literature

The search of the literature was broken out into two main sections; healthcare research and telehealth research.

Healthcare Research

After a brief history of healthcare in the United States, specific research on rural healthcare is presented. Then the literature on healthcare decisionmaking, and the challenges of healthcare in the United States will be discussed. Following will be a brief discussion of healthcare reform in the United States, a more extensive section on healthcare cost benefit analysis research, and finally a discussion of proposed solutions to the current issues faced by the healthcare system.

History of Healthcare in the United States

The healthcare industry has always been around, though it may have started with witch doctors or medicine women in tribal times. Use of telecommunication to enable healthcare has also been around; as smoke signals sent by African villages to warn others to stay away from diseased areas, for example. (Pryke, 2010)

In the 1900s the medical community began to organize, as the American Medical Association (AMA) grew from 8,000 physicians to over 70,000 - more than half the physicians in the U.S. Healthcare costs grew over the next 30 years as hospitals developed modern practices such as using antiseptic, washing hands, and performing surgery. Doctors were paid directly by their patients. Healthcare insurance, though available in Europe, had not quite caught on in the United States. (Silverman and Epstein, 2000)

In the 1940s, during the war, employers started to offer health insurance benefits to attract employees. President Truman proposes a national health program which was strongly opposed by physicians and denounced as a communist plot. During the 1950s and 1960s, private healthcare grew; by the end of the 60s there were more than 700 health insurance companies. The cost of hospital treatment more than doubled. Healthcare costs were 4.5 percent of the gross domestic product of the U.S. Doctors began to specialize. By 1970 more than 69 percent reported working full-time, caring for patients solely within their specialty. House calls, previously a common method of treatment, became a thing of the past. Medicare began, and Major Medical Coverage began to provide funding for high-cost medicines and procedures, spurring investment, research, and development (R&D) in healthcare. (Silverman and Epstein, 2000)

In 1970, total healthcare spending in the U.S. was about \$75 billion, about \$356 per person. Today, healthcare spending is \$8,402 per person, and up to 17.9 percent of the gross domestic product (Kaiser, 2012). As an attempt to bring down costs, Healthcare Maintenance Organizations (HMO) became popular in the 1980s and 1990s. An HMO requires a referral from a primary care physician to get diagnostic tests and to see specialists. In the 90s, Medicare and private insurance companies shifted to payments based on diagnosis instead of treatment. Pharmaceutical companies began to advertise directly to consumers and prescription drug prices began to skyrocket. More recently, "capitation," a method of paying for each person who is a member of a healthcare provider's network, has become more common. (Pearce, 2012)

Nonetheless, healthcare costs continue to rise at twice the rate of inflation. Healthcare is now seen by many to be in a "crisis" (Knauf and Aronson, 2009; Silverman and Epstein, 2000; Wicklund, 2011). Chronic diseases have overtaken infection, illness, and injuries as causes of death, and the present diagnostic method of payment is ill-suited to cover the cost of ongoing care. Sixteen percent of the population have no insurance. Medicare exerts a significant influence over the industry as the rising senior population takes a larger share of the healthcare budget. Fifty percent of health care spending treats just 5 percent of the population. Most research identifies the importance of succeeding at efforts to improve the health of the public through encouragement of a healthy lifestyle; the long-term impact of lowering the incidence of chronic diseases is recognized as a way to help reduce future healthcare spending. (Kaiser, 2012; *Status Check Pennsylvania Rural Health Care*, 2010)

Research on Healthcare in Rural Areas

Research on rural healthcare is sparse. According to Artnak, McGraw, and Stanley, "The few studies available on health care delivery in rural settings support the fact that much like the rest of the nation, the quality of health care in these areas falls far below what is desirable." (Artnak, McGraw, and Stanley, 2011) As pointed out by Jackson Rainer, a well-known health researcher: "Treating rural and isolated clients is neither fully articulated in the research literature nor well appreciated in public policy planning" (Rainer, 2010).

Pennsylvania Rural health Association notes that rural PA residents have lower incomes, less education, and poorer health than their urban counterparts. Fewer rural residents exercise regularly, and more of them are overweight and sedentary. There is also a difference in health insurance coverage. According to the U.S. Census Bureau's Small Area Health Insurance (SAHIE) program, results released in July of 2010 (based upon 2007 data) estimate that 14 percent of rural residents under 65 years old did not have private health care insurance. That's 3 percent higher than the number of those under age 65 in urban counties who did not have private health care insurance (11 percent). (*Status Check Pennsylvania Rural Health Care*, 2010; *US Census Bureau: Small Area Health Insurance Estimates: 2007 Health Insurance Coverage Status for Counties and States: Data Sets*, 2007)

Liu et al. studied rural health insurance to see if it could improve equity in health care utilization. They found that for the most part, it did, except when bureaucratic obstacles, low reimbursement rates and poor quality service interfered (Liu et al., 2012). Artnak, McGraw, and Stanley explored the issue of accessibility to care from rural areas and found that it impacts rural demographics on chronic illness. (Artnak, et al., 2011) Hossain and Laditka investigated why rural areas have higher non-urgent emergency visit rates than is typical. Normally, about one-third of emergency department visits are not emergencies, and would have been better suited to care in a primary care setting with their own physician. The rate rises with rates of uninsured or patients living in poverty, as well as whether or not the patient lives in a rural area. They found that the degree of rurality was not a factor, but the presence of a community health center was. (Hossain and Laditka, 2011)

Kanzleiter, Schwartz and Nyanungo studied rural community health centers, and discussed the mission of Rural Health Clinics which was to increase access to healthcare in rural areas which typically have a low supply of primary care physicians. They discussed payment methodology, and noted that this topic is of great importance to rural centers because they serve a disproportionate number of Medicaid patients. They also noted that the financial status of rural centers was more tenuous than urban centers, and that chronic disease and mental/behavioral health are the two most prominent issues facing rural health centers. (Kanzleiter, Schwartz and Nyanungo, 2010)

Trussel and Patrick did not find that rural hospitals were more prone to financial issues than urban, but still found that more than 25 percent of them were distressed, and three percent had closed during their study period. DelliFraine, Davis, Holt, and Baronner found that rural hospitals are not able to cover their costs of operations, and that they were worse off than urban hospitals from a cash flow perspective. (DelliFraine, Davis, Holt, and Baronner, 2010; Trussel and Patrick, 2010)

Kilwein, Curis and Woodman studied HIV/AIDS support networks in rural Pennsylvania, and found that some top problems were lack of providers, especially medical specialists, access problems, transportation difficulties, the high cost of face-to-face case management, and geographic isolation. (Kilwein, Curtis, and Woodman, 2008)

Castleden, Crooks, Schuurman, and Hanlon studied the nature of palliative care in rural regions, noting that the aesthetics and sites of palliative care, along with the perception of lack of choice for volunteer caregivers, are all influential in the social and physical dimensions. (Castleden, Crooks, Schuurman, and Hanlon, 2010)

Research on Healthcare Decision Making

When considering healthcare decisions for one person, patient outcome may be the only consideration. But when considering an entire population of people, researchers must be mindful of both patient outcome and resources available to treat the population. (Hoch and Smith, 2006)

Gabbay et al. reviewed 92 studies, over half of which purported to provide clear guidance to clinicians as to when to determine that further actions are unlikely to help a dying patient (futility). The other half refuted that the point of futility was reached or could be determined and therefore further treatment was warranted. They determined that among the 47 studies that supported withholding of treatment, none demonstrate clear determinable guidelines for clinicians to follow. They conclude that trying to rely upon statistically driven data to make such determinations is fraught with problems, and that physicians need to rely upon their own expertise rather than relying upon published data determining futility guidelines. (Gabbay et al., 2010)

Baily researches the controversy of futility of care and the ethics of cost control. Baily argues that universal access to quality care cannot be affordable unless the decision makers accept the moral legitimacy of taking cost into account in health care decisions, even decisions at the end of life. (Baily, 2011)

Banham, Lynch, Karnon developed an Equity-Effectiveness framework that, if utilized by a central healthcare decision making agency, would enable proper evaluations of health interventions in applied settings with an internally consistent approach to accounting for life expectancy. This would help physicians make better end-of-life decisions about treatment. (Banham, Lynch, and Karnon, 2011)

The Framingham Heart Study resulted in an index that assesses the 10 year risk of cardiovascular disease (Kannel, 1976). This index is widely used, and has more than 50 years of additional research on it, allowing physicians to determine whether further interventions would be helpful (Brindle et al., 2003).

One issue is whether or not these decision making tools should be made available to patients themselves. There is a trend toward enabling patients to be full partners in decision making rather than the previous paternalistic mode where the doctor made all the decisions and the patient had no choice. (Gallelli, Wells, Peltonen, and Groden, 2011)

Turbyville et al. researched commercial health plans to determine if the quality of the healthcare was reflected in the decision that diabetic patients made on whether or not to utilize the resources of the plan. They found no relationship between the two. (Turbyville, Rosenthal, Pawlson, and Scholle, 2011)

Beil explored the issue of the cost and efficacy of commonly prescribed cancer drugs that have all entered the market in the last few years. Americans spent \$23 billion on cancer drugs, more than spent on any other type of prescription drug in any other category. These drugs provide weeks or months of additional life for cancer patients at an extremely high cost. Perjeta, a breast cancer drug, provides up to six additional months of life at a cost of \$188,000. Provenge can provide a prostate cancer patient with four additional months of life, at a cost of \$93,000. Yervoy, another prostate cancer drug, costs \$120,000 for four months

of life. Tarceva helps pancreatic cancer patients get 14 to 16 additional days of life for about \$15,000. Beil reports on an interview with Dr. Thomas Smith from the Sidney Kimmel Comprehensive Cancer Center in Baltimore. He noted that "We are the only industrialized country that doesn't look at the cost balanced somehow with effectiveness in making decisions about drugs," and concludes that asking hard questions about health care is not a bad idea. (Beil, 2012)

Kuo and Mei-Shu developed a predictive model of healthcare and medication costs using data from the Longitudinal Health Insurance Database of Taiwanese, a population of 793,239 enrollees. Predictors used were age, gender, ADG group (Aggregated Diagnosis Groups, which are defined morbidity groups) and Rx-defined Morbidity Group. They found that adding the medication Rx-defined morbidity group improved the predictive capability of the model, and therefore was the best method for explaining the variation in healthcare costs. (Kuo and Mei-Shu, 2010)

Bong-Min researches the use of health technology assessment as a policy option in order to avoid unnecessary healthcare costs. Bong-Min found that health technology generally increases costs rather than saves costs, and health technology assessment tools help determine if new treatments are cost effective. He notes that some countries such as South Korea have already implemented health technology assessment policies requiring pharmaeconomic research (proof that a new drug will be more cost effective than what is already available) before reimbursing for prescriptions. He identifies culture, healthcare systems, and public trust in the government as factors that determine which countries will utilize health technology assessment. (Bong-Min, 2009)

Decisions are influenced by availability of services. The Atlas project studied hospital referral regions (HRRs) in different states regarding how much they spent on Medicare enrollees with severe chronic illnesses. Researchers demonstrated that clinical decisions governing the frequency of use of such supply-sensitive care as physician visits, referrals to specialists, hospital care, and diagnostic testing are strongly affected by local capacity, which strongly influences both the quantity and per capita cost of care provided to patients with chronic illnesses. They conclude that means other than in-patient hospital care must be found to reduce overtreatment of the chronically ill in the inpatient setting, particularly by improving the coordination of care. (Wennberg and Fisher, 2008)

One of the major issues in healthcare decision making is the collaborative efforts of groups of physicians. There have been many studies on this topic. Kuhlmann, Gavin, and Galavotti evaluated nine studies on integrating family planning services as part of an integrated health practice, and all reported overall satisfaction from the providers, clients, and community perspective, though only seven of the nine studies reported the measurement of the improvement, and none provided a cost benefit analysis. (Kuhlmann, Gavin, and Galavotti, 2010)

White and Glazier reviewed 65 studies on cost benefit of hospitalists (special doctors hired by hospitals rather than traditional physicians who maintain hospital privileges for their patients). The majority show that hospitalists reduce patient stays and cost less, but don't necessarily provide better care. The authors were concerned that the issue has not gotten better despite study, and they were not able to identify the underlying mechanisms driving the outcomes and associated quality of care so that it could be improved. (White and Glazier, 2011)

Sikorski, Lippa, König, van den Bussche, and Reidel-Heller reviewed 108 articles and chose 11 that were randomized controlled trials training general practitioners in depression care. Training alone did not improve outcomes; organizational structure changes were necessary before changes were seen. (Sikorski, Lippa, König, van den Bussche, and Riedel-Heller, 2012)

Chisholm-Burns et al. reviewed studies on the effectiveness of pharmacists as part of the healthcare team, and concluded that the majority of studies were limited due to partial cost analysis, study design, and inappropriate statistical analysis. They encouraged future investigators to adhere to the guidelines and recommendations of the Panel of Cost-Effectiveness in Health and Medicine. (Chisholm-Burns et al., 2010)

The efficacy of specialists versus primary care physicians and drug approval decision making was also the topic of study. Chauhan and Mason investigated 29 studies (out of the 1,400 screened) for the reasons

behind the slow progress in new prescription medicines in the United Kingdom, and concluded that though price was not the primary factor, the fact that specialists are more likely to be involved in the Drug and Therapeutic Committees gives them more access to the details of new drugs so that they are more likely to differentiate drugs with novel actions or identify areas with few alternatives. Primary care physicians are less likely to be involved in formal purchasing decision processes, and therefore are less likely to have new drugs on their consciousness. (Chauhan and Mason, 2008; Mason, 2008)

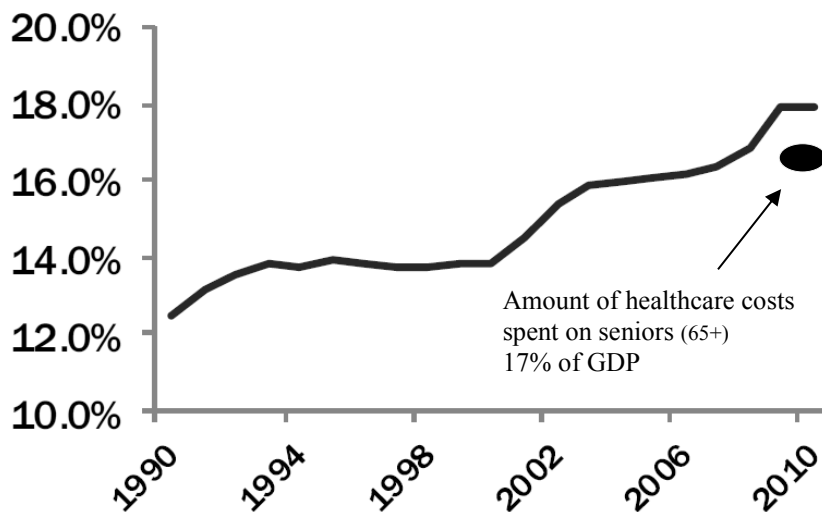
Healthcare Challenges in the United States

As noted in the brief history section, there are several challenges to healthcare, some of which have risen to the level of being called a "crisis" in the media (Knauf and Aronson, 2009; Silverman and Epstein, 2000; Wicklund, 2011). For most, the issues are the rising cost of healthcare, the even faster rising administrative costs of healthcare, administrative waste and overtreatment, the unique position healthcare holds regarding its financial analysis, and its multi-layer payment structure. The healthcare industry suffers from a lack of healthcare information technology data standards. The industry must also deal with more recent problems caused by the typical sedentary lifestyle of recent years, and a lack of prevention guidance built into the system. Additional problems include a growing senior population, growing chronic conditions and diseases, a shortage of physicians, end of life care management issues, and the difficulties involved in rural accessibility to healthcare.

Rising Costs of Healthcare

Healthcare costs have increased compared to previous years, and are expected to continue to grow, as can be seen in the graph of healthcare costs compared to Gross Domestic Product (GDP) in Figure 1, which came from Centers for Medicare and Medicaid Services, National Health Expenditure Accounts. (The tables from 2010, published in January of 2012 are available from [http:// www.cms.gov/Research-Statistics-Data-and-Systems/Statistics- Trends-and-Reports/NationalHealthExpendData/Downloads/tables.pdf](http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/tables.pdf).) (*Health Care Cost and Utilization Report: 2010, 2012*; Pryke, 2010)

Figure 1. Healthcare Costs as Percent of GDP according to CMS.



Knauf identifies the cost crisis as a major problem, and delves into a single diagnosis, end stage renal disease, as an example of why it would be beneficial to switch to a prevention focus instead of just treatment, noting that the current system rewards treatment, not prevention. (Knauf and Aronson, 2009)

Currently, the people of Pennsylvania pay annually over \$8,000 per capita in healthcare costs. If the healthcare system does not change, the health costs will more than triple to over \$25,000 per person within 20 years. While many researchers point to new technologies as the cause of the sharp rise in costs, others

believe that it is directly related to the high cost of administration. (Garrett, Holahan, Doan, and Headen, 2010; Kaiser, 2012)

High Administrative Costs of Healthcare

Administrative costs for private health insurance plans have risen dramatically over the past 10 years - by more than 117 percent. Compared to the administrative costs, actual healthcare costs only rose 74 percent, so administration costs are a larger part of rising healthcare costs. Researchers estimate that administrative costs eat up more than 30 percent of the healthcare dollar in administration and procedures. (Roth, 2010; *Thinking Outside the Pillbox: A system-wide approach to improving patient medication adherence for chronic disease*, 2009; Wikler, Basch, and Cutler, 2012)

According to the majority of healthcare researchers, the U.S. spends more on healthcare than any other country - and the quality of the basic healthcare is lower. Germany spends less than 6 percent of its healthcare dollars on administrative systems. (Nelson, 2010; Roth, 2010)

Most researchers believe that the high administrative costs are caused by the disconnected, bureaucratic, and for-profit competitive nature of the current healthcare system (Wikler et al., 2012). Estimates range from 22 to 40 percent of the healthcare administration dollar being completely wasted, or going into a shareholder's pocket, but not influencing the quality or quantity of healthcare (Bernstein, Centers for Disease Control and Prevention, United States Department of Health and Human Services, and National Center for Health Statistics, 2004; Berwick, 2003; CDC et al., 2007; Daniel, Damon, Mark, Mark, and Richard, 2012; Roth, 2010)

The literature on the reasons for the high administrative costs is also related to several other areas: the non-economic principles of healthcare, the multilayer payment structure of healthcare, the burden of overtreatment, the lack of healthcare information standards, the typical sedentary lifestyle of an American, the lack of prevention guidance, and end of life care management issues.

Non-Economic Principles of Healthcare

Normal economics principles do not apply to healthcare for a number of reasons. First is the ethical issue. With healthcare there is a desirable state of access for everyone regardless of ability to pay. Society at large does not wish to be responsible for the death of members of the community simply because they could not pay for the service. (Coleman, 2011; El-Sayed, 2012; Fleck, 2011)

Additionally, in healthcare, as noted in the *Research on Healthcare Decision Making* section, financials are not expected to be part of the equation; people are often unwilling or unable to put a price on their life. Physicians ordering treatments are not expected to take financials into account. Scholars are recognizing a great concern in the community at the idea that the amount of resources available must be balanced against the outcome expected. These fears have sometimes led to an "outcry" in the media, especially while healthcare reform was under debate, accompanied with warnings of impending rationing of healthcare and so called "death panels". (Gruenewald, 2012; Kernick, 2005; Lauridsen, Norup, and Rossel, 2008; Nord, 2010; Ruger, 2008b; Zunic et al., 2011)

Another reason healthcare does not follow normal economic principals; healthcare is one of the industries where the providers (the doctors) are more knowledgeable about the needs of the customers (the patients) than the patients are. The physicians, hospitals, and healthcare networks are trusted by the patient to do what is necessary and right rather than what would make the most money. Patients don't feel empowered to "go against doctor's orders," so if the doctor says to get a test or undergo a treatment, they do so, even if it is inconvenient, difficult, and unlikely to produce qualitative or quantitative value. Currently, to "opt out" of a physician ordered test or treatment requires signatures on forms that warn the patients of the consequences if they don't get a recommended test. Courts have been known to mandate a physician's order even if the patient clearly states they didn't want it. (Gallelli, et al., 2011)

One difficulty patients have in opting out of testing, and that physicians have in curtailing testing, is related to another contributor to the high cost of overtreatment: malpractice suits (Mulvany, 2010). The possibility of an astronomical malpractice settlement has greatly impacted the field (Bovbjerg and Bartow, 2003). The high price of malpractice insurance is a considerable issue that severely limits the amount of money a physician can make in private practice (Callens, Volbragt, and Nys, 2006; Hermer and Brody, 2010).

In Pennsylvania specifically, in recent years, the issue of the high cost of malpractice insurance has greatly reduced the number of independent private practices. The Project on Medical Liability in Pennsylvania notes that physicians and hospitals cite a “crisis of availability and affordability” of malpractice insurance that is driving out practitioners and compromising access to medical services. They also note that Pennsylvania physicians pay twice the national average for medical malpractice insurance. (Bovbjerg and Bartow, 2003)

Related very closely to the non-economic issues of healthcare is the multilayered payment system. Because of the multilayered payment system, the cost savings due to technology implementation that is typical in normal businesses do not apply because those who pay for the technology do not benefit from the savings of technology. As a result, healthcare is the last major industry to adopt technology to better serve its users. (Taylor, 2012)

Multilayer Payment Structure of Healthcare

The way healthcare invoices get paid is another reason the economically-driven rules between supply and demand are not applicable. The payer is not the recipient of the service. (Schimpff, 2012a, 2012b)

In Pennsylvania, the only group of people who pay directly for healthcare services are the uninsured, less than 11 percent of the population. While some uninsured patients pay out of their own pocket, many are unable to pay the high prices of care, especially emergency care. Pennsylvania hospitals cover nearly \$1 billion in costs each year for uninsured patients as they are mandated to treat everyone regardless of ability to pay (Baumgarten, 2012). So even in that situation, the receiver of the service is not the payer of the service.

For the remaining 89 percent of the population, healthcare costs are covered by different organizations based upon whether or not the person is employed, was in the service, is older or younger. More than 50 percent are covered by private insurance (either paid by the person or by the person's employer). For combat veterans, the Veterans Administration (VA) covers some or all of the healthcare costs. For seniors over 65, Medicare covers 80 percent of healthcare costs. In Pennsylvania 2.35 million people are seniors (and growing every day as the population gets older). For poor people in general, Medicaid (or Medical Assistance) covers the bills (2.18 million adults), and for children, CHIP (Children's Health Insurance Program) pays for healthcare (1.26 million children). (Claxton et al., 2012)

And sometimes the payer is not actually the payer. When an employer pays the cost of health insurance, the recipient of the service, the patient, is not even indirectly involved in the payment and the payer of the service (the insurance company) is paid by someone other than the recipient. Even in the case of public healthcare insurance such as Medicare and Medicaid, the recipient is still not the payer, the taxpayer is the payer who pays the payer, the government. Only individual self-paid health insurance has a more direct connection between the payer and the service.

This odd non-economic method of payment means that there is a unique relationship between the consumer (patient), the payer (the insurance company or the government), the employer (who, at times, provides the conduit to the insurance and may pay part or all of the costs), and the providers (doctors, nurses, hospitals) and their suppliers (medical equipment, pharmacies, etc). Mattke and the RAND team point to this "payment silos" structure of healthcare as the reason why numerous beneficial health care innovations (from the systems perspective) are not adopted because the current payment structure rewards a group other than the payers. For example, they note that Electronic Health Records generally would require investment and training on the part of the providers, but the beneficiaries are the private and public insurance companies. (Mattke et al., 2010)

Nelson, Cohen, Greenberg, and Kent reviewed 887 publications reporting 2,128 cost effectiveness ratios for innovative health care. They were looking for lower cost treatments that were decrementally cost effective; giving up quality for price. The number of comparison studies that increased quality and improved health (increasing costs as well) was 1,533, but they found very few (1.6 percent of the sample) that were decrementally cost effective (i.e. found equivalent alternatives to decrease costs). They concluded that because insurance tends to shield both physicians and patients from the true cost of care, there is no incentive to decrease the quality in order to save the costs. Even if the quality would only decrease slightly

and the cost savings were large, there was no incentive to save the money. (A.L. Nelson, Cohen, Greenberg, and Kent, 2009)

Figure 2. Components of Costs and economic issues.

	People with Health Condition	Family members of Person with Health Condition	Healthcare Insurance (public [gov] or private [employer or self])	Business or Industry
Healthcare Related Resource Use	Premiums paid to private insurance. Taxes paid to public insurance. Out of pocket health costs. Transportation costs. Home and/or car modifications due to health. Food for special diets. Loss of income for unpaid leave to attend treatment.	Premiums paid to private insurance. Taxes paid to public insurance. Out of pocket health costs. Transportation costs. Home and/or car modifications due to health. Food for special diets. Loss of income for unpaid leave to attend treatment.	Information Systems and Infrastructure. Administration. Prevention programs. Specialists Equipment. Infrastructure. Community Support Services. Residential Support Services. Prevention Programs. Research.	Premiums paid to private insurance. Taxes paid to public insurance. Out of pocket health costs. Transportation costs. Home and/or car modifications due to health. Food for special diets. Loss of income for unpaid leave to attend treatment.
Other Resource Use	Legal representation. Childcare.	Damage to property (i.e. for substance abuse, smoking, crime related activities)	Worker replacement costs (recruitment, training, retraining). Cost of implementing and adhering to regulations and legislation.	Regulations, inspection and monitoring, child welfare services, disability support services, court services, police services, prison services, emergency fire services, cost of administering taxes and benefits.
Production Losses	Loss of revenue due to unpaid sick leave, treatment related time off from work, reduced on-the-job productivity, premature retirement due to health issues, loss of opportunity for promotion, early mortality.	Loss of revenue and unpaid production while caring for sick family and friends.	Loss of revenue due to unpaid sick leave, treatment related time off from work, reduced on-the-job productivity, premature retirement due to health issues, loss of opportunity for promotion, early mortality.	N/A
Intangible Burdens	Lower Quality of Life, impaired functioning, psychosocial impact, loss of leisure time, loss of life.	Psychosocial costs of caring for sick family and friends.	Deadweight. Loss of additional taxation.	Employee morale

Simplification of a chart from Larg and Moss (2011).

Forgione, Vermeer, Surysekar, Wrieden and Plante advocate looking at this unique relationship in the framework of *Agency Theory*, through the lens of "optimal agreements governing interactions between the involved parties". Reviewing their activities through this lens can give public policy and healthcare advocates insight into rising and lowering costs. In Agency Theory, each involved party can be expected to work in their own best economic interests, so the balance between the parties must be taken into account when considering public policy. Patients want to be taken care of and get well - at the highest value service for the lowest out of pocket cost. Insurance companies want to make money. Employers want healthy productive employees who don't cost too much in healthcare. Government agencies also want people to be healthy, but don't want to spend too much. Pharmacies, medical equipment suppliers, physical therapists, labs, etc. - they benefit financially when people get sick. Doctors, nurses, other staff people help people, but they too need to make a living and benefit financially when people are ill. Healthcare networks want to do good in the community, but if they are for-profit, they are also expected to make money. A chart outlining the different payers and the economic issues involved can be found in Figure 2. (Larg and Moss, 2011)

Agency Theory demonstrates why, despite mountains of evidence that prevention costs less than treatment, it is difficult to get insurance companies to pay for prevention. The financial benefits of prevention occur "downstream", most likely when some other agency would be responsible for them. Childhood vaccines, for example, often don't prevent a disease for a decade or two - by which time the insurance company covering the cost of vaccines is no longer responsible for healthcare costs of the patient. Healthy lifestyle expenses such as gym membership, nutrition counseling, classes and support groups all impact costs of chronic illnesses in a major way; but often not until the person is in their sixties, by which time it is Medicare, and not the insurance company, which pays the costs. This is also why employers are often the only ones willing and able to pay for healthy lifestyle support; they are the ones who benefit the most from healthy productive employees. (Baicker, Cutler, and Zirui, 2010; L. L. Berry and Mirabito, 2011; DeVries Iii, 2010)

Forgione et al (2005) trace the different payment systems used for the billions of dollars that the United States has spent on Medicare and Medicaid (starting with 0 in 1965 and increasing to \$661 billion by 2008). According to Forgione et al. during the 70s, simple reimbursement of costs led to over treatment of patients, excess hospital capacity, and spiraling out-of-control expansion. In 1983 the government switched to a prospective payment system, which set the prices at a fixed fee amount based upon the diagnosis. This drastically changed the model; hospitals were incented to shorten patient's stay in the hospital rather than lengthen them to increase their billings. Another major change occurred in the nineties, when Health Maintenance Organizations (HMO) and Preferred Provider Organizations (PPO) instituted capitation; a payment structure where organizations get a fixed amount per member per month, regardless of quantity (or quality) of care. This incentivizes them to delay or deny treatments causing patients to be hospitalized sicker, get discharged before they were stable, and heavily relied upon outpatient services (which were often reimbursed at higher rates than in-hospital services). (Forgione, Vermeer, Surysekar, Wrieden, and Plante, 2005)

In a new twist, capitation is being tried again, but this time the payment is made through an intermediary, an Accountable Care Organization (ACO) which shares in the savings if the cost of treatment is lower than fee-for-service. When capitation was tried through HMOs in the nineties, it was not well received, so not everyone agrees that the capitation (ACO or not) will achieve the expected goals, and some are afraid that it will lead to low quality of healthcare. (Cox, 2011; Grieve, Sekhon, Hu, and Bloom, 2008; Pearce, 2012)

Kanzleiter, et al also provided a history of payment systems for Medicare and Medicaid, and emphasized the importance of the Medicare and Medicaid dollars to the financial stability of the community health centers. (Kanzleiter, et al., 2010)

Bitton, Martin, and Landon called the current system "deeply flawed" and see a new concept called the "medical home" as a solution. They interviewed people involved in the 26 demonstrations in 18 states of

the Medical Home concept. They believe that the medical home concept will reverse the decades-long trend of rewarding specialists and penalizing primary care physicians, which has been causing a shortage of primary care physicians and inadequate support for high quality care. (Bitton, Martin, and Landon, 2010)

Peikes, Zutshi, Genevro, Parchman and Meyers reviewed 26 studies out of the 498 identified that cited evidence of patient-centered medical home model. The results were mixed; a few favorable, a few indicating that it was not cost effective, and much of it was inconclusive. They noted that more rigorous studies are needed. (Peikes, Zutshi, Genevro, Parchman, and Meyers, 2012)

Overtreatment and Waste

Overtreatment is also related to the multilayer payment system, because there is no direct link between the amount that employers or governments pay for insurance, and the cost that is borne by the patient. (Forgione, et al., 2005; Larg and Moss, 2011) Furthermore, malpractice influences overtreatment by setting defensive standard of care that requires a great deal of unnecessary testing. (Bovbjerg and Bartow, 2003; Hermer and Brody, 2010)

Brownlee explains the causes and outcomes of overtreatment, making the claim that the current system encourages disconnects between healthcare providers, unnecessary testing, and an overwhelming number of unnecessary surgeries. (Brownlee, 2008)

As has already been cited, the Atlas Project studied hospital referral regions (HRRs) in different states and determined that local capacity determined the treatment rather than standards of care. In a play on "if you build it they will come", this study determined "if you buy the diagnostic equipment, they will be tested" whether they need it or not. They conclude that overtreatment of the chronically ill is a problem, and that better coordination of care at the preventative stage is needed to avoid it. (Wennberg and Fisher, 2008)

Lack of Healthcare Information Technology Data Standards

Lack of standards is a major waste of healthcare dollars. Research is clear that if hospitals, physicians, healthcare networks, providers, insurance companies, and government agencies were to all use the same process, the same fieldnames, and the same codes for diagnostic, treatment, and payment, the healthcare system could save billions of dollars each year. (Bouhaddou et al., 2012)

The prevailing level of data interoperability in the healthcare industry can be characterized as a mess. Ghosh and Scott proposed developing catalysts and antecedents in order to aggregate data for better healthcare decision-making, but found that even with a single system, the data was not interoperable. Systematic and semantic differences caused by diversity of data entry standards, and conflicts between multiple systems made it a real challenge to develop a working model. (Ghosh and Scott, 2011)

Roth noted that even within a single government such as the United States, there were a competing hodge-podge of poorly integrated and often conflicting programs each with its own standards, computer systems, database schema, rules and policies. (M. Nelson, 2010; Roth, 2010)

Gruman makes the case that the lack of health information technology (HIT) standards also drastically decreases the quality of care. He notes that the current chaotic state of healthcare delivery is increasingly fragmented and increasingly relies upon the patient to keep track of all their own medical records. He notes that people with chronic illnesses generally see many physicians, and that doctors generally do not currently communicate, even when they are within the same system or have offices in the same building. He notes that personal EHR systems are time consuming to populate and doctors won't access them in any case, wasting whatever resources were invested in populating them. (Gruman, 2011; Karapinar-Çarkit et al., 2010)

Wikler, Basch and Cutler note that because each health care payer has his/her own customized data requirements for transaction, the number of hours that physicians, nurses, and clerical staff spend per week in claims and authorization is staggering. Physicians spend 43 minutes each and every day, and nurses spend half of their time (21 hours per week), while clerical staff spend 53 hours per week per physician (necessitating multiple clerical staff per physician). The healthcare industry employs more billing staff than any other industry nationwide. A typical transaction consists of eight separate steps in

the revenue cycle, compared with most industries which typically only have three or four. (Wikler, et al., 2012)

The 1996 Health Insurance Portability and Accountability Act (HIPAA) stated that it was setting standards for identified organizations to use, but then listed 13 different sets of standards maintained by 11 different organizations ("Coding Classification Standards," 2012). The relationship between these codes and the organizations that maintain them is so complex as to require eight different certifications to understand all of them. Employment in the healthcare industry has been largely immune to the recession, but it is not because the industry is hiring more doctors, it is because the industry is hiring more clerks to code medical records. A decade ago a staff to physician ratio of 3:1 was commonly acceptable. Now, staff ratio needs to be between 5 and 7 to 1 physician in order to keep up with the large amounts of coding necessary for all the different insurance companies and government organizations. Wikler, Basch, and Cutler point to poor policy design, weak implementation and enforcement, as well as a lack of leadership on the part of the federal government regarding data standards of HIPAA. (Wikler, et al., 2012)

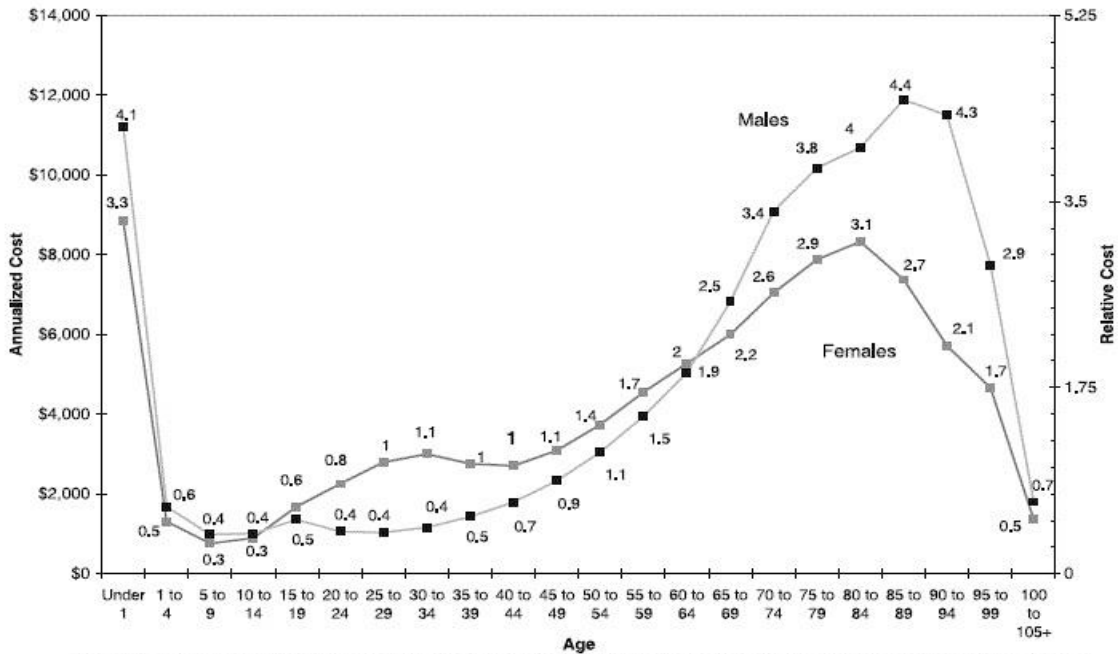
Growing Senior Population

Part of the problem with rising healthcare costs is the growing percentage of baby boomers entering their senior years. Seventeen percent of GDP is spent on people over 65. Currently there are over two million seniors in Pennsylvania. By 2020 there will be over 2.4 million seniors in Pennsylvania, (a 22 percent increase), and many of them may be centenarians (over 100 years old). The basic healthcare system developed to handle broken arms and traumatic accidents is not optimized for the chronic illnesses which impact 45 percent of the population, and are especially common among older people (Kumar and Nigmatullin, 2010; Kumar and Prevost, 2011). Eighty-five percent of each person's Medicare dollars are spent on preventable chronic conditions, 20 to 33 percent of Medicare is spent on the last year of life, and 40 percent of those Medicare dollars are spent in the last month of life (El-Sayed, 2012).

The healthcare costs of seniors are three to five times that of a younger person (See Figure 3). If they have multiple chronic conditions, costs can be seven times more (See Figure 4) (CDC, et al., 2007). Society is facing much higher than expected costs and lower quality of healthcare as a result. (Martini, Garrett, Lindquist and Isham, 2007)

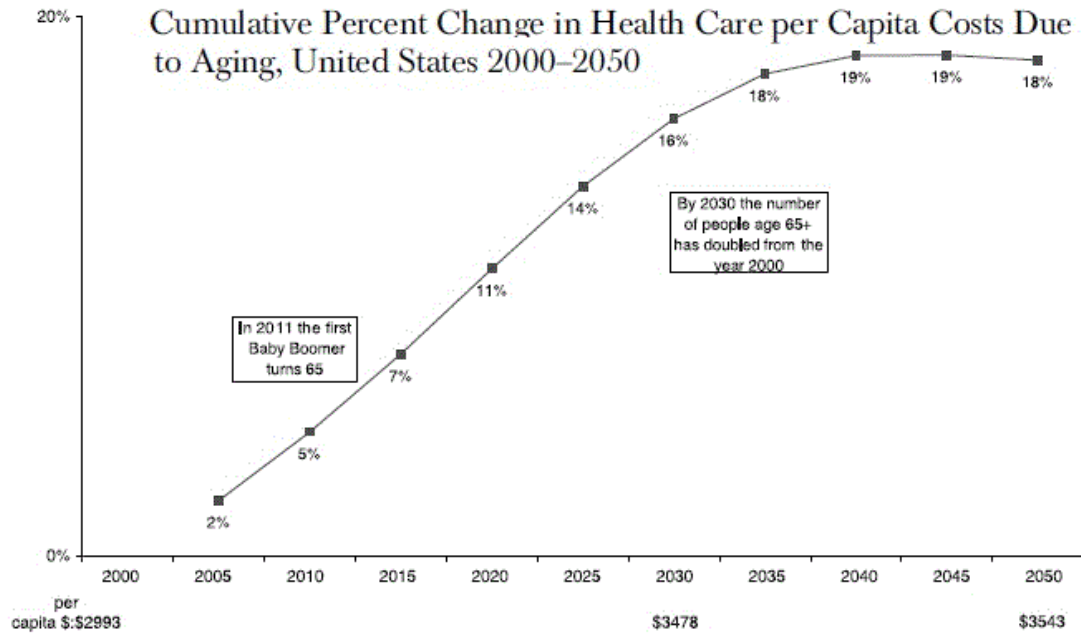
Figure 5 shows how each county in Pennsylvania has been impacted with just a single example - the cost of a broken hip, a common issue among seniors. Breaking a hip often prevents a senior from exercising and eating right, which leads to depression and a host of other chronic illnesses (CDC, et al., 2007; Peifer, 2008). The majority of counties demonstrate a higher incidence of broken hips than in the past. This is one of those help issues that research shows can be prevented through good nutrition and daily exercise.

Figure 3. Typical Medical Costs by Age



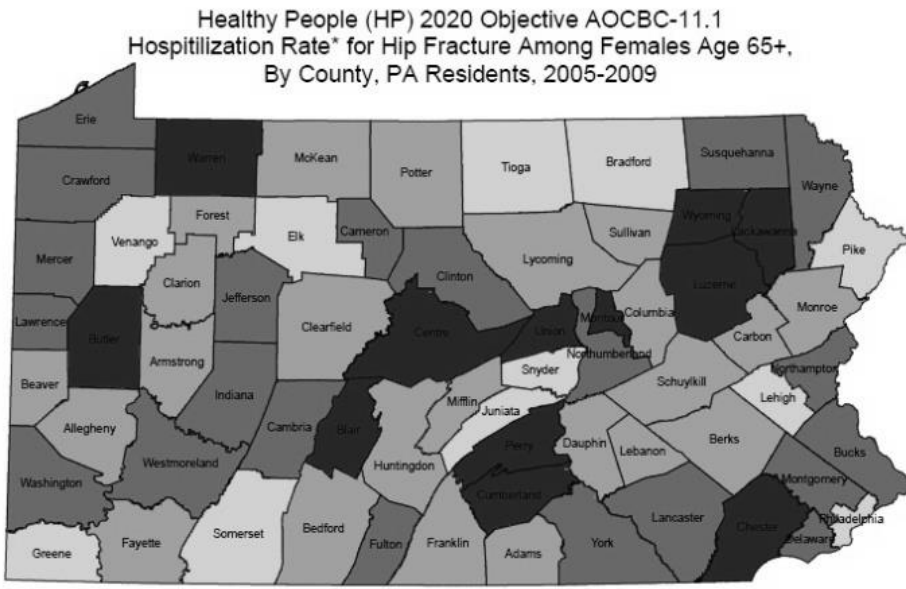
Source: HealthPartners medical and pharmacy claims 2002-2003 standardized to the U.S. 2001 Medical Expenditure Panel Survey per capita U.S. costs, in 2003 dollars.

Figure 4. Change in Health Care Costs Per Capita Due to Aging



Source: Health Research and Educational Trust (2007)

Figure 5. Hospitalization Rates of Hip Fractures in Pennsylvania Counties compared to Health People 2020 Goal (741.2)

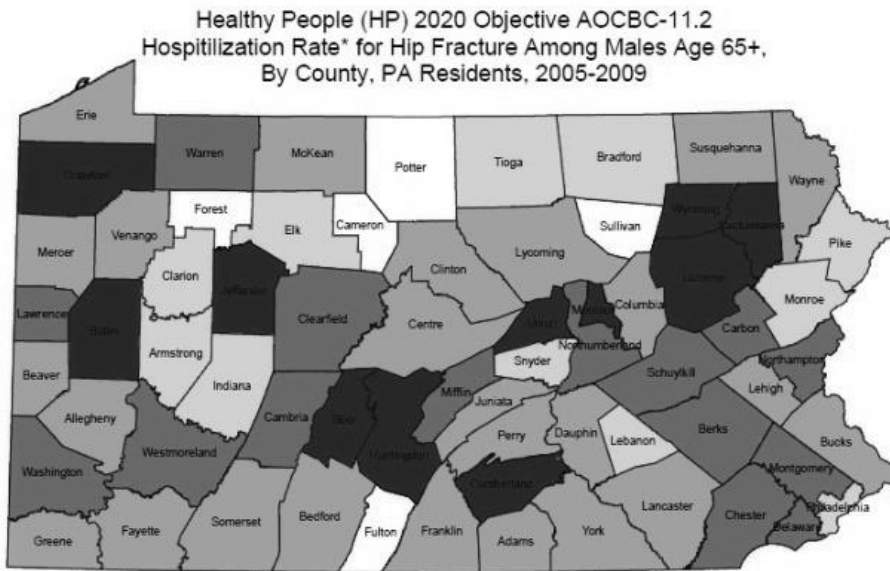


HP 2020 Goal = 741.2

Rate:

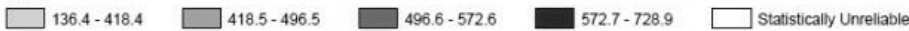


*Rate per 100,000 residents age 65 and older, age-adjusted to 2000 standard population.



HP 2020 Goal = 418.4

Rate:



*Rate per 100,000 residents age 65 and older, age-adjusted to 2000 standard population.

Growing Chronic Conditions and Diseases

Chronic conditions and diseases came up again and again throughout the literature as a major problem in today's healthcare. The Pennsylvania Department of Health estimated the cost of chronic conditions to the state-paid Medicaid system was almost \$2 billion, and noted that they were the cause of 70 percent of all deaths in Pennsylvania. (Avila, 2011) Each year the U.S. population spends \$128 billion on patients with arthritis, \$148 billion on patients with Alzheimer's disease, \$174 billion on patients with preventable Type II diabetes, and over \$432 billion on heart disease and stroke. (Avila, 2011) Another \$120 billion is spent on chronic autoimmune disorders such as lupis, graves disease, vasculitis, anemia, celiac disease, and a host of others. (Nakazawa, 2008)

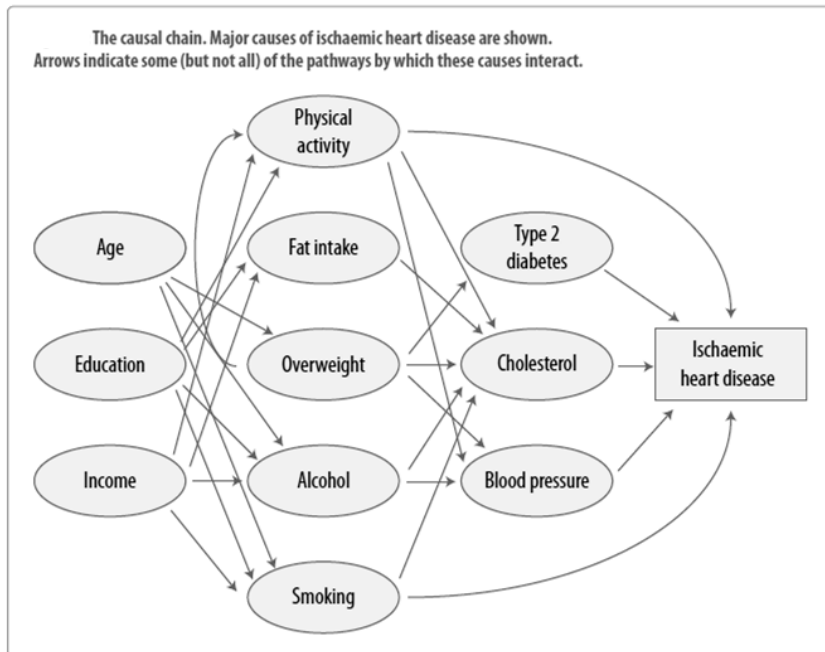
The Centers for Medicare and Medicaid Services published a report that shows that there has been a steady increase in post-acute care services as the number of chronic conditions increase, with at least 41 percent of the Medicare beneficiaries needing post-acute care. It also noted that beneficiaries with multiple chronic conditions were more likely to be hospitalized, had more hospitalizations during the year, and that more than two-thirds of Medicare beneficiaries had multiple chronic conditions. It indicated far reaching implications of chronic illnesses for the healthcare system built on a fee-for-service model, and noted that it was important to understand the impact. (Lochner, 2012)

Seventy-five percent of each healthcare dollar currently goes to chronic illnesses that are easily preventable (Freudenberg and Olden, 2011). The Pennsylvania Department of Health notes that modifiable behaviors of unhealthy lifestyle are responsible for much of the chronic illness (Avila, 2011). The Pennsylvania Health Care Cost Containment Council underscored the need for chronic disease prevention and control, and called for Pennsylvanians to improve their own health status and adopt healthy lifestyles (Martin, 2010).

The current healthcare system is set up for diagnosis and treatment; it does not deal with the issue of prevention and healthy lifestyle (Hoffman, 1997; Kurzweil and Grossman, 2004; Weil, 2000). There is very little support for lifestyle change guidance such as nutrition counseling, exercise programs, weight maintenance help, vitamins and supplements, stress reducing activities, etc., though the research is overwhelming that lifestyle changes are essential for the abatement of rising healthcare costs. (Anderson et al., 2009; Artnak, et al., 2011; Gallelli, et al., 2011; Mattke, et al., 2010). Even the word "prevention" in the current healthcare system often only means undergoing diagnostic tests such as colonoscopy, mammogram, and pap smears, all of which can only treat a disease once it has started rather than focusing on behaviors and practices that prevent them from starting. (Alexa, Marian, Jae Hak, Diana, and Stephanie, 2010)

The World Health Organization identifies healthy lifestyle issues as a global health risk. Figure 6 shows the causal chain between lifestyle and just one of the major chronic illnesses that is growing. (Mathers, Stevens, and Mascarenhas, 2009)

Figure 6. World Health Organization Causal Chain



While the healthcare system in general has not emphasized wellness and healthy lifestyles, the work environment has started to implement them. Baicker, Cutler, and Zirui found \$3.27 of healthcare costs savings for every dollar spent on wellness programs, and worksite absenteeism costs decreased by \$2.73 per dollar spent. (Baicker, et al., 2010)

Johnson and Johnson leaders estimate that wellness programs have cumulatively saved the company \$250 million on health care costs over the past decade; from 2002 to 2008, the return was \$2.71 for every dollar spent. Doctors Richard Milani and Carl Lavie studied a random sample of 185 workers and their spouses undergoing an exercise and cardiac rehabilitation program. Medical claim costs had declined by \$1,421 per participant, compared with those from the previous year. A control group showed no such improvements. They found that every dollar invested in the intervention yielded \$6 in health care savings (L. L. Berry, Mirabito, and Baun, 2010)

The timeframe for savings can be more than a few years, however. Osilla, et al, investigated worksite wellness, which the majority (58 percent) of corporations has, with an accelerating trend of employees taking part. They reviewed 33 studies, and concluded that the results were mixed because the study designs were not rigorous enough, and the payback period was longer than two years. They felt that despite the mostly positive outcomes, the body of evidence did not support such widespread adoption of wellness programs because the employee, and not necessarily the company, benefitted. (Chan Osilla et al., 2012)

The success of the majority of workplace wellness notwithstanding, research on the impact of healthy lifestyle behaviors on healthcare costs shows a positive relationship. Hagberg and Lindholm reviewed 26 articles from a society perspective to see if exercise was cost effective. Twenty of the 26 were cost effective overall. Ten were cost utility studies and 10 were cost effective reviews. Most studies (18) left out some costs that might lessen the cost effective finding, but all studies also left out impacts that would increase cost effective findings, such as productivity gains and future healthcare savings. They also reported that a sedentary life style leads to death in one third of the cases for heart disease, colon cancer, and diabetes. They concluded that there is evidence that exercise programs can cost effectively improve health, especially among older heart patients. (Hagberg and Lindholm, 2006)

Windle, Hughes, Linck, Russell, and Woods reviewed 12 papers on the impact of exercise programs on the elderly. Data suggest a minimum of two sessions per week of at least 45 minutes duration in a group-

led approach with a trained leader is effective. Incremental cost effectiveness ratio ranged from £7300 (\$9,499) to £12,100 (\$15,615)¹ per QALY gained. Furthermore, an overall effect of improved mental wellbeing was found. (Windle, Hughes, Linck, Russell, and Woods, 2010)

Another problem adding significantly to healthcare costs in addition to the sedentary lifestyle is the proliferation of a high-fat, high-carbohydrate diet (Cadilhac et al., 2011; Levi, Segal, St. Laurent, and Kohn, 2011). Smoking and Drinking also contribute significantly to high healthcare costs. (Sturm, 2002) Many patients don't understand the importance of the role their lifestyle plays in the proliferation of their chronic health conditions, especially among older patients who are used to being told what to do and not used to living healthfully and self-managing their conditions (Mattke, et al., 2010; Suter, Suter, and Johnston, 2011).

Prevention regarding medication adherence is also an issue. The New England Healthcare Institute estimates that the cost of poor adherence (patients with chronic diseases who do not eat right, exercise, and take their medication regularly) is more than \$290 billion each year. (*Thinking Outside the Pillbox: A system-wide approach to improving patient medication adherence for chronic disease*, 2009)

End of Life Care Management Issues

The availability of treatments that keep the body alive is another problem with healthcare in general. It has changed the community's concept of where and when a person should live with chronic illnesses, and when and where they should eventually die from those conditions.

Years ago people lived at home, taken care of by family members until they died at home. More commonly these days, people live in nursing homes and die in a hospital. (Mattke, et al., 2010) As already noted, up to 33 percent of Medicare dollars get spent on the last year of life, and 40 percent of those Medicare dollars are spent in the last month of life. (El-Sayed, 2012)

What has caused the shift to nursing homes instead of home care? One influence is the changing structure of the family, most notably the fact that women, previously unpaid long-term care laborers, have much higher mobility and employment, and therefore are less able to serve as unpaid caregivers. Some people believe that another influence on this change in behavior occurred in 1951, when the Department Of Health And Human Services Centers for Disease Control and Prevention and the National Center for Health Statistics stopped allowing physicians to notate old age as cause of death. (Sondik, 2003) Elderly people whose health is failing are constantly taken to the hospital, again and again, in an effort to "fix" the problem, even when the cause is due to old age. Well-meaning family and friends will often take a person to a hospital even when they've clearly stated they prefer to stay at home. (Abel, Rich, Griffin, and Purdy, 2009; Riley and Lubitz, 2010) The fear is that family members are not "doing all that they can" if they don't take a person who may be dying to the hospital. There is a resistance to the idea that someone should be allowed to die without intervention (Artnak, et al., 2011).

This is not necessarily because people want to die in a hospital. More than 75 percent of survey respondents want to live and die at home (Donnelly, 2012). Brumley, Enguidanos, and Jamison found increased satisfaction with palliative home care rather than usual care (which usually indicated hospital or hospice). Additionally, costs were reduced by 33 percent. ("Disease Management Update," 2007) Nonetheless, more than 80 percent of people die in a hospital, hooked up to various machines, unable to return home. (Abel, et al., 2009; Artnak, et al., 2011; Grabowski, 2007)

Shortage of Physicians and Rural Accessibility

Physician shortage is a national problem. According to the Department of Health and Human Services, the supply of physicians will fall short of demand by 5.5 percent by 2020 (Mattke, et al., 2010). Two-thirds of Pennsylvania primary care clinicians practice in just five counties demonstrating a severe shortage of primary care clinicians that is about to get much worse as the majority of primary care doctors will retire in the next decade (*2009 Pulse of Pennsylvania's Physician and Physician Assistant Workforce: A Report on the 2008 Survey of Physicians and Physician Assistants*, 2009).

¹ Using 1 Euro to 1.3012 Dollar, the exchange rate on April 26, 2013. http://www.likeforex.com/currency-converter/euro-eur_usd-us-dollar.htm/1 .

Rural areas are harder hit from this problem. According to the Pennsylvania Department of Health, rural counties do not have as many primary care physicians as urban counties. Over half the counties have no psychologists, psychiatrists or social workers (Schopp, Demiris, and Glueckauf, 2006). Kanzleiter, Schwartz, and Nyanungo noted that rural areas have a harder time attracting physicians from the already-low supply, much more difficult than urban areas. The health center administrators they interviewed listed several reasons why rural locations interfered in their ability to recruit physicians (Kanzleiter, et al., 2010). DelliFraine, et al, noted that the high cost of recruiting physicians to rural areas because of the shortage added significantly to the financial distress of rural hospitals (DelliFraine, et al., 2010).

Even without the physician shortage, with more problems and fewer financial resources, rural residents have more difficulties in obtaining access to care. Lack of access to mental and behavioral health services is especially problematic, resulting in increased hospitalization, emergency room use, homelessness, isolation, increased family violence, child abuse, physical illness, and more.

Healthcare Reform in the United States

There are reams of papers on how to "solve" the problems outlined previously in the healthcare system. Roth proposes a system of healthcare that carefully balances the facilities (specialty clinics, full feature hospitals, regional community health clinics, primary practice physicians) and change the payment structure so that everyone - health providers and patients - are rewarded financially when people stay healthy and don't need treatment. (Roth, 2010)

Freudenberg and Olden proposed four broad strategies. First, modify regulation to extend further protections over the environment and consumer markets. They note that tobacco, alcohol use, and foods high in fat, sugar, and salt contribute substantially to chronic disease. Second, strengthen the public health infrastructure, especially funding for chronic disease control. Third, create incentives for environmental changes that would promote physical activity and discourage sedentary behaviors through zoning for walking, bicycling, and other forms of active transportation. Fourth, they stress the need for the health care system to modify its practices and focus on prevention by extending the reach of evidence-based intervention programs, reimbursing for tobacco use cessation coaching, nutrition and alcohol counseling and providing health providers with prevention skills. (Freudenberg and Olden, 2011)

Another attempt to identify solutions to the healthcare issues were published in a 2009 report in the American Journal of Managed Care. (Antos et al., 2009)

- Invest in Health Information Technology Systems
- Use Comparative Effectiveness Research
- Improve the Healthcare Provider Workforce
- Adjust Fee for Service Payment structure
- Build Accountability into Payment system
- Incorporate Coverage Flexibility/Rapid Learning into system
- Utilize an Exchange model that promotes competition
- Reduce Inefficient Private Insurance
- Promote Prevention and Wellness
- Support Patient Preferences for Palliative Care

Wikler, Basch, and Cutler advocates the three pronged strategy for eliminating administrative waste. 1) Integration, which means embedding what they call "administrative simplification" using systems and rules as implementation of new legislation occurs. 2) Coordination, bringing together similar administrative processes to maximize efficiency. 3) Leadership, by creating a federal office dedicated to simplifying health care administration of plans. They believe that over \$40 billion each year could be saved by eliminating administrative waste.

Proposed Payment Structure Changes

The Journal of Managed Care also discusses the four primary methods to change the payment structure: *Pay for Performance*, *Value Based Insurance Design*, *Integrated Delivery Systems*, and *Medical Home*. They published a special supplement that described each one in detail, the advantage and disadvantages of

each. While not identifying which one would be optimum, it was stated that one of these must be fully implemented in order to eliminate the problems in the current system. (Conrad, 2009)

Kumar and Nigmatullin outlined a very clear case for changing the current payment model of healthcare in the United States. They developed a closed loop system model showing the interrelationship between the choice of spending more money on treating chronic diseases (and therefore having less and less money to spend on prevention), or focusing on prevention and lifestyle changes (but decreasing healthcare dollars that go to treatment). They advocate breaking the current feedback loop that escalates costs by investing in prevention. (Kumar and Nigmatullin, 2010)

Gemmill, Thomson, and Mossialos advocate equity, requiring richer people to pay more for healthcare than poorer, with access based upon need. They also point out that that patients often do not have sufficient information to make rational choices, as they may forego or delay useful treatments at the expense of future health damage. Therefore the payment structure should guard against that. (Gemmill, Thomson, and Mossialos, 2008)

Utilization of Cost Benefit Analysis in Healthcare Research

Many researchers have proposed that cost benefit analysis and treatment effectiveness research be utilized in order to ensure the optimum value for the money. This section describes the current methods used in cost benefit analysis.

Healthcare cost research falls into various grand categories such as *Cost of Illness* and *Comparative Effectiveness*. Larg and Moss do an excellent job of describing the attributes of a good Cost of Illness study (which is designed to estimate the cost of a certain malady or illness on individuals, healthcare systems, and society)(Larg and Moss, 2011).

As outlined in the *Non-Economic Principles of Healthcare* section starting on page 12, costs can be paid by the patient, the insurance company, the government, or the provider themselves. Costs can be direct or indirect. A direct cost is the amount paid for diagnosis and treatment. An indirect cost could be travel to the treatment, or the economic cost to society due to lost productivity. Costs may also be intangible, as in the case of pain and suffering or the reduction in quality of life. (Kernick, 2005)

Whether the study is cost of illness or comparative effectiveness, the healthcare costs themselves are assessed using a variety of methods, described in this section. General categories of methods of Healthcare Costs Analysis are *Cost Benefit Analysis*, *Budget Impact Analysis*, *Cost Effective Analysis*, *Cost Utility Analysis*, *Cost Minimization Analysis*, and *Cost Consequence Analysis*. (Davalos, et al., 2009)

Cost Benefit Analysis is the typical cost assessment of the financial impact in any field. Most healthcare researchers reject its use because it is overly simplistic. Researchers have developed the other methods in order to accommodate the uniqueness of healthcare cost estimation (described here). Nonetheless, the generic economic analysis is often used in research despite concerns about its applicability to healthcare studies. (Musich, Burton, and Edington, 1999)

Budget Impact Analysis assesses the financial impact of the introduction of a new treatment. Orlewska and Gulacsi did a review of budget impact analysis articles in bio-medical journals from 2000 to 2008 and found 34 studies that met the criteria out of an initial population of 559. After reviewing the source of funding, the design, the data source, and the results, they described several methods of budget impact analysis used in the studies. Most used deterministic calculation, Markov models, and discrete-event simulations. (Orlewska and Gulácsi, 2009)

Cost Effective Analysis uses something else (other than money) as an outcome. These alternative measures take into account both quantity and quality of life. Examples include number of events (NE), simple life-years (LY), Quality Adjusted Life Year (QALY), Disability Adjusted Life Years (DALY), Prevalent Years of Health Life Lost to Disability (PYLD) and Willingness to Pay (WTP). The last four of these are a bit more complex; a more detailed explanation might be helpful.

Quality Adjusted Life Years (QALY)

Hoch provides the example of treating a veteran with post-traumatic stress disorder with either drugs or therapy. If the veteran were to get therapy and live for 5 years with a quality of life of .9, that would result in 4.5 QALYs. If the veteran were to take prescribed drugs and live for 7.5 years, but the quality of life was assessed at .6, then that would also result in 4.5 QALYs. If the costs of therapies were less than the costs of drugs, therapies would be the better choice. Despite having different years of life (5 years versus 7.5 years), the outcomes had equal QALYs. (Hoch and Smith, 2006)

Young, Rowen, Norquist, and Brazier created a Rasch analysis to develop health state classifications so that researchers could perform a similar analysis from any symptom questionnaire. In their study, they used the example of the Flushing Symptoms Questionnaire, which assesses the seriousness of flushing as a symptom (Young, Rowen, Norquist, and Brazier, 2010). This value, then, can be used to generate the QALY weighting.

Disability-adjusted Life Years (DALY)

Disability-adjusted Life Years is similar to QALY, but specific to years of living with a debilitating disability. Haagsma, Polinder, van Beeck, Mulder, and Bonsel used two different methods (annual profile model and standard QALY model). They recommended the annual profile model for mild conditions because they felt the standard model would overestimate the benefits. The standard model was recommended for severe injuries because the annual profile model would underestimate the benefits. (Haagsma, Polinder, van Beeck, Mulder, and Bonsel, 2009)

Prevalent Years of Health Life Lost to Disability (PYLD)

Prevalent Years of Health Life Lost to Disability is associated with many different diseases and injuries, and is sometimes used instead of DALY. It is an attempt to compare normal non-disabled outcomes to living a life with disability. (Mathers, et al., 2009)

Willingness to Pay (WTP)

Some researchers have tried to mitigate the issue of QALY by establishing a market-driven number, the amount the payer is willing to pay for the outcome. This is especially important in healthcare issues where the quantity of years of life is not at issue, but only the quality of life. Of course, willingness to pay is in the eye of the beholder and willingness to pay does not necessarily indicate ability to pay. (Bobinac, van Exel, Rutten, and Brouwer, 2010; Lieu et al., 2009)

Some researchers call QALY-based studies *Cost Utility Analysis* in order to differentiate from studies that don't use QALY. Cost Utility Analysis have recently become more prevalent than Cost Effective Analysis. (Wong, Carlson, Thariani, and Veenstra, 2010). *Cost Minimization Analysis* is also a type of Cost Effective Analysis, but the patient outcomes are assumed to be equivalent rather than based upon quality of life. (Hoch and Smith, 2006)

Cost Consequence Analysis

Cost Consequence Analysis considers multiple outcomes rather than just one as Cost Effectiveness studies do. Cost Consequence Analysis is used by decision makers who can apply their own weights to various outcomes. (Kernick, 2005) While this provides the most flexibility, it also makes the results less generalizable.

Challenges of Cost Benefit Analysis in Healthcare

Cost Benefit Analysis has severe limitations. Although newer cost effectiveness analysis methods try to make adjustments, most cost benefit research only measures quantity of life, not quality. Since healthcare technology and practice has reached the point where a person can be kept alive almost indefinitely regardless of age or infirmity, the impact of treatments on the quality of life can be enormously important, more-so than the quantity of life. Furthermore, in research the value assigned to the life year is traditionally \$50,000, the origins of which is several decades old and actually meaningless. (Hoch and Smith, 2006)

There is no universally accepted standard for measuring the quality of life weights, and that estimation can result in drastically different results. Generally, researchers administer some assessment or preference based measure such as EQ-5D (EuroQol Health States), HUI3 (Health Utilities Index Mark 3), or SF-6D (a measurement of health and wellbeing). The assessments are then valued using different valuation techniques such as Time Trade-Off, Standard Gamble, Visual Analogue Scaling, Ranking and Discrete Choice Experiments.

Unger points out that QALY and other economic variables do not apply well to children who cannot be surveyed using EQ-5D, and often must be provided by proxy (i.e., their parents). Unger recommends considering the family perspective, and advocates a discrete-choice method for a willingness to pay model to assess different treatments. (Ungar, 2011)

Zimovetz, Wolowacz, Classi, and Birt reviewed 37 studies to treat major depressive disorder, and concluded that the variety of measurements (symptom free days, health state utilities, DALY, QALY, and efficacy of second-line treatments) lead to difficulties in comparisons. (Zimovetz, Wolowacz, Classi, and Birt, 2012)

Ferrusi, Leighi, Kulin, and Marshall concluded that researchers of comparative research studies rarely estimate anything other than costs, and that looking at costs does not provide enough information for decision-making support due to the uncertainty involved. (Ferrusi, Leighi, Kulin, and Marshall, 2011)

Applying just financial factors to healthcare decisions is problematic. Detsky, and Laupacis state that QALY should not be used alone for decision making. Cost Analysis research can only provide cost effective measurement information relative to an arbitrary threshold. In other words, utilizing multiple factors for decision making will maximize the benefits within an allocated budget, but more economically attractive options may get overlooked. Furthermore, the assumptions used in the analysis may be susceptible to error and bias. ("Disease Management Update," 2007)

Dalziel, Segal, and Mortimer found a number of different outcome measurements when they studied 245 health interventions. Outcomes included QALY, DALY, LY. They concluded that each type of condition or modality needs to be judged on its own unique attributes; they cannot be grouped together with broad generalities. They looked at the studies where the individual was able to reduce his/her own risk of disease or injury, or where a major cause of the condition was his/her own behavior (which includes almost all chronic diseases). They pointed out that these studies had a very low median incremental cost effectiveness ratio, whereas diagnostic screenings, vaccinations, and mental disorders had the highest incremental cost-effectiveness ratio. (Dalziel, Segal, and Mortimer, 2008)

Which Costs?

Another issue in cost analysis is: which costs are used? The base cost to provide the service? The cost to the patient? The cost to the insurance company? The cost to the government? The cost to society? For a single treatment, these may all be different amounts. (deBrantes, Rastogi, and Soerensen, 2011; Newman and McMahon, 2011)

Tunis noted that the extent of cost benefit for any treatment or service is directly related to the choice of cost definition - which is not standardized. The study compared the estimates of the cost effectiveness of two drugs using both the wholesale acquisition cost and the average wholesale price, and the cost effectiveness ratio went from .44 to 1.73, which would completely change the recommendation for treatment. The results were further complicated by the fact that there is not only a wholesale cost, but also a charged cost, an allowed cost, and a paid cost; often controlled by different parties. (Tunis, 2009) Cutler and Marzilli found that the social cost of a resource was much different than the price. For example, the social cost of a new drug might be one-third the market price to insurance companies, and one-half the market price when paid for by one of the government healthcare options (Medicare or Medicaid). (Cutler and Marzilli Ericson, 2010; Gordon, 2012)

Prenger, Braakman-Jansen, Pieterse, der Palen, and Seydel found that behavioral intervention studies often do not include partial (though beneficial) change. They discussed ways in which researchers could

incorporate appropriate measures of partial change when reporting cost effectiveness of a treatment. (Prenger, Braakman-Jansen, Pieterse, der Palen, and Seydel, 2012)

Peterson, Hollis, Pogge point out that cost benefits analysis incentivizes RandD for drugs of incremental or questionable value. The analysis provides greater returns on drugs that would be sold in high volumes, even if they did very little, while ignoring rare diseases or life-saving drugs because they would only be sold in limited quantities. (Peterson, Hollis, and Pogge, 2010)

Gemmill, Thomson, and Mossialos reviewed 173 studies regarding user charges (co-pays, co-insurance, deductibles, reference pricing, and formularies) on prescription drugs, which are purported to steer patients toward cost effective care. They found, however, that in practice they do lower the initial cost for healthcare but do not lead to long term control of pharmaceutical spending and do not contain total healthcare costs. They point out that providing harmful or ineffective commodities to those who are willing to pay is efficient, while providing effective and beneficial to those unable to pay is inefficient (concept of allocative efficiency). (Gemmill, et al., 2008)

Cost Shifting

There have been many attempts in legislation to lower costs using a variety of methods. Some researchers question the value of the different methods, claiming that sometimes savings at one level adds to costs at another level, known as "cost shifting" (Kaufman, 2011).

Roy and Madhavan reviewed 101 articles on Medicaid and Medicare policies on prescriptions drugs that solely focused on the costs of the drug themselves. Many of the studies revealed that when Medicare or Medicaid changed their policies in an attempt to rein in costs (for example, by restricting access through formularies or necessitating pre-authorization), they actually increased costs because patients had to visit their doctor to make the change - and the cost of the doctor visit would often wipe out the cost savings of the restriction. (Roy and Madhavan, 2008)

Recent bills introduced in the legislature at the federal level incorporate the requirement of comparative effectiveness data, and there has been some research on the issue. Vernon, Golec, and Stevens warn that RandD costs for drug development will rise if additional comparative studies must be done in order to bring innovative treatments into the healthcare system. (Vernon, Golec, and Stevens, 2010) Berger and Grainger from Eli Lilly, on the other hand, believe that comparative effectiveness analysis studies are the next step in evolving healthcare that will increase treatment options. (Berger and Grainger, 2010) Like many other pharmaceutical companies, however, they are concerned that comparative effectiveness research will not be used as one of many decision making points, but rather would enable cost-effectiveness guidelines to override healthcare decisions. Selker provides a good outline of this issue and guidelines for government agencies (such as keeping the policy making bodies and the research bodies separate). Selker advocates keeping the comparative effectiveness research scientific, and sponsored by the Agency for Health Quality Research. (Selker, 2009)

Vos, et al reviewed 339 studies of hospitals incorporating process improvement programs, and did not find much success. They identified the factors that hampered progress; functional structure of the hospitals do not lend themselves to improvement, unfamiliarity with proper process improvement techniques, and the limited areas where streamlining could be useful. The authors advised hospital management to understand the factors for failure in the existing literature and to take them into account before attempting their own process improvements. (Vos et al., 2011)

Practitioners might complain that cost cutting impacts quality. However, Moore, McMullen, Woolford, and Berger did not find that quality was related to cost when they studied the variations of clinical process in birth control facilities. They recommended that clinics adopt best practices by clinics using lower costs in order to decrease variability and lower costs by 20 percent. (Moore, McMullen, Woolford, and Berger, 2010)

Impact of Utilization and Volume on Costs

The number of people expected to use a diagnostic test or treatment relates directly to its cost. An MRI machine, for example, might cost \$1 million to purchase and maintain throughout its product lifecycle. If

the hospital that purchases it only gets one person who needs an MRI, the cost for that one MRI scan would be \$1 million. But if 100,000 people use it, the cost of each of the 100,000 MRIs is \$10. The Medical Expenditure Panel Survey published by the Agency for Healthcare Research and Quality estimates this impact through a factor called *utilization*. Unfortunately, the AHRQ survey, the source for much of the utilization research, underwent a major redesign in the last year, so aligning previous data and current data may be difficult. (S. B. Cohen, Ezzati-Rice, Zodet, Machlin, and Yu, 2011; "How safe is your hospital?," 2012)

Issues of Cost Benefit Applied to Telehealth

The issue of volume of treatment also leads to a vicious cycle, especially when talking about new technologies such as telehealth. A weak demand for telehealth products and services results in higher costs for telehealth products and services, which leads to a negative cost-benefit analysis result. If the products and services were used more, however, the costs would go down, and they would become very cost effective. (Mattke, et al., 2010; Newman and McMahon, 2011)

There are even more issues when applying cost benefit analysis studies to telehealth. Hundreds of studies have been done on various aspects of telehealth, but in the past, the conclusion was generally the same; adding patient facing technology such as telehealth and telemedicine results in equivalent, more accessible, but more expensive, healthcare. (Davalos, et al., 2009; Gamble, Savage, and Icenogle, 2004; Pyne, Fortney, Tripathi, Maciejewski, and Williams, 2010)

There are issues with that conclusion, however. One common criticism of telehealth cost analysis was that telehealth looked more expensive because the costs saved were often paid by the patient such as traveling to the hospital, missing out on work, etc. The major beneficiary, the patient, was often left out of the equation. In many cases, when those added costs were involved in the calculation, the cost benefit was more equitable - but only as a whole, and not specifically to the provider. (Backhus et al., 1997; Davalos, et al., 2009; Forgione, et al., 2005; Gamble, et al., 2004; E. D. Harris, 1997; K. D. Harris and Campbell, 2000; Johnston, Wheeler, Deuser, and Sousa, 2000)

Another criticism is that most cost benefit analyses compare the cost of traditional treatment to telehealth treatment, and do not consider the cost of no treatment. The cost of in-person treatment may be prohibitive, so people do not get the preventative treatment they need to avoid high-cost treatment later. If the cost benefit analysis considers the cost of no traditional care due to accessibility issues compared to more accessible telehealth, the savings would be more apparent. This is especially apparent in rural areas, because the no-treatment option is common due to the high cost of travel normally borne by the patient. (Newman and McMahon, 2011)

Additionally, most telehealth cost benefit studies were done before the most recent wave of new, less expensive technologies were available. It has only been the last two years since the release of the iPad 2, which made face to face videoconferencing and connecting to "apps" easier (under the right conditions). A high quality videoconferencing system in the year 2000 cost more than \$250,000 and required special leased lines costing thousands of dollars each month. Today the same quality system would only cost a few hundred dollars, and can run over any high-speed internet connection. (Gamble, et al., 2004; Rhoads, 2007) Changes in the ease of use and the costs of technology may now make telehealth more feasible, but the changes have been too recent, and have only just begun to appear in cost benefit analysis studies. (Gallelli, et al., 2011; Hooshmand and University of Miami, 2010; Newman and McMahon, 2011; Orlov, 2010; Urquhart, Wainwright, and Lewis, 2010)

Another issue in a cost analysis of telehealth is whether or not the calculation includes all the costs associated with implementation, just the devices themselves, or the devices and the infrastructure. With any technology project, "defining" where the project stops and "business operations" begins has always been difficult. With telehealth, that difficulty multiplies. When the broadband infrastructure already exists, the high monthly maintenance cost of the connection does not need to be accounted for when considering the value. Furthermore, if both the broadband infrastructure and the devices already exist, as in the case when using common PCs with webcams, Skype or Google Hangouts, VPNs (for security), or smartphones and using the Internet as the connection medium, the incremental cost of telehealth is nothing. Remote

monitoring devices, if medical, are a bit more specific; but common motion sensors and RFID chips are inexpensive and generally available for multiple purposes. The larger issue, therefore, is whether or not the state legislature is encouraging entrepreneurship and funding startups, as well as focusing on the "technology roadways" - i.e. broadband access. (Perry and Kocakulâh, 2010)

Finally, another problem with cost benefit analysis is that it often compares telehealth to traditional medicine without considering the most important factor; process change. If telehealth is simply added to the current process, healthcare costs go up. For example, telestroke is a telehealth service where neurology specialists provide the difficult-to-determine diagnosis that guides which of the two treatment options should be followed in emergency rooms for patients presenting with symptoms of a stroke. But half the studies on telestroke didn't change the process regarding transporting the patients to the specialist hospital after diagnosis. Despite the fact that the time-critical diagnosis was already completed, the hospital still transported the patient as soon as possible, adding the cost of the telehealth diagnosis, but still spending the traditional costs of transportation and specialist referral and rehabilitation. (Newman and McMahan, 2011)

Telehealth Research

This section begins with a brief description of the history of telehealth and a discussion of how telehealth might provide a solution for some of the issues in healthcare, especially the problem of chronic diseases, lack of accessibility, and lack of standards. Following this is a discussion of studies on telehealth, the financial benefits, the non-financial benefits, and then studies specifically targeting rural areas both in the United States and in other countries.

The next section describes the best practices for telehealth projects, the growth of telehealth. Finally, a discussion on the obstacles and proposed solutions to the more widespread adoption of telehealth is covered.

Brief Historical Background of Telehealth

Over the past thirty years, there have been "waves" of research on telemedicine, telehealth, and health information technology. In general, when computers were new in the seventies, telehealth projects (though it was usually called telemedicine) used closed circuit television and point-to-point leased lines. Despite positive outcomes, the high expense deterred a wholesale switch from traditional care. By the eighties, many of the telehealth implementations were dropped (Capalbo and Heggem, 1999). The next wave of well-known studies came in the late nineties on the heels of the World-Wide-Web-fueled growth spurt known as the Internet Bubble. However, like most technologies, when the bubble burst (known as the Dot Com Crash), the resulting economic downturn spurred a recession starting in February of 2001, and many telehealth projects were abandoned (Preston, Powers, Kwong, and Center for Connected Health, 2011). It is only recently, after widespread infrastructure and sophisticated but inexpensive technologies became available, that interest and enthusiasm is becoming more apparent. (A. M. Cohen, 2009; Navarro, 2006; Rhoads, 2010; Urquhart, et al., 2010)

A report on Health and Wellbeing in the home from Rand separates telecare (home based monitoring) into three generations. The first generation referred to unconnected single-purpose devices such as glucose meters, sleep support devices, ventilators, etc. The second generation included connected devices such as alarm pendants and biomarker monitoring devices with an alert sent to a service if the biomarkers go outside the specified range. The third generation of devices combines the connectivity, adds it to multi-purpose monitoring devices, as well as interactivity that allows feedback and conversations between health professional and patient. The report noted that these devices have great potential, but are not yet covered by health insurance because they are not disease specific, but rather patient centric. (Mattke, et al., 2010)

Telehealth Cases and Projects: Focus on Prevention and Wellness

There have been many noted successful telehealth projects, and the most successful were those that took a whole system approach, encouraged collaboration, and focused on prevention and wellness rather than just treatment. Many researchers propose that if telehealth were focused on prevention, it would make

high-priced treatments less necessary (Artnak, et al., 2011; D. C. Baker and Bufka, 2011; Gruenewald, 2012; Lantos and Meadow, 2011; Newman and McMahon, 2011; Nord, 2010; Ruger, 2008a, 2008b; Steventon et al., 2012)

The Rural Maryland Council conducted a state-wide inventory of telehealth projects, and found 18 projects. The projects had all started between 2000 and 2011, and ranged in funding scope from \$18,000 to \$500,000. They also conducted an on-line survey and got 30 respondents, half of which responded with information on telehealth projects. (*Final report of the December 2010 Maryland Telehealth and Telemedicine (THTM) Roundtable*, 2011)

Financial Benefits of Telehealth

Pearl, the Executive Director of The Permanente Medical Group notes that chronic disease already consumes 85 percent of Medicare costs, and that "aging in place" and electronic health system data standards could save more than \$700 billion over the next fifteen to twenty years. (Pryke, 2010)

The concept of applying telehealth to "aging in place" was tested in Philadelphia at the Program of All-Inclusive Care for Elderly (PACE) program when they added telehealth remote monitoring to the program. More than \$1.8 million annually was saved when 33 residents were able to move out of nursing homes into remotely monitored homes. The cost of maintaining the seniors in the housing with telehealth was only \$288,600 per year, while the cost of the nursing home was \$2,135,250 each year. (Orlov, 2010)

One of the early studies on telehealth consisted of setting up a live video link to the Kaiser Permanente Nurses, and was conducted by Johnston, Wheeler, Deuser, and Sousa in 2000. They worked with 212 subjects randomly chosen to be in the telehealth (n=102) or control (n=110) group. They found that the telehealth intervention was shown to be effective, well received by patients, and capable of maintaining quality of care at a lower cost. Patients seemed pleased with the equipment and the ability to access a home health care provider 24 hours a day. The average direct cost for home health services was \$1,830 in the intervention group and \$1,167 in the control group (keeping in mind that the technology system that costs thousands of dollars in 1999 would cost less than \$50 today). The total mean costs of care, excluding home health care costs, were \$1,948 in the intervention group and \$2,674 in the control group. (Johnston, et al., 2000)

Several studies on heart failure patients using telecare saved 17 percent to 75 percent in healthcare costs. One in particular, a 2-year long well-designed random control study identified a decrease in healthcare costs for the telecare group from \$8,500 to \$7,400. The control group, however, increased an average of \$9,200 to \$18,800. The telehealth group saved over 30 percent in claims, and the per-member month costs decreased by 44 percent for patients over 65 and 27 percent for patients under 65. When calculated for the whole of California, telecare would save the state government up to \$281 million each year, or \$8,600 for each beneficiary covered by Medicaid. A similar program for diabetes, when calculated for California, would save the state tax payers \$127 million each year, about \$939 per Medicaid enrollee with Diabetes. (Newman and McMahon, 2011)

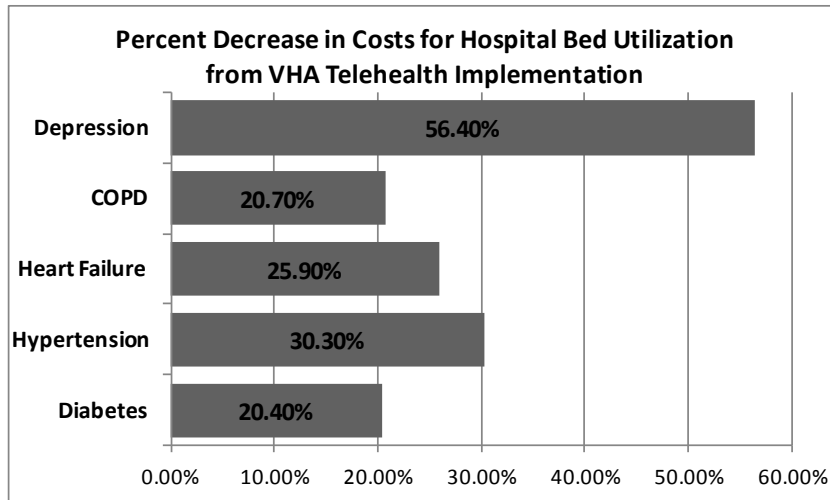
Finkelstein, Speedie, and Potthoff conducted a study in 2006 on videoconferencing uses of telehealth, and found that virtual visits between a skilled home healthcare nurse and chronically ill patients at home can improve patient outcome at lower cost than traditional skilled face-to-face home healthcare visits. (Finkelstein, et al., 2006)

Polisena, Coyle D, Coyle K, and McGill also conducted a search of the literature in 2008 focused on studies that identified costs as a major factor. Of the 22 studies they reviewed, only two did not show a cost savings for telehealth practices. (Polisena, McGill, Coyle, and Coyle, 2009)

The Veterans Health Administration (VHA) has been one of the most successful in using telehealth, in large part because many of the obstacles regarding reimbursement and licensing do not apply to them. In the late 1990s, Dr. Kenneth Kizer reoriented the VHA away from hospital-based treatment to a patient-centered model emphasizing prevention and health promotion. Additionally, because 40 percent of veterans lived in rural areas, the VHA invested in a Home Telehealth program that is now the largest single telehealth program in the world, providing telehealth care to over 50,000 patients in 2011. The

system is based on a Care Coordinator, who provides ongoing monitoring and coaching on the agreed care pathway. Some of the savings can be seen in Figure 7. (Cruickshank, Winpenny, Beer, and Manning, 2010; Darkins, 2008; Lindeman, 2010; Taylor, 2012)

Figure 7. Percent Decrease in Costs for Hospital Bed Utilization from VHA Telehealth Implementation.



Mohit Kaushal, Digital Healthcare Director for the Federal Communications Commission (FCC), testified last year at a congressional hearing on the subject of healthcare and the documented benefits of the VHA program:

"Although economic studies like these are open to criticism due to the difficulty in quantifying savings, the Veterans Hospital System has implemented its Care Coordination/Home Telehealth Program (CCHT) for 32,000 veteran patients with chronic conditions. The program has resulted in a 19 percent reduction in hospital admissions and a 25 percent reduction in bed days for those veterans who are admitted. There is also a significant cost saving associated with these improved clinical outcomes. The CCHT Program, at \$1600 per patient per year, costs far less than the VHA's home-based primary care services, at \$13,121 per patient per year, and nursing home care rates, at \$77,745 per patient per year."

Latifi and his colleagues at the University of Arizona found that the cost of a single avoided transport covered the cost of the entire telehealth system. In 2009, the 17 unnecessary transfers saved \$104,852. More widespread use nationally would save \$537 million. (Newman and McMahon, 2011)

The Turnstall Health Group in England studied telecare, and estimated the cost benefits for the average local authority (about 350,000 people, 38,500 of them over 65) was over £3 million (almost \$4 million), and could be up to £7.8 million (over \$10 million). The weekly cost of healthcare was £6.25 (\$8.41) rather than £167 (\$217.50), which was what they were spending before switching to telecare. The Scottish government saved over £11 million

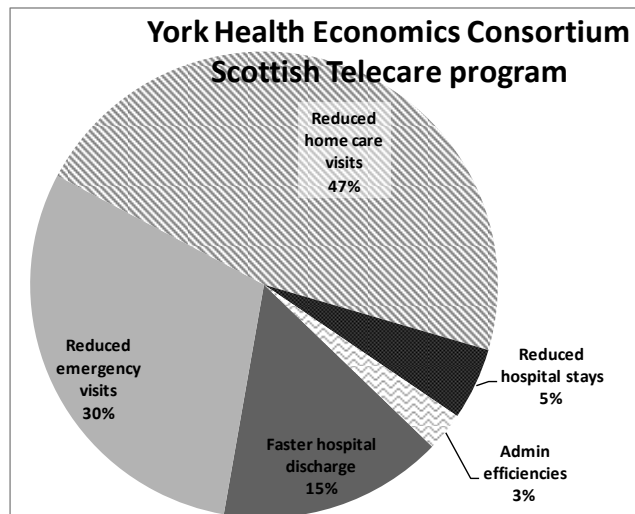


Figure 8. York Health Economics Consortium Scottish Telecare Program (Taylor, 2012, p. 20)

(\$14.33 million) through increased speed for discharge from hospital, reduced emergency admissions, reduced overnight hospital stays, reduced home visits, and administrative efficiencies. (Taylor, 2012)

Non-Financial Benefits

Often the benefits are broader than financial, as documented by Davalos, et al (2009). For example, Lupari, Coates, Adamson, Crealey reported on 8 papers (out of the 568 references identified) that discussed how nurses can provide care to elderly patients with multiple chronic conditions in their own homes. The studies reported positive qualitative outcomes. However, there was not a significant improvement in the number of emergency admissions, bed days, nor costs. (Lupari, Coates, Adamson, and Crealey, 2011)

Wade et al. describe an online program to coach parents on how to care for their children with traumatic brain injury. The majority (69 percent) preferred the online program over traditional in-person training, and 100 percent of the therapists preferred the online training. (S. L. Wade, Oberjohn, Conaway, Osinska, and Bangert, 2011)

Harrison et al. studied the records of over 30,000 patients who were discharged from a hospital. Telehealth was associated with reduced rates of readmission to the hospital; the telehealth group was 23 percent less likely to be readmitted within 30 days. (Harrison, Hara, Pope, Young, and Rula, 2011)

Noel, Vogel, Erdos, Cornwall, and Levin conducted a study in 2004 on 104 participants randomly assigned to intervention or control groups, although there was only remote monitoring (no videoconferencing). They found that integrating telehealth with the healthcare institution's electronic database significantly reduces resource use and improves cognitive status, treatment compliance, and stability of chronic disease for homebound elderly with common complex problems such as heart failure, chronic lung disease, and/or diabetes. (Noel, et al., 2004)

In the United Kingdom, the Whole System Demonstrator programme was set up to gather evidence of the efficacy of telehealth involving a randomized control study of 6,191 patients in 238 general practitioner offices across three regions. Using a combination of 92 strategic documents from the literature and 115 interviews of people involved in the program, one group of researchers found a 15 percent reduction in emergency room visits, a 20 percent reduction in hospital admissions, a 14 percent reduction in elective admissions, a 14 percent reductions in bed days, and an 8 percent reduction in costs. (Hendy et al., 2012) Another group of researchers studied 3,230 people with chronic illnesses, randomly assigned to a telehealth group (N = 1,605) or a control group (N = 1,625). Members of the telehealth group were significantly less likely to die or go to the hospital than the control group. (Steventon, et al., 2012)

One study involved telemedicine abortions (using the drug mifepristone). The telehealth applications were found to be just as safe and effective as clinic abortions, and the introduction of telehealth increased the rate of first trimester abortions and reduced the rate of second trimester abortions. The new service also increased the likelihood that women who lived more than 50 miles away from a clinic would obtain an abortion. (Grossman, Grindlay, Buchacker, Potter, and Schmertmann, 2012)

One study showed that nurses in oncology clinics were very receptive to telehealth for medical education. The researchers noted the nurses especially liked the fact that they could learn about specialty care without leaving their communities, and felt that the program provided optimal healthcare for anyone, anytime, anywhere. (Sevean, Dampier, Spadoni, Strickland, and Pilatzke, 2008)

Dishman, an Intel Fellow and Director of Health Innovation Policy for Intel noted several technologies that enabled the elderly to remain at home, including the *phone touch*, a technology where a patient's tremors or symptoms of Parkinson's or Alzheimer disease can be detected, and *magic carpet*, which records gait, weight, stride, etc. Dishman believes that fully 50 percent of the current healthcare done in clinics and hospitals can be moved to the home. (Pryke, 2010)

A survey of a Picture Archiving and Communication System (PACS) telehealth implementation answered by 1,518 clinicians who had used the system between 2 and 5 years showed some insights. Most (83 percent) felt that it benefited their work, and was better than hard copies. More than 50 percent said they had had no training, and 20 percent felt that the system was unreliable, unavailable for at least one week

every year. Additionally, some felt that the image was poorer quality than the hard copy. (Tan and Lewis, 2010)

Telehealth in Rural Areas

There have been more pilot projects, model projects, and government funding for telehealth specifically in rural areas than in urban areas because the economics of rural healthcare are very different than the economics of urban healthcare due to the high cost of traveling and the scarcity of physicians.

Telehealth has been forwarded as a way to deal with the shortage of physicians. (Tracy, 2011) Telehealth can help educate more physicians. Even more outside-the-box telehealth can be used through MOOCs (Massively Open Online Classes) to provide more widely spread proper, accurate, and effective medical knowledge on health topics. (Hill, 2012)

According to the researchers, it is also essential to expand the usefulness of physician assistants, certified registered nurse practitioners, and certified nurse midwives by changing the restrictive state regulations that limit or exclude them from reimbursement opportunities through telehealth. This action would do much to solve the issue of rural accessibility to healthcare, and research indicates that these practitioners are highly accepted by patients and could manage 60 to 80 percent of patients primary health care needs (if they were allowed to do so). They also call for the use of Electronic Medical Records to ensure that the level of rural emergency services is consistent with urban areas. However, they also note that broadband access is often not available, with estimates of less than 40 percent of rural residents having broadband access. (*Status Check Pennsylvania Rural Health Care*, 2010)

In 2010, Hooshmand studied 222 families with children who had special needs residing in rural areas in Florida. She split the group into a telehealth group and a traditional face-to-face group. The telehealth group had lower costs and higher satisfaction rates, while there was no difference between the groups regarding care and outcomes. (Hooshmand and University of Miami, 2010)

A hospital in South Dakota is in such a rural area that it works via webcam only, and has no in-patient beds. The project was able to decrease in hospital admissions to other hospitals outside of the area by 18 percent. (Abrams, 2012)

Dollinger and Chwalisz set up a successful project using a neighbor to help with care/observation of “shut ins” in rural areas of Illinois, providing them help and support through a videoconferencing link. Caregivers who have completed the intervention report significantly less stress and improved social role functioning support that is still evident at 6 months. (Clancy Dollinger and Chwalisz, 2011)

Wade, Karnon, Elshaug, and Hiller conducted a systematic review of telehealth from an economic point of view, and included several rural telehealth projects. They found the majority of the studies showed telehealth to be less costly than the non-telehealth alternative. Health outcomes were improved in a third of the studies. In three studies of telehealth to rural areas, the health services paid more for telehealth than traditional care. However, the researchers pointed out that the cost of the patients travel was an offset, making it less costly from a society perspective (and even from an individual perspective when healthcare insurance covers travel costs as well as treatment). Wade et al. also pointed out that patients will make the most rational choice for themselves first, independent of preferred policies. If costs to see a telehealth doctor are lower, they will choose it. Wade, et al, also looked at the models of telehealth, including 1) home care, 2) access to specialists, 3) rural service delivery, and 4) local service delivery between hospital and primary care. The model of care was more important in determining the value of the service than the clinical discipline, the type of technology, or the date of the study. They concluded that: "Delivery of health services by real time video communication was cost-effective for home care and access to on-call hospital specialists, showed mixed results for rural service delivery, and was not cost-effective for local delivery of services between hospitals and primary care." (Wade, Karnon, Elshaug, and Hiller, 2010)

The National Rural Health Association issues a policy brief and identified health care access and cost as persistent problems in rural areas. It conducted a study that illustrated substantial barriers to healthcare, and proposed telehealth as a potential solution. It noted that telehealth lowers the cost of care by providing early and timely diagnosis, improving triage, reducing unnecessary transfers, and improving the

management of chronic diseases. The study showed that more than 85 percent of the patients remained in the local community, which enhanced the financial viability of the community hospitals. (Hughes, Bell, Larson, and Weems, 2010)

Canada has many rural areas where there is a shortage of medical personnel, and telehealth has been proposed as a solution. Duplantie, Gagnon, Fortin, and Landry conducted a Delphi study, which is a method of structure interviewing. They interviewed 12 telehealth experts across Canada. They started with 34 questions, but after initial interviews, modified the list and categorized the questions under 15 themes. They also noted issues with the definition of telehealth. If 60 percent of the experts agreed on the answer to the question, it was determined to have reached consensus. In the end, the result was a list of 18 factors prioritized by whether or not telehealth was likely to have an impact on them. The top nine factors in the list are:

- Providing a second opinion in case of doubt;
- Giving rural and remote specialists the opportunity to transmit more information to discuss complex cases;
- Diminishing the feeling of isolation;
- Support decision making;
- Extending the variety of services available in rural regions;
- Offering complementary services, giving more relief to rural and remote specialists; and
- Maintaining natural professional networks between physicians. (Duplantie, Gagnon, Fortin, and Landry, 2007)

Schopp, Demiris, and Glueckauf investigated the issues regarding providing psychological services to rural areas through telehealth. They noted that legislation, intended to help rural areas increase telehealth use, has actually prevented more widespread adoption by restricting telehealth reimbursement to rural areas and to certain classifications of provider. Psychologists have taken a wait-and-see attitude in the hopes that restrictions would be lifted. They noted that the telehealth cost an average of \$67.70 per rural consultation, compared to the typical \$284.77 cost of traditional rural consultation (not counting the added average \$83.60 in client travel). (Schopp, et al., 2006)

Gamble, Savage, and Icenogle used a value-chain analysis in analyzing the benefits of telehealth in a rural health program. Value-chain analysis is based on the work of E. Porter, a well-known management consultant who separated all business processes into primary and support activities. Using the value-chain analysis, it is easy to see the issues regarding the cost drivers for telehealth, and why telehealth has not grown despite the apparent benefits. (Gamble, et al., 2004)

Armer did a qualitative study comparing two groups: rural counties with telehealth education for nurses, and rural counties without telehealth education for nurses. Armer found support for superior professional development and connectedness with telemedicine capability. Those with telehealth access reported both current and potential applications of technology, and cited many examples of both formal and informal learning. Those without telemedicine reportedly saw opportunities in using telehealth that they did not have. (Armer, 2003)

Patients with diabetes in rural areas of New York were studied using a randomized controlled sample. The treatment group used telehealth for diabetes counseling and care, while the control group got the usual care from a primary care physician. The telehealth group increased diet and exercise knowledge over time and reduced their waist circumference over the 2 years by 1.2 centimeters, which was .2 centimeters less than the control group. Path analysis demonstrated that the intervention, through improved diet and exercise knowledge, was related to the decrease in waist circumference after 2 years. (Fau et al., 2010)

Best Practices of Telehealth

The research team created an initial list of best practices for telehealth from the search of the literature, relying mainly on two major studies. The first was an extensive search of the literature conducted on telehealth in 2008 by Jarvis-Selinger, Chan, Payne, Plohman, and Ho. They identified telehealth best practices and issues. They found 397 articles on the topic from a variety of sub-fields, including medicine,

nursing, rehabilitation, social work, speech pathology, and pharmacy, of which they reviewed 225. They identified best practices related to the environmental conditions that must be met (including basic technological infrastructure, site-to-site technological compatibility, and available technical support) for a successful telehealth implementation. Additionally, certain process conditions were pointed out including 1) the development of change management, 2) user training plans, 3) understanding program cost, 4) remuneration issues, 5) development of organizational protocols for system use, and 6) interprofessional collaboration. (Jarvis-Selinger, Chan, Payne, Plohman, and Ho, 2008)

Moehr, Schaafsma, Anglin, Pantazi, Grimm, and Anglin identified best practices for telehealth projects in 2006. They found the most effective use was when telehealth focused on chronic conditions that require visual information for proper management, and when it involved established teams in regularly scheduled visits or in sessions scheduled well in advance. Both educational and administrative applications generated the most benefit. Best practices included well-planned technical infrastructure, strong program management, and a thorough needs analysis. According to their research, problems occurred when telehealth was used without prior planning, particularly under emergency conditions or when only part of the services were provided through telehealth. For instance, if the telehealth system could monitor blood pressure, but could not take someone's temperature, it was not as effective. The same applied if the cardiologist was on the system, but not the internist. They also found problems when the telehealth services had not been properly introduced to the entire team. (Moehr et al., 2006)

The VHA has many recommendations for best practices of telehealth. It recommends finding a way to deliver a step-change increase in the scale of telehealth implementation; small independent projects do not produce the benefit. Those who manage the delivery of telehealth need to interact closely with the responsible clinicians primarily caring for the patients. Telehealth should be established as a centralized care coordination service. The care pathways benefit from design at the national level. National oversight is essential in terms of commissioning, procurement, and best practice adoption. Clinician engagement is essential, based around clear evidence of benefit to specific patients and disease groups. Funding needs to be addressed through sustainable reimbursement policies. Targeted patient selection is essential, based upon strict criteria of who benefits. The lessons that the VHA learned was that telehealth reduced the imbalance between hospital and primary care spending, and made better use of scarce clinical resources. Establishing telehealth required considerable investment and time, as well as a substantial change to the organizational infrastructure and performance management. Based on VHA's experience, telehealth can be cost effectively applied to broader populations for prevention and wellness programs. It also noted that integrated patient records greatly facilitate collaboration between clinicians involved in patient care. And that training is vital to ensure stable, effective, consistent services. (Cruickshank, et al., 2010)

Davalos et al. provided a list of recommendations for best practice for documenting the benefits of telehealth. They described several common outcomes of telehealth: reduced morbidity, avoided mortality, reduced length of hospital stay, avoided emergency room visits, hospitalizations and readmissions, increased productivity, avoided spread of communicable diseases, more efficient access to healthcare, avoided physician visits and patient transportation costs, increased knowledge for self-care, faster diagnosis, more accurate diagnosis, reduced waiting time, increased medical adherence, increased collaboration among practitioners, increased patient satisfaction, avoided travel time, decreased risk for job loss or income loss due to healthcare time. They also noted that few telehealth studies included all of these benefits, and even fewer translated the benefits into costs. They provided several different methods to translate the benefits to cost for documentation purposes. (Davalos, et al., 2009)

One of the most important issues regarding best practices of telehealth, however, is the reciprocal relationship between volume of adoption and costs. The current legislative regulations on telehealth reimbursement interfere more than it might first appear. By restricting payment for telehealth to rural areas, for certain medical personnel, and only to healthcare provider offices instead of to the home, the cost of telehealth (the equipment, infrastructure, process integration, training, etc.) increases exponentially. Any savings for any telehealth program depends upon lowering the cost of telehealth, but only if widely adopted by everyone, everywhere. In California, for example, the savings to the taxpayer if Medicaid reimbursed telehealth costs without restrictions would be \$408 million every year; but only if

telehealth is generally adopted for all healthcare, nationwide. If the technology were only used for the small subset of patients with diabetes and heart problems, only in rural areas, and only for physicians and not the healthcare associated with these chronic conditions, the cost would outweigh the benefits. (Newman and McMahon, 2011)

Cusack and a team of researchers and clinicians echoed that idea in their study of three different models of telehealth. They developed a simulation to test which was most effective. They found a hybrid model of all was most cost effective (a combination of store-and-forward and real-time video). They noted that the predicted savings of \$4.3 billion per year would only become reality if telehealth were implemented in all emergency rooms, prisons, nursing homes, and physician offices in the United States.

Growth of Telehealth

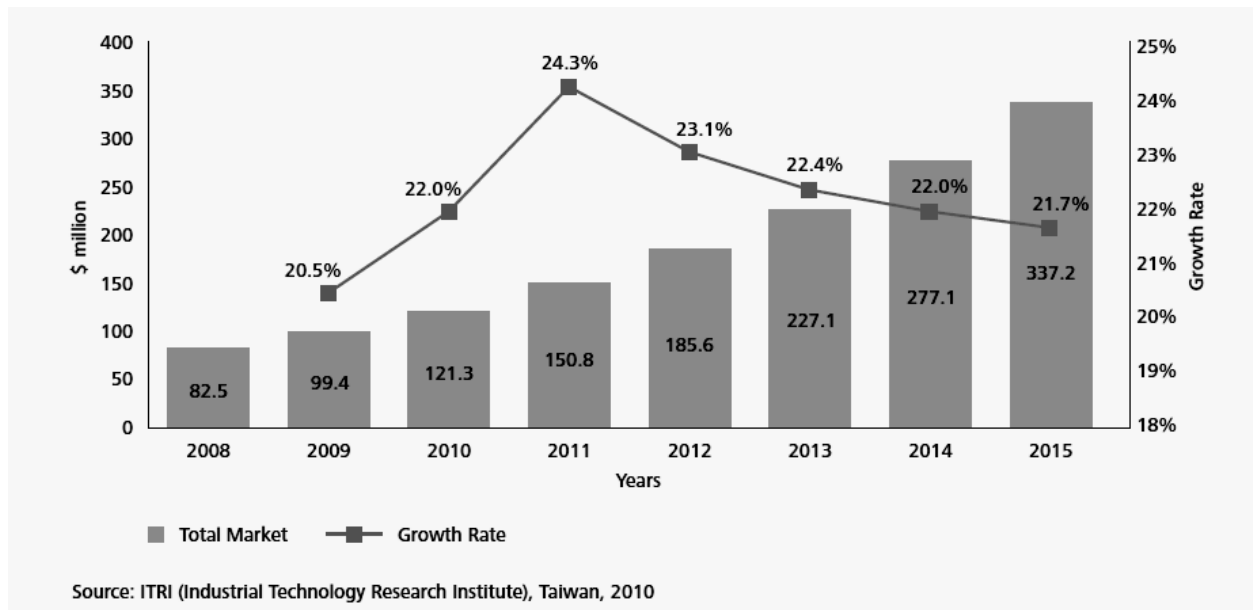
This section starts with a description of the growth of telehealth both in the United States and in other countries. Following is a description of the challenges to further growth in this country. Finally, the solutions discussed in the literature to some of the challenges and obstacles to more widespread telehealth growth will be investigated.

Growth Abroad Astronomical, Growth Domestic Tempered

In other parts of the world, telehealth is growing at an astronomical rate, especially considering the economic downturn and the shrinking of most industries. In Europe, the telecare market (the aspect of telehealth concerned with providing monitoring services to people in their homes) grew from \$138 million to over \$240 million from 2004 to 2010. The telehealth market in the United Kingdom was £141.7 million (about \$215 million in US currency²) in 2010 and is expected to be over £320 million (about \$486 million in US currency) in the next two years. The European telehealth market in general is expected to continue to increase at a steady 12 percent rate.

Adoption of telehealth in routine healthcare in the United States has been slow (D. C. Baker and Bufka, 2011; Cusack et al., 2008). The United States has seen a recent peak of growth in telecare as can be seen in the graph in Figure 9, but the rate of expansion has been tempered somewhat based upon limited changes to the current reimbursement and licensing practices. (Taylor, 2012)

Figure 9. Estimated growth of telecare market in the United States (Taylor, 2012, p. pg 8)



² Using the exchange rate of \$1.52 for every £1, which was the exchange rate on April 1, 2013)

CSMG (a market analyst firm) proposes that if insurer reimbursement policies extended to telehealth, including personal emergency response service, monitoring, telemedicine, mobile health information, RFID tracking and health and fitness software, the market would be \$4.6 billion in 2014, and well over \$12 billion by 2020. PriceWaterhouseCoopers Health Research Institute estimates mobile health markets of \$7.7 billion to \$43 billion, depending upon reimbursement policies. Even at the low end, 40 percent of survey American consumers indicated they were willing to pay for mobile monitoring equipment if it could send health information directly to their physician, and globally the percent went up to 70 percent. (Gallelli, et al., 2011)

Mobile Telehealth Growth for Patient Education

But what about the patients themselves, and their ability to use telehealth outside of the physicians' purview? Do patients look up health-based information while utilizing mobile devices such as smartphones? During the last year the concept of mHealth has become popular, and many consider this an essential part of telehealth. Individuals can access health information, programs, and applications ("apps") on their smartphones and/or tablets that help them track and/or manage their health. Fox and Dugan report that 19 percent of smartphone owners have at least one health app on their phone with the focus on healthy lifestyle (exercise, diet, and weight tracking). People are a little less willing to text about their health. The majority of cell phone owners (80 percent) send and receive text messages, but just 9 percent of cell phone owners say they receive any text updates or alerts about health or medical issues.

The majority, 52 percent of smartphone owners, have looked up health information on their phones. Even among non-smart phones, one in three cell phone owners (31 percent) have used their phone to look for health information. As can be seen in Figure 10, in a comparable, national survey conducted two years ago, just 17 percent of cell phone owners had used their phones to look for health advice, so this is a major growth. (Fox and Duggan, 2012)

Harvard University researchers conducted an experiment on the effectiveness of a smartphone application that provides online therapy for social anxiety. Those who used the on-line applications reduced their anxiety level (as measured by the questionnaire) by 22 points. The control group (wait listed) only dropped their anxiety level by 8 points, a significant difference. (Carey, 2012)

Growth in Availability, But Perhaps Not Use

A 2006 study by University of Pittsburgh Department of Health Policy and Management shows what Peifer calls "extensive" use of telehealth (particularly telecare) with older populations. Homecare agencies were surveyed, and 167 of them responded. The data showed that 38 percent of home health agencies, 24 percent of hospice and 17 percent of private duty nurses were using remote vital signs monitoring. The researchers estimated that up to 6,336 people in Pennsylvania were using remote vital signs monitoring technologies. (Peifer, 2008)

Health Information Accessed by Phone, Then and Now

% of cell phone owners within each group who use their phone to look up health or medical information

	2010	2012
All cell phone owners	17%	31%
Men	17	29*
Women	16	33*
Age		
18-29	29	42*
30-49	18	39*
50-64	7	19*
65+	8	9
Race/Ethnicity		
White, non-Hispanic	15	27*
Black, non-Hispanic	19	35*
Hispanic	25	38*
Annual household income		
Less than \$30,000/yr	15	28*
\$30,000-\$49,999	17	30*
\$50,000-\$74,999	17	37*
\$75,000+	22	37*
Education level		
No high school diploma	16	17
High School grad	12	26*
Some college	21	33*
College+	20	38*

Source: Pew Internet/CHCF Health Surveys: August 9-September 13, 2010, N=3,001 adults; August 7-September 6, 2012, N=3,014 adults ages 18+. Margin of error for both surveys is +/- 3 percentage points for results based on cell phone owners.

*Statistically significant difference compared with the same group in the previous survey.

Figure 10. The growing amount of health information accessed on mobile phones.

Sometimes telehealth is available and implemented, but not used. Murray and the team studying three different telehealth systems had to change their study methodology from observation to interview because the systems implemented were not being used often enough for them to observe (Murray et al., 2011). At the federal level, the United States expected much more telehealth use than has been seen in actuality. This lag in use becomes obvious from the Congressional Budget Office estimates for telehealth between 2008 and 2012. The Medicare budget expected \$150 million to be spent on telehealth between 2008 and 2012. In actuality, only \$20 million were spent, less than 14 percent of the amount budgeted. (Downey, 2012)

Challenges to Telehealth Growth

Several researchers have itemized reasons for the lack of growth of telehealth despite its potential to solve some of the healthcare issues being experienced. They include 1) an outdated definition of telehealth, 2) complex, non-standard, and incongruent reimbursement practices for telehealth, 3) unresolved licensing and legal issues, 4) lack of process, training, and support for telehealth, 5) lack of recognition of the best practices for telehealth which include multi-disciplinary collaboration and use for prevention and chronic illnesses, and 6) current healthcare payment structures which accrue the financial benefits of telehealth to an agency other than the payer of telehealth services. These six categories can be seen threaded throughout the obstacles to telehealth documented in the literature.

As already noted, the definition of telehealth is an issue. Medicare and Medicaid have placed restrictions on telehealth. Telehealth is only allowed in certain fields such as psychiatry and emergency medicine. Telehealth is only allowed in rural areas with a physician shortage. Telehealth is only allowed from certain places, such as from one doctor's office to another doctor's office or hospital. And telehealth is not allowed to the home. (D. C. Baker and Bufka, 2011; Bell et al., 2011; CMS, 2008; *Medicare Telehealth Reimbursement Information*)

When telehealth systems were expensive devices requiring a dedicated leased line for each system, limiting its use to specific locations and for high-need populations made sense. But that is no longer the case. Wade, et al, found that telehealth to the home was cost effective, but telehealth from the physicians office to the hospitals was not (V. A. Wade, et al., 2010). Given the general infrastructure and devices now available, most (if not all) researchers find that these outdated restrictions impact development negatively. (Davalos, et al., 2009; Gamble, et al., 2004; Schopp, et al., 2006)

Mattke and the Rand team identified several reason patients resisted the technology including lack of familiarity, limited experience with self-management of chronic conditions, lack of training and support for using the technology, high expense of the technology, and cultural disdain for stigmatization of disabilities. They also noted that providers feel there is limited evidence of their effectiveness, lack of integration into processes of healthcare, fear of the potential disruption that occurs with self-managed healthcare conditions, and concern over the quality and exaggerated claims of the products. Additionally, the current system of healthcare based upon acute illness rather than ongoing management of chronic conditions, and do not provide a method to pay for prevention, which would more effectively utilize the healthcare dollar. (Mattke, et al., 2010)

Gruman blames the lack of growth on the fragmented nature of the current health system, the lack of interoperability between EHR systems, the fact that users are not playing a meaningful role in development and testing of applications, and patients with multiple conditions are not consulted as they should be. (Gruman, 2011)

Pryke feels the government is not doing enough. Pryke notes that innovative telehealth technologies are being developed in the United States, but it is only in European countries where telehealth is being implemented on a significant scale with government funding. He points to lack of broadband access, and claims that 70 percent of clinicians outside metropolitan areas don't have broadband because of the high cost of internet connectivity in rural areas. He also notes that physician and patient buy-in are still lacking, but blames the Medicare reimbursement system the most, quoting Senator Wyden who testified that the Medicare reimbursement system is flawed, barely acknowledging the capabilities of telehealth. Dishman from Intel outlines four main barriers to telehealth: lack of imagination on the part of physicians about how

telehealth could be used, an out of date Medicare incentive scheme not based on outcomes, the majority of investment dollars going to drug diagnostics instead of telehealth, and lack of training in telehealth. (Pryke, 2010)

Wicklund points to a lack of trial-based evidence that telehealth improves outcomes because there are a very small number of clinical trials. One of the problems he noted was that the technology is evolving so rapidly that by the time the clinical trial is complete, the technology used is very outdated. (Wicklund, 2012)

Taylor lists impediments to telehealth adoption as 1) concern over installation costs, 2) cultural resistance from clinicians, 3) lack of clarity over how services should be funded, 4) lack of understanding about how to use telehealth, 5) inadequate staff education, and 6) a lack of leadership and change management capability (especially regarding information standards and security). (Taylor, 2012)

Cusak, et al also noted that costs for telehealth are borne by the providers and savings accrue to the payers, which was a major impediment to telehealth growth. They found that the initial increase in professional fees for health visits are offset by the savings achieved when specialists are involved earlier in a patient's care, and when tests are not duplicated. Other barriers they identified were dysfunctional reimbursement patterns, concerns about malpractice, and lack of cross-state licensure. (Cusack, et al., 2008)

The Rural Maryland Council identified four major barriers to robust telehealth implementation: Funding and Reimbursement, Lack of Leadership and Coordination, Poor access to Broadband in rural areas, and Legal Impediments and Licensing issues. (*Final report of the December 2010 Maryland Telehealth and Telemedicine (THTM) Roundtable*, 2011)

The National Rural Health Association identified five specific challenges to reimbursement of telehealth, including geographic restrictions, coding limitations, provider eligibility limitations, inequitable originating site fees, and ineligibility of store and forward applications. (Hughes, et al., 2010)

Gregg Malkary published a report on the telehealth industry in 2006, and commented that a major obstacle was the fact that healthcare and government agencies were not reimbursing for telehealth monitoring. He noted that it was a major problem because even though it cost less overall, if patients had to purchase the technology themselves, they would not do so. (Gee, 2006)

Davalos, et al, feels that a major obstacle of telehealth coverage is the lack of concrete evidence from studies because of a dearth of rigorous economic studies on telehealth. There is a distinct lack of funding for large-scale programs, multi-outcome interventions, or investigations into long-term effects of telehealth. (Davalos, et al., 2009)

Newman and McMahon identified several barriers to more widespread adoption. They pointed to process issues, technology purchase funding, integration, training, maintenance, legal issues such as cross-state licensing, confidentiality, liability, and restrictive and non-standardized reimbursement policies by both public and private insurers. (Newman and McMahon, 2011)

There are several legal issues with telehealth. Some are simple clarifications. For example, there is confusion surrounding whether or not storing information about a patient on the web, or popular videoconferencing such as Facetime and Skype, are a violation of the Health Insurance Portability and Accountability Act. (D. C. Baker and Bufka, 2011; Orłowski, Ayers, and Peters, 2008)

But some legal issues are seemingly intractable. By far the largest legal issue regarding telehealth has to do with licensure. Currently, medical personnel (physicians, physician assistants, nurses, nurse practitioners, psychologist, social workers, etc.) are all licensed by the state where they practice. A Pennsylvania resident can travel down to Maryland or over to New Jersey and get medical care, and no state laws or regulations would be broken. But a Pennsylvania resident is not allowed to speak over a videoconferencing link with the doctor in another state because the doctor would need to be licensed in Pennsylvania. Each state has its own medical and nursing associations which sets standards for physicians and nurses. Since state standards are different, a physician or a nurse must be licensed in each state in which they might have a patient. If a physician or nurse provides services to someone physically in another state, they could be prosecuted and might lose their license in their own state. This restriction

severely curtails the ability of physicians and nurses to provide telehealth services. (D. C. Baker and Bufka, 2011; Hughes, et al., 2010; Newman and McMahon, 2011; Schopp, et al., 2006)

Many states have expedited licensing process for cross-state medical licensing, but not all. State medical boards have the responsibility to safeguard the people who live in their state from unlicensed or fraudulent practitioners. Many are loath to either trust the medical licensure of another state, or make it any easier for out-of-state practitioners to perform services in their state. In some states like Pennsylvania there is an exception for consultative medical practices, though there is some confusion over whether its purpose was for occasional consults or if it can be used for a physician or nurse to regularly schedule appointments with patients. But even this exception requires an excessive amount time and resources to complete the paperwork. (Wakefield, 2010)

The National Conference of State Legislatures identifies lack of existing broadband Internet access as one of the most significant challenges facing the expansion of health information technology (Ewing, 2011). The infrastructure needed for telehealth needs to be ubiquitous; it will not work without a centralized single network that is always available everywhere. The FCC has recognized that broadband accessibility is a problem in rural areas because broadband providers would lose money. There aren't enough people in a rural area to pay the cost of laying the cable or building the towers. In September of 2012 Commissioner Ajit Pai, in the opening remarks for at the Rural Broadband Roundtable held in Oswego, Kansas stated the following:(M. Berry, 2012)

The economics are as simple as they are unfortunate. Broadband networks in more densely populated areas are the most profitable; networks in more sparsely populated areas are the least.

But then he goes on to talk of encouraging the private sector to invest.

We need a regulatory environment that encourages the private sector to invest in and upgrade rural broadband networks. When regulators make it difficult for broadband service providers like CenturyLink to deploy broadband, rural America loses. So if the regulatory environment is unfavorable, broadband service providers are likely to jettison their rural investments first.

The unfavorable environment that Commissioner Pai speaks of is the current one. In 1917, the early days of the telephone, the federal government nationalized the telecommunications industry because they recognized that a telephone system cannot work without a centralized single network. Once the central core was built, there needed to be a way to connect everyone, even those in areas where it was normally too expensive to connect. There were subsidies available to provide telephone service in rural areas, collected from all users (the Universal Service Fund). But that fund was established when local service and long distance service were separate, and when telephone companies provided telephone service on landlines. The Universal Service Fund was established before the World Wide Web and the Internet. There have been recent proposals to make the Universal Service Fund available for broadband connectivity, a plan called the Connect America Fund, but that won't happen until 2018. (Wyatt, 2011)

The FCC does have programs to encourage rural health care. However, the Government Accountability Office published a report that was highly critical of the FCC's programs designed to increase access of Rural Health Care. The program requirements are highly complex; more than half of the applicants drop out of the process before completing it due to the overwhelming paperwork requirements. The documentation required for each entity involved in the process (especially the "letter of agency") is extremely time-consuming and resource-intensive, and the program only provides 25 percent subsidy for the cost of Internet connection. Administrative costs, travel, legal, marketing, process improvement and training costs are ineligible for funding. As a result, the funding for the program is underutilized, and the total program disbursements have never gotten close to the funding cap. Just over \$327 million has been disbursed over the course of the past ten years; the funding cap is \$400 million *per year*. The moneys that have been disbursed by the FCC have not been equally distributed; the majority of the funds (just under 55 percent) have gone to one single state (Alaska). Further criticism is that the FCC has not conducted a

needs assessment, and does not provide any coordination or oversight for the programs which could potentially reduce costs by enabling shared resources between programs. (Goldstein, 2010)

Additionally, the FCC does not provide for enough bandwidth for telehealth. The definition of "broadband" according to the FCC documentation is woefully inadequate for videoconferencing telehealth. Act 183 defines broadband as only 128 kilobits per second upstream. Videoconferencing requires multiple megabits per second both upstream and downstream, i.e. more than 4000 kilobits per second (4 megabits per second) both ways. (Commission, 2010; Daubert, Bonner, Himowitz, and Gregory, 2011; FCC, 2010)

Additionally, security issues need to be resolved. The basic Internet protocols have no native security, which is essential for the exchange of private health information. Agreement on security protocols or the free widespread availability of VPN is essential. A VPN is a virtual private network, which is simply a way of encoding data sent over the Internet so that it can't be plucked out of the airwaves or read with a protocol analyzer. An analogy might be putting an envelope around a letter rather than sending only postcards. Having the government provide a standard VPN would help because each telehealth system wouldn't have to develop their own security, which would add significantly to the cost. Of course, infrastructure changes are better done at the federal level rather than the state level, and must be coordinated with several agencies that manage Internet protocols. (Schwartz and Lonborg, 2011)

A lack of data standards has delayed Electronic Health System adoption, as there is no guarantee that whatever data fields a system uses will be acceptable to other systems for transaction processing because there are no centralized standards. Eventually all the independent and individual EHR systems will morph into a single, unified, integrated, national health care electronic data system. At that point in time, instead of being a cost drag on healthcare, the integrated EHR system can raise healthcare quality, decrease administrative costs, and ensure that patients get the best care possible by a team of well-integrated professionals. Until that time, electronic health systems are adding to the rising administrative costs instead of saving costs. (Bouhaddou, et al., 2012; Mantel, 2010)

Payment and Reimbursement Issues of Telehealth

The financial benefits of implementing data standards for electronic health management systems accrue to the healthcare providers, but costs for implementation are borne by the payers. With video or remote monitoring telehealth systems, on the other hand, the healthcare providers bear the costs, while payers reap the financial benefits. (Cusack, et al., 2008; Gamble, et al., 2004; Wikler, et al., 2012)

The National Rural Health Association recommends that all reimbursement limitations be lifted. They also recommend that telehealth should not have separate billing procedures. Reimbursement should be allowed for any clinician currently reimbursed, and not just physicians. Presently, physical therapists, respiratory therapists, occupational therapists, speech therapists, social workers are not able to be reimbursed through telehealth. They also recommend that fair market value should be reimbursed rather than a lesser amount. Additionally, they recommend that store-and-forward applications should be reimbursed. (Hughes, et al., 2010)

Information Technology Data Standards Impact on Telehealth

Normally, incompatible systems are a problem. It is easy to see benefits when the systems interoperate. Because incompatible data standards is not an issue at the VHA, and because electronic patient records are already widely available, collaboration between different clinicians involved in patient care has been greatly facilitated. (Cruikshank, et al., 2010; Darkins, 2008)

In Minnesota, four payers and five medical groups agreed upon authorization process utilizing a decision support system for ordering diagnostic scans. Not only did unnecessary testing go down, but the amount of time providers spent interacting administratively with health plans also went down. One group saw the time per thousand tests drop from 154 hours to just 2.5 hours, resulting in a savings of over \$84 million over three years. (Wikler, et al., 2012)

Resistance to New Technology

A common thread through the literature was that the age of the patients and the physicians were a strong determiner of the growth of telehealth, and that older generations resisted the use of new technologies (Mattke, et al., 2010). "Under the age of 50" was a prevalent refrain heard from IT administrators commenting on factors to implement IT uptake. (Glasmeier, Benner, Ohdedar, and Carpenter, 2008) Some believe that as the population of people who grew up with computers and mobile technology enters adulthood, the technology itself poses much less of an obstacle culturally. (Maria, 2011)

Proposed Solutions to Telehealth Obstacles

Several researchers have created lists of options that would help remove obstacles to adoption. Mattke and the Rand team recommend that policymakers create a vision for the future role of telehealth, provide coverage policies that encourage use and find a payment structure that supports patient-centered ongoing management of chronic diseases. They also specify that clarifying the regulatory environment is important, improving the infrastructure, and promoting health literacy. Vendors should work to make their products more user friendly, provide better training and support, and focus on generating solid evidence of the clinical and cost effectiveness of their new technologies. Healthcare providers should put more emphasis on improving health outcomes, and move away from the role of paternalistic caregiver and towards the role of knowledgeable partner to patients, educating and supporting them toward wellness. (Mattke, et al., 2010)

The Deloitte report on telehealth has eight actions to break through the barriers to more widespread adoption. Policy makers need to take or strengthen their leadership roles. They need to develop clinical and information governance framework that enables telehealth instead of the current one which puts barriers up. They need to align incentives and develop a pricing model based on cost-effective end-to-end services to patients. They need to develop more effective funding models, business models that support deployment of telehealth. They should consider encouraging physicians to prescribe telehealth to those who would benefit the most. The industry needs to work with healthcare and social care providers to raise awareness, and develop a training and education curriculum on the technology. (Taylor, 2012)

Pryke notes that the system of funding for healthcare needs an entire overhaul. He quotes experts who document that a fully implemented and integrated telehealth system would save over \$700 billion over the next fifteen to twenty years, and move over fifty percent of healthcare services to the home. He also calls for fully integrated EHR system - a single system that everyone uses, and a switch for RandD funding from the current majority spent on drugs to be spent instead on telehealth RandD. (Pryke, 2010)

The PA eHealth Collaborative has made two recommendations to overcome barriers to EHR adoption. First, align state law to conform with HIPAA information exchange standards, (with which PA laws are not yet in alignment). Second create a new authority to assume the role of governing ehealth collaboration, transitioning to an independent, non-profit organization upon the end of the legislative term. ("Pennsylvania eHealth Collaborative," 2012)

Cusack, et al, identifies several actions that will remove the barriers. Policy-makers should overhaul the reimbursement models and create incentives to adopt telehealth rather than continue the current policies which disincentives telehealth adoption. Lawmakers must renew efforts to clarify who is liable in a telehealth encounter. Lawmakers must also remove the barrier of state-level medical licensing. Telehealth, to reach its full potential, needs to have national licensure of physicians and medical health practitioners. (Cusack, et al., 2008)

Cross-state licensing is a difficult challenge to overcome. Currently, most advocacy organizations are recommending one of two routes; either adoption of a common uniform licensure application which could be filled out once and be accepted by all states, or a credential verification organization who investigates the credentials of each professional and then reports that information to any state in which the professional wishes to practice. Some researchers have suggested that a better way around this issue would be for the federal government to declare that the location of the practitioner, rather than the location of the patient, determines under which jurisdiction the licensing falls. That would eliminate the

problem the same way that a patient traveling to a different state for treatment eliminates the problem. It would be possible for the federal government to legislate this change in licensure laws because the Supremacy Clause of the Constitution preempts state laws. However, there is a strong presumption against preempting state regulations in the area of health, safety, and licensing. (Wakefield, 2010)

Some believe that this is a case where preempting state regulations is imperative. Rep. Mike Thompson from California (one of the states that utilizes telehealth more than any other, and has already implemented this definition), introduced legislation called *The Telehealth Promotion Act of 2012 (H.R. 6719, 112th Congress)* that would establish a federal healthcare reimbursement policy, wherein "no [medical] benefit covered shall be excluded solely because it is furnished via a telecommunications system." This policy would change the definition of telehealth by defining it as a method of providing a healthcare service, not a medical service itself requiring special codes or billing procedures. This policy would also allow medical practitioners to provide services via email and telephone, and insurance companies would not be allowed to deny reimbursement, or limit the type of reimbursement available, simply because of the method of service provision. (McCann, 2013)

The legislation also addresses the often thorny issue of licensure at the federal level; if Rep. Thompson's bill were to pass, "providers in all federal health plans would only need to be licensed in the state of their physical location and would be free to treat eligible patients anywhere in the nation." States would not be able to prosecute healthcare providers for practicing across state lines because the definition of jurisdiction of licensure would have changed from the site where the patient is to the site where the healthcare provider is. (McCann, 2013)

These policies are similar to the recommendations made by Newman and McMahan. They identified several changes that should be made to current telehealth law in order to encourage, rather than restrict, more widespread adoption of the technologies. They recommend that the term "telemedicine" be replaced with "telehealth", which is a broader term allowing many more opportunities for healthcare. They advocate removing the restrictions on store and forward, email, and telephone. Additionally, they feel that any service covered under standard contract terms should be covered regardless of whether it is provided in person or via telehealth. Any requirements for "in person" visits should be eliminated, and all visits, whether virtual or not, should be covered. Private healthcare payers should also be required to cover all healthcare services provided, irrespective of the setting, (i.e. location of the provider, or location of the patient). They also recommend removing the requirement necessitating additional written informed consent waivers prior to services being rendered. They've noted that the telehealth industry is being artificially restricted because of the limitations of reimbursement. (Newman and McMahan, 2011)

Role of the State and Federal Government

Policymakers and government entities are highly keen on investigating telehealth as a solution that could fundamentally change healthcare delivery (Mattke, et al., 2010). They often see it as a solution for substituting for increasingly scarce professional labor (physicians and nurses) while reducing costs.

Benefits of Government Intervention in Telehealth

Overcoming challenges and improving healthcare in rural areas is especially important to the state because the lack of private healthcare insurance is a problem for public policy. Based upon the Pennsylvania's Insurance Department's Health Insurance survey of 2008, rural counties in Pennsylvania tend to have higher percentages of their population without health insurance than urban/suburban counties. The five counties with the largest percentage of uninsured residents are all rural. At 18 percent, Union county has the highest percentage of uninsured residents in the state. (*A Snapshot of Pennsylvania's Uninsured*, 2009)

When uninsured rural residents end up in hospitals in health-crisis mode, it is taxpayers who foot the bill. Because there is a higher percentage of uninsured residents in rural counties, it is important to understand how insurance practices and legislation interact with the impact that telehealth has on the quality and costs of healthcare in rural counties of Pennsylvania.

Another benefit of governmental intervention is to lower risk. There is a major risk in implementing electronic health records without first establishing mandated standards. Consider one example, even if a bit oversimplified for purposes of illustration. If Healthcare Provider A chooses a system where the patient address is on one line with a limit of 80 characters for the street, and Healthcare Provider B chooses a system where the patient address is on two lines with 60 characters each, the two systems now cannot exchange information with each other without elaborate translation protocols individually developed by programmers. Multiply this single issue by the 500 different fields of data that is stored for each patient, for each doctor visit, and for each diagnostic test. Multiply it again by the hundreds of different healthcare providers in the state. It becomes obvious very quickly that a lack of standards is a major problem. (Mantel, 2010; Rhoads, 1999, 2005, 2008; "The Direct Project Overview," 2013)

Lack of standards may not be a problem for everyone. Lack of standards may be advantageous to information technology programmers and system designers who are hired to implement all the translating and converting. Lack of standards may also be advantageous to healthcare providers and insurance companies because the difficulty of exchanging data may make it less likely the patient will switch healthcare providers or insurance companies. They also may see their own programs as a competitive advantage over others. These competitive factors may be why each insurance company and each healthcare provider tends to implement their own individual standards rather than follow any of the currently available standards and guidelines. (Menachemi, Powers, and Brooks, 2011)

But most researchers agree that lack of standards is a hardship to the patient and the government, as can be seen in the literature review. The added administrative costs of entering, storing converting and exchanging that data have to be added to the cost of treatment. (Wikler, et al., 2012) Mandated data standards at the most detailed level is why countries like Germany can get away with only spending six percent of their healthcare dollar on administration, while the United States government and patients spend between 25 and 40 percent of their healthcare dollar on administration. (M. Nelson, 2010; Roth, 2010)

Timing is critical. Mandating standards at the most detailed technical level (fieldnames and sizes, data schema, exchange protocols) lowers the cost of technology implementation for everyone if established at the right time. Standards mandated at the federal level can save billions of dollars, but only if the standards are established before the majority of systems are built. If the majority of systems get built first, and *then* the standards are established, converting to the newly published standards will cost billions of dollars more. (Rhoads, 2005; "The Direct Project Overview," 2013) Unfortunately, if EHR standards are developed the typical way standards are developed, i.e. garnered through consensus, it will take too long to achieve. In theory, the US Government could mandate standards that could be achieved in much less time, saving healthcare providers and insurance companies billions of dollars.

The role that government plays in providing infrastructure, the virtual roadways to the Internet known as broadband access, is also important. Telehealth costs are greatly impacted by infrastructure costs. Telehealth systems compared in previous research included the infrastructure costs (the cost of the point to point leased line or ISDN line from one site to another) because there was no publicly available Internet to use.

As the infrastructure becomes more widely available at lower costs, the implementation cost of telehealth is greatly diminished. Therefore, the decisions the state and local government make about broadband accessibility can strongly impact the feasibility of all telehealth projects. If the government provides the infrastructure of telehealth (just as they provide roads for cars and trucks to travel throughout the state), the feasibility equation changes quite drastically. (Rhoads, 2008)

Timing of this is also an issue. If the technological infrastructure in Pennsylvania were provided early enough, it would encourage entrepreneurship, job creation, technology innovation, and workforce development. If Pennsylvania companies need to include the expense of building their own infrastructure (i.e. leased lines, satellite connections), it would discourage entrepreneurship, job creation, technology innovation, and workforce development in the field of telehealth. It would make sense for them to become

established in a state where the infrastructure already exists. (Gallelli, et al., 2011; Mattke, et al., 2010; Singh, et al., 2010)

Patient Protection and Affordable Care Act

Healthcare reform has already been begun. There has been quite a bit of upheaval recently in the healthcare community due to the legislative changes. It started in 1996 with HIPAA which started on the long road to setting standards for healthcare organizations to use. More recently and most notably the Patient Protection and Affordable Care Act (PPACA, known colloquially as "Obamacare") was signed into law in March of 2010. Many of the mandates didn't take effect until this year, and many people were waiting to see if the judicial courts would overturn or weaken the law. In June of 2012, the Supreme Court ruled the law constitutional, weakening only the mandate that states accept the changes in Medicaid coverage. States can, if they so choose, forego the federal money for expanded Medicaid coverage and restrict Medicaid instead of expanding it. All the other mandates, which are extensive, were held as constitutional.

PPACA will greatly impact who pays for unreimbursed healthcare costs. The American Hospital Association estimates U.S. hospitals were left with \$39.3 billion in unpaid bills in 2010 because they are required to treat people regardless of ability to pay (Cox, 2011). Some states will be adding currently uninsured people to the public roles of Medicaid. Doing so will be expensive, though PPACA will more than fully cover the costs by Federal subsidies for at least the first three years. Pennsylvania has not committed to expand Medical Assistance at this time (LoBasso, 2012).

Having preventative medical care available may lower the cost of healthcare overall. Previously uninsured people may have avoided preventative actions and behaviors because they could not afford it. Delaying treatment increased the cost to the taxpayer. The theory is that if the government paid for preventative treatment, the cost of treatment would ultimately go down, costing the Pennsylvania taxpayer less money in the end.

Pennsylvania Health Information Exchange

Additionally, there has been a large investment in a Pennsylvania Health Information Exchange, a centralized health information technology system where healthcare providers and patients can gather and share healthcare information electronically through Electronic Health Records (EHR) ("Pennsylvania eHealth Collaborative," 2012). The Pennsylvania Health Information Exchange impacts Telehealth on several levels. The most basic level is that it sets up the guidelines for the first phase of EHR, which is to enable providers to share information more easily. That will decrease the costs to all health providers by decreasing the uncertainty in the requirements for information exchange.

GOALS AND OBJECTIVES

The three main goals of this research were to: 1) provide an overview of telehealth including an economic assessment of its impact, 2) describe telehealth implementations in rural counties, and 3) identify obstacles preventing wider implementations.

The first issue regarding the overview was the definition (or more accurately, definitions) of telehealth. Part of the overview was also to catalog and classify telehealth initiatives across PA's hospitals and doctor's offices in rural counties. Additionally, this first goal included identifying funding sources, both facility costs and patient costs, for telehealth in rural counties. Finally, this goal included determining how much of the Pennsylvania healthcare budget was going to telehealth products and services, and, given current information, what would the economic impact of wider-spread adoption of telehealth in rural counties be on the Pennsylvania healthcare budget.

The second goal was to describe and evaluate the implementation of telehealth initiatives across rural Pennsylvania counties. This goal included determining the success level of the telehealth initiatives across Pennsylvania hospitals and doctors' offices in rural counties (based upon the opinion of the doctors,

nurses, and office staff). This second goal also included determining best practices of telehealth, and estimating the amount of insurance coverage for telehealth use.

The third goal was to identify any obstacles preventing more widespread use of telehealth. Most specifically, this third goal included determining if any of the following issues would prevent rural Pennsylvania from properly using telehealth technologies:

- technological infrastructure;
- legal developments;
- education and training;
- project planning and implementation;
- technology adoption resistance; and
- insurance reimbursement practices.

These goals and their underlying objectives were designed to provide the essential information necessary to determine how telehealth could be used to equalize the differential in healthcare availability between rural and urban areas. Through these goals, this report identifies how telehealth might offer the benefits of greater health care access, cost efficiencies and improved patient outcomes while decreasing the risks associated with new technologies and policies. This research also identifies barriers that might be preventing further use of telehealth as well as developing opportunities for greater use in such a way that would improve healthcare quality while lowering costs. Finally, this research provides an estimate given available information, on the impact on the Pennsylvania healthcare budget if there were more widespread use of telehealth in rural counties.

METHODOLOGY

The project started in March 2012 and was completed in May 2013. The steps were separated into phases, though some aspects of the different phases overlapped:

- Introductory Phase
 1. Define the term telehealth
 2. Identify the scope of coverage of telehealth within the study.
 3. Determine the definition for rural.
 4. Carry out a review of the literature.
 5. Identify themes within the literature.
 6. Compile the resources available.
 7. Conduct preliminary interviews.
 8. Identify interview themes.
- Survey Phase
 9. Develop drafts of the surveys.
 10. Revise drafts of the surveys based upon the themes.
 11. Launch the surveys.
 12. Conduct more in-depth interviews as time allowed.
 13. Update the review of the literature.
- Analysis and Reporting Phase
 14. Develop first draft of the healthcare cost estimates of telehealth.
 15. Aggregate and analyze the survey data.
 16. Utilizing the themes identified earlier, code the interviews.
 17. Revise healthcare cost estimate of telehealth
 18. Revised and finalize the report.

Impact of Legislation and New Agency

As already noted, PPACA was determined to be constitutional halfway through the timeframe of this study. It should also be noted that partway through the research Pennsylvania (with funding from the American Recovery and Reinvestment Act (ARRA) formed the Pennsylvania eHealth Collaborative, under the Pennsylvania eHealth Information Technology Act of Jul. 5, 2012, (P.L. 1042, No. 121) creating a new Commonwealth agency, the Pennsylvania eHealth Partnership Authority. Both impacted the research, and became a major source of information about some aspects of telehealth.

Refining the Definition of Telehealth

In the Introduction (both of this paper and in the surveys), telehealth was defined as the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration, which comes from the federal Office of Advancement of Telehealth (OATS), which is an office of the Health Resources and Services Administration (HRSA), part of U.S. Department of Health and Human Services.

The definition from OATS did not provide the specifics needed for a research study of this type, however, and there were many different definitions of telehealth in common use across PA's rural counties. The research team could not pre-determine which definition might be familiar to those completing the surveys. Some definitions included provider education, remote diagnosis, patient monitoring, and web consultations. Some definitions included store and forward technologies. Some included electronic health records. Some did not include any of those services.

The research team started out with the following descriptions to define telehealth:

Live Videoconferencing - the practice of medicine utilizing videoconference technologies (not just audio). The use of the technology must be "live" to qualify as telehealth. For example, if a teaching physician records a video consultation with a patient for provider education purposes and posts the video clip online for discussion by students that would not be considered telehealth. However, if the teaching physician conducts a live consultation with a patient while medical or nursing students watch via a videoconference, that would be considered telehealth.

Remote Monitoring Equipment - the use of equipment that is monitored "live" and transmitted through electronic means over large distances. In other words, if a facility monitors a patient remotely and connects via video feed to doctors or nurses in another region to discuss progress, that would be considered telehealth. However, if the patient is monitored electronically, and the results of that monitoring are sent to a physician through email, who then leaves instructions or only talks with the patient on the phone, that would not qualify as telehealth (for purposes of this project).

The initial rationale for the strict definition was to ensure that telehealth would not be used as a catch-all phrase for anything anyone wants to include (such as a simple bridge telephone call between patients, primary care physicians and specialists), but rather focuses exclusively on the newer, just-available technologies, such as videoconferencing and live remote monitoring. The research team also identified the uses for telehealth to be categorized as one of five types: provider education, patient education, remote diagnosis, consultation, or monitoring/follow-up care.

During the initial interviews and survey draft revisions, however, it became quickly apparent that the definition of telehealth could not be limited to just live videoconferencing and remote monitoring equipment. The problem was the plethora of definitions already known by so many people in the field of telehealth. It was confusing to the survey takers to change the telehealth definition from their already-familiar definition. It was easier to expand the definition rather than replace it with a more restrictive definition. As a result, the research team changed focus and included the others - mostly so that they could be controlled within the analysis.

Therefore, within the survey, the types of telehealth were listed as:

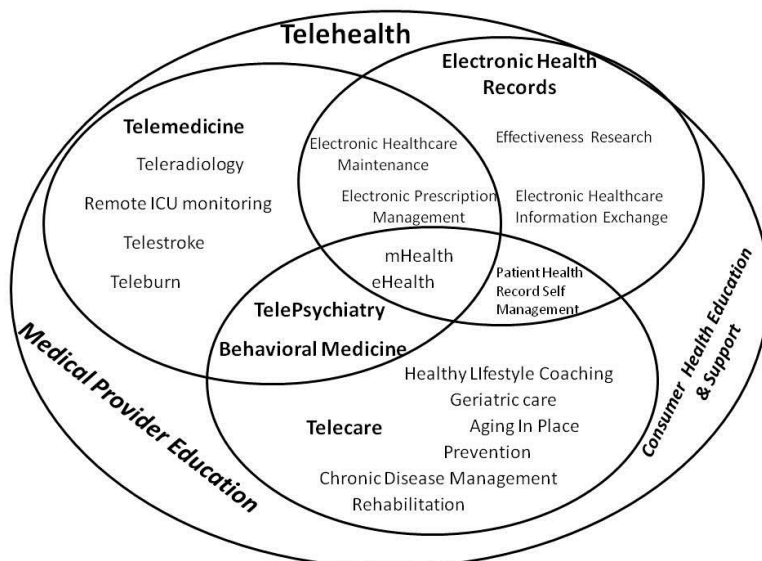
- Live Real-time Videoconferencing (either clinical or educational);
- Live Real-time Remote monitoring;
- Store and Forward Videorecording (either clinical or educational);
- Store and Forward Diagnostic scans (Radiology, etc.);
- Store and Forward Remote monitoring;
- Electronic Health Record;
- Diagnostic Decision Support Systems; and
- Web-based discussion boards.

Telehealth is an umbrella term "including telemedicine (which also may include telestroke, teleburn, teleradiology, etc.), telepsychiatry, telecare, mHealth, and eHealth (for mobile healthcare and electronic healthcare) as well as on-line electronic health records and medical education. All of these terms would involve one or more of the types of telehealth on the list.

Telemedicine generally refers to diagnostic and consultative activities of physicians and technicians (such as radiologists) using technology, including both videoconferencing and store-and-forward images. Telemedicine also often includes more specific telehealth treatments: *Telestroke* diagnoses the type of stroke a person may have had; *Teleburn* diagnoses of the level of burn; and *Teleradiology* helps denote diagnostic review of images such as CT scans, x-rays, and MRIs.

Telecare is generally used when referring to remote monitoring of the type that will help with prevention and diagnosis of people within their homes (most often applied to older populations who remain in their own homes instead of going into a nursing home). *Telepsychiatry* is the term used when telehealth is used by psychiatrists and psychologists to provide diagnosis and therapeutic interventions with patients. The newer term *mHealth* usually denotes providing healthcare information over a smart phone or tablet computer, while *eHealth* is used most often when referring to electronic health records. Some don't consider *electronic health records* (EHR) as part of telehealth. Some also exclude medical education either for patients or practitioners. Medicare, for example, often doesn't include remote diagnostic services as telehealth, whereas Medicaid often does. A graphic representation of the relationship between the different terms is shown in Figure 11. Note that the technologies used by these areas (remote monitoring, videoconferencing, store and forward images, etc.) are shared among all of them.

Figure 11. Illustration depicting Telehealth Definition



In any case, the research team took extra pains to make very clear at each turn which services were included in the definition at any one time. Additionally, the definition of telehealth was identified as an issue regarding telehealth because the differences in definition often determine the legality or reimbursement of telehealth.

Definition of Rural County

The definition of rural county was determined to be any county where the number of persons per square mile is less than 284, the average for all counties in Pennsylvania, which is the definition of the Center for Rural Pennsylvania.

Search of the Literature Methodology

There were several phases to the search of the literature. The phases were interspersed throughout the study, taking place during the interviews, survey development and healthcare cost model development. The search of the literature was initially done informally. For the subsequent reviews, however, a more formal approach was taken so that critical documents were not missed. The initial phase informed the survey development, interview list, and data preparation. The second phase updated the initial information and provided additional insights for the analysis and report.

Initial Literature Search on Telehealth

The first phase included a review of the academic literature and the many government reports and programs on the use of technology in improving healthcare. Investigators utilized Academic Search Complete (EBSCOhost), Research Library (PROQuest), and ScienceDirect (Elsevier), three of the most commonly used academic literature search tools. Search terms included telehealth, telemedicine, rural, home healthcare, health videoconferencing. Different combinations yielded different results, but when a likely-looking title was identified, it was placed into the list for further review.

The literature was discussed by the team and broken out into 5 different sub-domains; *background topics, broadband rules, broadband availability gap, recent books published, issues/discussion points*. Under the background topics, were sub-sub topics; *components of telehealth, progression of the law, terminology, five components of Medicare/Medicaid reimbursement, legal/policy frameworks, soft skill concerns, model legislation, malpractice, healthcare broadband, FCC performance management, and caregivers role*. Additionally, information was gathered on well-documented projects and model legislation.

As the team documented the identified topics, items which might be issues and discussion points were noted. Categories of potential items included: *continuity and security issues, implementation issues and sources of advice*. Sub-issues were identified under those categories, including: *potential liabilities, security and ownership of data, potential problems regarding interrupted power or availability of data connectivity, and differences between how private insurance companies deal with telehealth and government funded healthcare deal with telehealth*.

The literature review was also used to identify interviewees for more detailed targeted questions. The research team also reviewed surveys and reports published by health insurance trade organizations, as well as magazines and websites targeted to healthcare technology decision makers. The focus was on articles on telehealth and meeting the needs of rural areas.

Subsequent Search on Healthcare Costs

After the initial search of the literature and months of interviews, research team members were still unsure of what type of healthcare cost data was necessary to make direct estimates of the impact of telehealth. Because of the impact of changes in the healthcare system, the number of academic articles on the topic has been growing in recent years. Therefore, a second search of the literature focused on just healthcare costs estimates was performed. The following databases were searched for articles in academic journals:

- Academic Search Complete
- Alt HealthWatch

- Business Source Premier
- EconLit
- Health Source: Nursing/Academic Edition
- MEDLINE

Subsequent to this search of the academic literature, the election and ruling regarding the constitutionality of PPACA occurred. Seeking relevant current data, another search was done for information related to cost impacts. Because it may take years for scholarly papers to appear in journals, the research team decided to add a focus on industry organizations reports, government publications, and popular press articles to obtain more up-to-date information.

After the interviews and the analysis of the interviews, the literature search was revisited to evaluate the themes identified by the interview analysis.

Interview Phases and Methods

The interviews also were done in stages. Initial interviews were conducted with various telehealth vendors and government agency contacts to get a preliminary idea of what issues might be uncovered. The team often shared early drafts with interviewees to get input on the survey design. Additional resources were also identified, including websites, organizations, companies, and people who had been involved in telehealth projects.

In 2002 the Telehealth Network Grant Program (TNGP) took over three other existing programs: 1) the Rural Telemedicine Grant Program (RTGP), 2) the Congressionally Mandated Projects involving telehealth, and 3) special projects from the Health Resources and Service Administration (HRSA). TNGP managed over \$34 million, which funded 92 projects, part of a pool of the remaining 159 telehealth projects. Twenty three of those projects were in Pennsylvania. The grantees from the previously awarded Telehealth Grants were contacted for interviews. For the original 23 projects, the research team found contact information for 26 people, and were able to reach 16 of them. In general, the grant awardees were asked whether the grant projects were still going, how they impacted any programs going on today, and whether they considered them successful.

In the next stage of interviews, the team used the information from the interviews to provide material in constructing proper questions for the survey in the next phase. Questions regarding the list of potential obstacles in the survey, (as well as the procedures and practices) were asked to identify whether or not *best practices* were being used. (Best practices are those processes and procedures associated with successful implementations.) Interview questions included queries about any telehealth they knew about, the acceptability of certain questions being considered for the survey, the optimum wording of questions, and methods to increase response rate for the surveys.

In the third stage of interviews, the surveys had already been launched, and the focus moved to identifying more telehealth projects and getting a deeper level of understanding of the issues than the surveys were likely to provide. Investigators spoke with knowledgeable people about selected projects from the list being compiled to gather more detailed information. Interviewees were generally identified through articles and websites, or through previous interviewed people who often provided contact information for other experts with whom to speak. In all, the research team identified 251 people knowledgeable in telehealth and/or healthcare by reviewing their titles and the organization to which they belonged, or based upon the information provided by the referrer. The team searched out contact information on the 251 people either from the people who referred them, websites which identified them, or simply looking them up in the phone book. The principle investigator conducted 94 interviews (including the 16 telehealth grantees), out of the original 251 identified. The majority of interviews (71 percent) were done by telephone, and 29 percent were conducted in-person. Notes were taken of the interviews, tagged with a number and the date, and placed in a file folder for coding later.

Additionally, all of the hospitals located in rural counties were contacted by a member of the team to determine if they were involved in telehealth. Seventy-five hospitals (out of the 258 for which contact information was available) were in rural counties. The research team member called and asked to speak

with a specific contact for that hospital (if the telehealth person's name was known from previous lists), or asked for "the person involved in telehealth" clarifying the definition of telehealth if asked. Twenty-five hospitals did not return calls from the team member. The research team member was able to reach someone in 50 (66 percent) of the hospitals, often the main receptionist (or sometimes several levels of receptionists and department personnel). The team member was able to have an additional follow-up conversation with someone identified as "being involved in telehealth" (generally a director of patient care, information technology, or someone in the CEOs office) in 18 of the hospitals, five of which resulted in sharing only that they were not allowed to discuss any of their projects. The remaining 13 shared whatever information they could about whatever telehealth initiatives they knew about. Sixty-two telehealth initiatives were identified from the 13 rural hospitals.

All interviews in all phases were free form, starting out with questions about the role the interviewee played in the world of telehealth and investigating relevant topics related to the goals of the study. Interviewees who seemed to go above and beyond, (sharing data, contacts, and expertise) were sent a nominal gift (a book on managing information technology) to thank them for their help and support.

Survey Methods

There were two surveys used in the study. The first was a widely distributed survey of anyone in the population of medical and information technology professionals or who worked in a hospital. Organizations involved in telehealth and medical trade organizations were contacted and asked to distribute the survey to anyone who might be involved in telehealth. This method resulted in more information obtained about telehealth. The survey could be distributed through email or through a website. Because the distribution method was not controlled, the survey could not be used to estimate the *amount* of telehealth because the sample would be biased in favor of clinicians already familiar with telehealth. The wide distribution also made it difficult to restrict it to just Pennsylvania.

The purpose of the second survey was to estimate the amount of telehealth in Pennsylvania. To eliminate bias and stay within budget, the second survey focused just on physicians, with a tightly controlled random sample. This survey did not include detailed specific questions on telehealth, and was a shorter 18 question survey. This survey was sent out in paper format, although the cover letter also invited the physician to complete the survey on-line.

Role Based Widely Distributed Survey

The role based openly distributed survey was sent out to medical societies, healthcare advocacy groups, list serves, etc. starting in August. The longer survey had many more detailed questions, but only asks relevant questions based upon the role of the person answering the survey, so it could be thought of as five different surveys in one link. The PDF was frequently distributed through email, however. Nonetheless, only four of the role based surveys were returned in paper format; the majority of respondents filled out the survey online.

Physicians Random Sample Survey

Physicians Random Sample Survey was launched in September. A list of physicians' addresses and phone numbers was purchased from a medical personnel broker. The specialties included in the list were:

- (EM) Emergency Medicine;
- (FP) Family Practice;
- (GP) General Practice;
- (GPM) General Preventive Medicine;
- (ID) Infectious Diseases;
- (IM) Internal Medicine;
- (P) Psychiatry;
- (PM) Physical Medicine and Rehab;
- (PTH) Pathology - Anatomic/clinical; and
- (R) Radiology.

This resulted in a complete list of 9,247 records. Each record on the list was assigned a random number using Excel's Random function (and then copied and pasted as value so that the random number would not change each time the spreadsheet recalculated formulas.) The records were put into sequential order based on the random number and every group of three hundred were assigned a different "selection batch number." The batches determined when the survey (along with a self-addressed, postage-paid business reply envelop) would be mailed to the physicians on that list; every week three hundred more were sent. Each survey contained a unique control code so that it could be traced back to the original record in the randomly controlled sample for tracking purposes.

The reason for the batches was so that the phone follow up calls could be conducted in timely conjunction with the surveys being sent. A student was added to the team to call the physicians, ask them if they received the survey and if they planned to fill it out. The student could also ask the physician the survey questions on the spot and fill out the answers on-line, or fax the survey over to the physician again. Furthermore, more batches or fewer batches could be sent depending upon the response rate. All these options made it very convenient for the physicians to respond, and allowed the research team to flexibly control the sampling process.

The research team wanted to avoid any technology bias in the survey results. According to some researchers, web-only surveys introduce a bias towards technology (Kaplowitz, Hadlock, and Levine, 2004). To decrease the possible impact of any technology bias, the research team chose to send the surveys in the mail, though a web page was listed in the cover letter that would allow the physicians to take the survey online should they so choose. Additionally, some physicians provided their email address by phone, so these physicians were emailed a link to the survey. Almost 75 percent of the surveys were returned in the postal mail. Because this survey is based upon a statistically valid controlled random sample, the amount of telehealth use in Pennsylvania was able to be estimated from these results.

The primary investigator decided that the surveys would continue to be sent and follow up calls would continue to be made until at least two of the following conditions were met; 1) the entire list was exhausted, 2) the time limit was reached (i.e. the report was due), or 3) the number of surveys necessary for a valid sample for the 9,247 physicians at a 95 percent confidence level with a 10 percent confidence interval was received³. In the second week of November, the number of surveys entered reached the valid sample size criteria and the third condition was met, but the team continued on until the time limit was reached. In the end, 3,000 physicians were mailed the survey and follow up calls were made to 2,515 physicians.

Increasing Response Rate Activities

The team did several things designed to increase response rate as much as possible for both the role-based survey and the controlled sample physician survey.

For the role-based survey, 369 people from 215 organizations were contacted through email with the request to distribute the survey to their members or constituents. The survey was given to them in both paper and electronic link format, and they were able to return it in the mail, fax it back, or answer the questions on-line. Seven said they would, and five returned to the researchers with the actual newsletter or email used to disperse the survey. Responses were received for 190 surveys.

For the controlled sample survey, the investigators maintained a several-phase process. 1) The survey was sent in the mail with a self-addressed business reply envelope so that the physician didn't have to pay postage. They could just fill out the survey and return it in the mail. 2) A few days within their receiving the paper survey, a member of the research team called the physician directly, asked if they had received the survey, and offered to allow the physician to answer the questions immediately over the phone or be sent a link to answer the questions on-line. After the first week, researchers added another option; fax.

³ According to the <http://bphc.hrsa.gov/policiesregulations/performanceasures/patientsurvey/calculating.html> website sample size calculator, a valid sample for the 9247 physicians at a 95% confidence level with a 10% confidence interval was 96 surveys. We actually received 323 surveys, which for the 9247 physicians at a 95% confidence level gives us a 5.4% confidence interval.

The team member would send the physician the survey through the fax line, and/or the physician could fax-back the filled in survey. 3) In the beginning, the team member would also re-contact the physicians a few days later to be reminded if they hadn't yet filled out the survey on-line, or faxed it back, or sent it back in the mail. (Toward the end time ran out and physicians were only contacted the first time). A week by week count of the waves of surveys sent and follow-up calls made is shown in Figure 12.

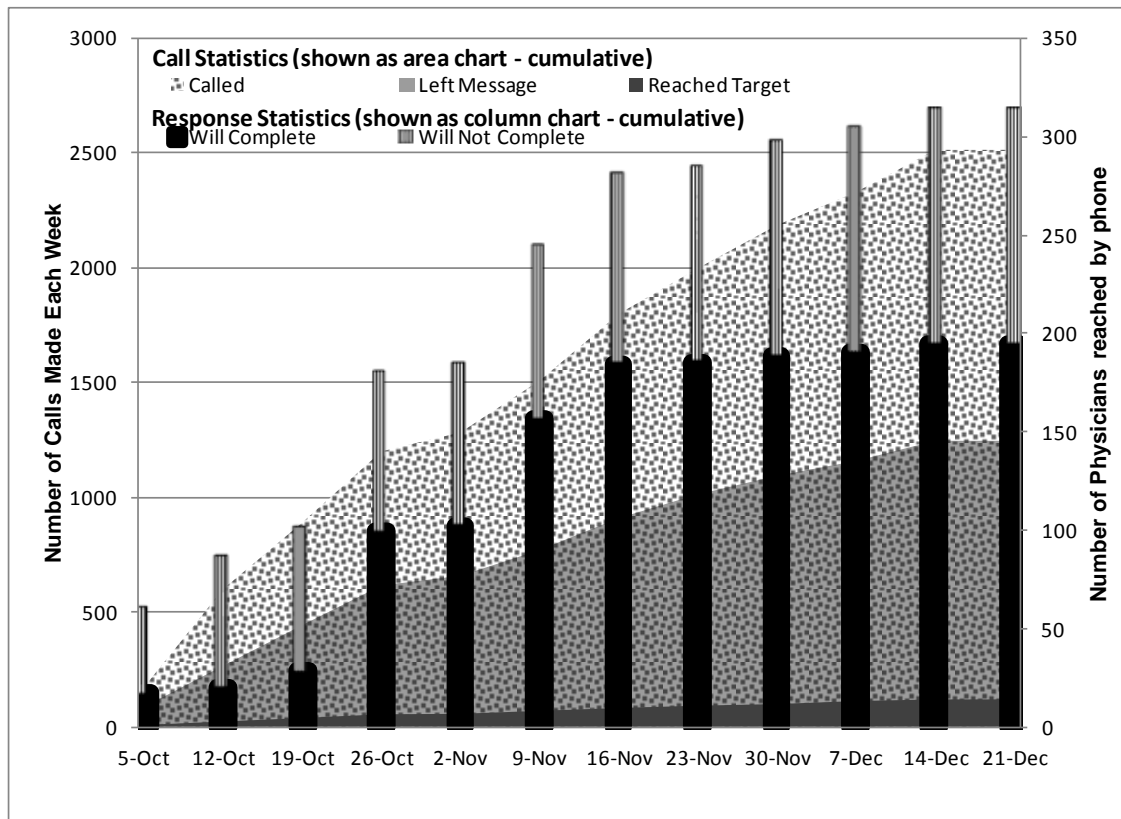
Figure 12. Physician Call List Statistic Table

	Oct 5	Oct 12	Oct 19	Oct 26	Nov 2	Nov 9	Nov16	Nov 23	Nov 30	Dec 7	Dec 14	Dec 21
Called	172	600	890	1,200	1,283	1,509	1,800	1,999	2,187	2,331	2,515	2,515
Reached Target	7	22	37	53	55	68	80	90	97	110	117	117
Left Message	86	266	444	617	660	772	912	1,016	1,097	1,162	1,250	1,250
Will Complete	17	20	28	99	102	156	184	185	188	190	194	194
Will Not Complete	44	67	73	81	82	88	96	99	109	114	119	119
Verbal Surveys	1	2	2	4	5	6	6	6	6	6	6	6
Sent email	7	20	24	29	30	33	38	38	41	42	44	44
# Surveys Online	2	7	9	13	18	34	42	55	58	62	71	117
# Surveys Postal	0	0	0	59	59	59	86	86	86	86	86	206
Total Completed Surveys	2	7	9	72	77	93	128	141	144	148	157	323
Response Rate/Will Complete	12%	24%	28%	55%	63%	62%	64%	67%	69%	70%	72%	84%
Response Rate/Called	1.2%	1.2%	1.1%	3.1%	4.0%	4.6%	5.2%	5.6%	5.8%	5.9%	5.9%	6.8%
Response Rate/Mailed	0.7%	1.0%	1.0%	3.0%	3.7%	4.1%	4.6%	4.9%	5.0%	5.0%	5.0%	5.8%
Business Reply Envelopes Received	0	0	0	64	67	70	73	76	79	82	157	277
Number Surveys Mailed	300	600	900	1,200	1,500	1,800	2,100	2,400	2,700	3,000	3,000	3,000

* All numbers are running totals (i.e. cumulative counts, not weekly counts)

It may be easier to visualize this information in a chart, as shown in Figure 13, which shows how many physicians were called, how many messages were left, and how many physicians were reached each week (shown as a cumulative number using the value axis on the left). The columns in front of the area on the chart indicate how many physicians (who were reached) said they would send in the survey, and how many said they would not send in the survey (a cumulative number, using the value axis on the right).

Figure 13. Physician Call Statistics Chart- Calls Made and Physician Reached



After the survey was closed, and the information released, the respondents who provided address information were to have been sent follow up information about where they can view the survey results.

Cost Impact Methodology

To assess the financial impact of telehealth on future healthcare costs, the team used a combination of sources comprised of the interview analysis, the literature review, and the survey data. The decision making process to determine which assumptions to be used is explained here.

Interview Analysis Methods

After the first round of interviews and the initial search of the literature were completed, before the surveys were developed, the team reviewed the interview notes and literature looking for repetitive statements which might indicate issues. Each team member compiled an independent list of issues, and then the team worked together to identify an agreed upon list (described in the *Initial Literature Search on Telehealth* section).

After the second round of interviews and the subsequent search of the literature, the team re-reviewed the list of issues, in light of the additional information garnered from the interviews and literature especially that focused specifically on telehealth cost estimates. The result was a different list, a list of themes that impacted the estimates of the growth and cost impact of telehealth.

Assessing the Influence Levels

During the discussions, the issue of the non-random method of choosing interviewees was raised. It became apparent to the team that each interviewee should not be equally influential in the theme analysis. The thought process was that the statements of vendors, who were rightfully seeking opportunities to expand telehealth growth, should not be given the same weight as those who had a more patient-satisfaction orientation, such as the doctors and nurses who provided telehealth services to patients.

Additionally, some of the interviewees had many years of experience in the field of telehealth, while others were relatively new to the field. Furthermore, those in administrative positions, who were not directly experiencing any telehealth implementations should not have the same influence as those who were in the field, dealing with telehealth issues every day. After several different methods of systematizing and illustrating this perspective were reviewed, the final method was chosen. Each interviewee would be assessed on each of the issues (amount of bias, patient perspective, and amount of experience) on a Likert scale.

The team took this additional step, assessing on a scale of 1 to 5 for each of these attributes for each interviewee. For each attribute, a lower number indicated less of the attribute, and a higher number indicated more of the attribute. For example, a vendor would typically be assigned a lower unbiased ranking than a healthcare provider or researcher, as well as a lower patient perspective, but would typically be assigned a higher experience level than a non-telehealth government agency. Figure 14 shows the table describing the assessment levels.

Figure 14. Table explaining the influence factor.

Attribute Ranked	1- Low Assessment Indication	5 - High Assessment Indication
Likelihood for unbiased opinion	Likely biased.	Likely unbiased.
Patient perspective	Focus on other than patient.	Highly focused on patient.
Telehealth experience level	Relatively new to telehealth.	More than a decade of experience in telehealth.
Average influence	Less influence.	More influence.

Additionally, each interviewee was assigned one of the categories of constituents involved in the healthcare process: community (which included patients and advocacy organizations as well as employers and private insurance companies), providers (which included physicians, healthcare networks or trade organizations working on their behalf), government (including both state and federal levels), and vendors of telehealth equipment, supplies, or services. The frequency and influence of each constituency was graphically illustrated (in the results section, on page 81). The constituencies were considered when identifying which of the original 53 statements were most salient to the objective of estimating the impact of telehealth on the cost of future healthcare.

The final theme list went through several rounds of refinement as the team worked on what would be most meaningful and which items impacted the healthcare cost estimate of telehealth the most. Several issues became obvious relatively quickly that influenced the team's decision on the themes. The issues were the 1) variety of telehealth aspects, 2) the use for the telehealth, 3) the changing costs of telehealth, 4) the volume of telehealth, and 5) the underlying issues of the healthcare system.

The list of 53 phrases or statements originally used to code the interviews was consolidated down to 11 major themes - just the themes that were directly influential in telehealth, mentioned most often in the interviews by the people with the highest level of influence. The team felt that these items were the most salient. Subsequently, the healthcare model underwent a final revision after the formal coding based upon the most salient themes.

Gathering People and Cost Estimates

The research team used information found in the literature review as well as a new source of data on hospitals in Pennsylvania (EpiQMS - Epidemiologic Query and Mapping System, a new statistical service available on the <http://www.portal.state.pa.us> website) to assess the cost impact of telehealth. Information from the Governor's office, from various advocacy organizations, and other websites were also used.

Addressing the Underlying Assumptions

There were several difficulties regarding the impact of telehealth on future healthcare costs.

First, telehealth has many different aspects and the cost impact is very different for the different aspects. Additionally, the cost structure of telehealth has changed drastically in the last few years as new devices have become available at a lower price, and infrastructure has become more available at lower cost. None of the cost estimates of the past would be useful for an estimate for the future. Furthermore, the cost of telehealth itself is highly dependent upon volume; how common telehealth is. The largest cost of telehealth is infrastructure, and infrastructure is normally a shared expense. If a single use of telehealth must bear the entire cost of infrastructure to implement it, the cost would be too large and the value would never break even. But if the infrastructure cost was shared among a million implementations, the cost of infrastructure is nominal. The team was faced with a question: Which assumptions about the costs of telehealth should be included in the cost estimate?

Even more glaring, however, is the second issue; telehealth is just a means to an end; telehealth by itself cannot impact healthcare costs without considering what is done with it. The research team compiled a litany of research and cases from the literature and the interviews. The results run the gamut. Some improved healthcare quality but cost more than "traditional" healthcare. Some indicated the same healthcare quality but cost less. Some decreased healthcare quality and cost more. The results depended upon the amount of training provided, the level of knowledge of the people utilizing the telehealth, how well the telehealth was integrated into the processes and procedures of the institution, and use of telehealth for chronic issues and prevention rather than acute treatment; none of which could be traced to the type of telehealth, but only to the use of telehealth. The team was faced with another question: Which uses of telehealth should be assumed?

The next issue, however, appeared to be the most daunting. Often, telehealth was identified as a way to "fix" many of the problems identified by the interviewers and the literature in healthcare. As described in the *Healthcare Challenges in the United States* section starting on page 11, there are many sectors who point to a "crisis" in healthcare, though what they mean by that often is based upon their point of view. The crisis could be any of the following:

- the rising cost of healthcare;
- the growing complexity of the multilayer healthcare payer system;
- the aging of the baby boomers;
- the focus on treatment rather than prevention;
- the growing cost of managing chronic illnesses (especially lifestyle based, i.e. diabetes and obesity);
- the shortage of physicians (either primary care practitioners or specialists); and
- the inaccessibility of healthcare (especially among the rural counties).

Each of these issues is discussed in the search of the literature section, and each of these issues were identified by a subsection of those interviewed as a problem that could be mitigated through telehealth. If some or all of the problems with healthcare were mitigated through telehealth, then telehealth would have a major impact on the overall cost of healthcare. This raised another dilemma for the team: Should the potential solutions that telehealth might provide to these problems be taken into account when assessing the cost impact of telehealth on healthcare?

Finally, all of these issues were impacted by the obstacles to more widespread use of telehealth. Since the literature, the interviews, and the surveys all agreed that the major impediments to telehealth are definitions, licensure, and reimbursement, it would be difficult to assess the costs without knowing if these obstacles were to be removed. The final issue wrestled by the team: Should it be assumed that the obstacles to more widespread use of telehealth were removed?

The research team had to step back and rethink the themes and assumptions for estimating the health impact of telehealth. Over the course of more than six months, the team underwent an incremental iterative (and often contentious) process of looking at various methods based on the themes to estimate the health impact of telehealth.

Gathering Cost Impact Information

The research team used information on the number of people who used healthcare (employer-based insurance, self-paid insurance, Medicare, Medical Assistance, out of pocket, etc.) from a variety of sources. The team used information on the number of people diagnosed with certain chronic illnesses (diabetes, cardiovascular disease, etc.) and the typical costs associated with those illnesses as well as the relationship between those illnesses and the age of the population. The team also searched out other attempts to estimate the future costs of healthcare related specifically to telehealth and then, (as explained in the next section) estimates of other impacts to healthcare. As the team found telehealth vendors or other resources, it added them to the list of resources and vendors.

Assumptions For Analysis of Cost Impact

The team has asked four questions relating to choosing which assumptions would be used for the cost impact analysis:

- Which assumptions about the costs of telehealth should be included in the cost estimate?
- Which uses of telehealth should be assumed?
- Should the potential solutions that telehealth might provide to these problems be taken into account when assessing the cost impact of telehealth on healthcare?
- Should the assumption be made that the obstacles to more widespread use of telehealth have been removed?

In answering these questions, the team wanted to keep certain characteristics of a solution in mind. During the discussions, the team looked for a solution that would:

- Overcome the difficulty in assessing the change of any single aspect of healthcare (including those identified by the theme analysis.)
- Incorporate the total cost of healthcare - not just the individual components.
- Avoid reapportionment of costs. Decreasing cost for one constituency could not be offset by increase in costs from another constituency.
- Recognize the current payment structure limitations, but not be limited to current restrictions.
- Recognize the impact of societal norms and human behavior, including the possibility of changes to the current trends.
- Pay attention to long term impacts as well as short term impacts.
- Evaluate based on same-or-higher-than-current quality of healthcare.
- Evaluate higher quality from the patient's point of view, not the medical community's point of view.
- Incorporate access to and use of available healthcare as a component, not just existence of services.

Trying to assess any single component of costs, especially during the difficult investment-and-building phase of telehealth development, might obscure the long term value of telehealth. To use an analogy, from 1947 to 1968 when the FCC limited access to the cellular network to 23 lines per area, a cost benefit analysis of the wireless telephone would have been negative. But in 1968 the FCC reconsidered its position based upon a proposal from ATandT. ATandT had to envision a world where cell phones could be used just about anywhere due to the already-built infrastructure of cell phone towers across the landscape. ATandT convinced the FCC that once established, mobile phone technology would have value to society. The FCC restriction, which was the major cause for the negative cost benefit analysis, was lifted. Cellular technology grew, and its ubiquity demonstrates the positive cost benefit analysis found today. (Bellis)

Furthermore, it would also not make any sense to do a cost analysis for rural versus urban. A cost analysis also could not be limited to just Pennsylvania, since an integrated working telehealth network requires the cooperation of a larger geographic area and a larger population than any single state. To use an analogy, the Internet would not have much value, and would not have revolutionized the world, if it had been limited to a single state.

A New Approach: Macro-analysis

In general, the team started by trying to apply the cost estimating methods used in the research found in the literature. As each method was tried it was determined to be insufficient to meaningfully estimate the cost impact, it became obvious none of them would suffice.

What was needed was a new approach.

A macro approach to the healthcare cost analysis was tried. The impact on the state would be delineated after the impact of the whole was estimated. At that point, based upon population or proportionate costs, the impact to Pennsylvania could be determined. Therefore, the team answered the questions about the assumptions posed earlier in the following way.

- The costs of telehealth would not be included in the cost estimate at all. Instead, the cost estimate would show only the impact after telehealth was already ubiquitous.
- The different uses of telehealth should be broken out so that the impact of different types of uses could be assessed.
- The different potential solutions that telehealth might provide to documented healthcare problems should be broken out so that the impact could be assessed.
- The assumption should be made that the obstacles to more widespread use of telehealth were removed.

Using the theme based information and the information found in the literature, the team envisioned a world where there were no restrictions, and all obstacles to telehealth were gone. The definitional limitations of telehealth imposed by Medicare, Medicaid, and insurance companies that restrict reimbursements are a major cause of the current high cost of telehealth which results in a negative return on investment. Those restrictions would have to be lifted so that the cost benefit analysis for telehealth could become positive.

The current rules were put in place when telehealth required point-to-point leased lines for implementation, and under that technology the current restrictions made sense. Within the last 5 years, however, the technology has changed drastically. Only by updating the regulations to match current capabilities is it possible to calculate the impact of telehealth on healthcare.

A new set of questions presented themselves to the team:

- What would be the impact on healthcare of a completely connected working telehealth system that encompasses all of the components integrated together?
- What would be the true value of a working telehealth network, including all the resources that would be available on it?
- How would an integrated working telehealth network impact costs of healthcare?
- How would an integrated working telehealth network impact the behavior of the patients, the users of healthcare?

Telehealth Program Impact Scenarios for Years One, Five, and Twenty

The research team started with the current numbers and dollars for various aspects of healthcare. Then, based upon the additional research found, the team identified several value-added activities that research has shown impacts healthcare costs. These became the *Telehealth Program Impact Scenarios (TPIS)*. Finally, the team estimated the cost impact for different TPIS for the 1st year, the 5th year, and the 20th year after implementation.

The team chose 1, 5, and 20 years for a particular reason. People are used to seeing annual numbers, so providing a single year incremental increase makes it easier to see an annual perspective. The 1 year change does not refer to 2014, because the model assumes that the Telehealth Program under discussion has already been implemented. Since it would take more than 1 year for any of the Telehealth Programs to be implemented, the 1 year change could not possibly happen in 2014. However, it provides those viewing the model with a good understanding of what the annual impacts of the change might be.

Five years is a good time frame to see the beginning of a payback on a technology project such as telehealth. All technology projects follow a very specific lifecycle. (Rhoads, 2006) The initial cost of the

technology project often seems high until the benefits can be realized. The difficulty is that the benefits only get realized when all of the different aspects work together in one seamless whole, often years in the future after the technology has been completely integrated into "the way things are done". The same is true for the TPIS discussed in this section.

But 1 and 5 years was not enough. There is an additional influential factor. Some of the telehealth program benefits rely upon the outcomes of a change in human behavior. Furthermore, the beneficial outcomes of that behavior change do not happen immediately, but often times many years down the road. It took well over 40 years for the sedentary lifestyle trends of the United States to result in the record-levels of obesity, heart disease, diabetes, and chronic illnesses currently being experienced. Therefore, to see the true benefit of the prevention programs implemented through telehealth, the team felt that a 20-year timeframe for the model was necessary.

Separate aspects of telehealth were included in the list of value added activities: integrated EHR systems and videoconferencing and remote monitoring, as well as specified uses of telehealth: eliminating waste/overtreatment, and implementing a wellness/prevention program. For this report, the cost impact for each of the value-added activities on healthcare have been analyzed as if they were implemented separately, without any synergies with the other value-added activities. Then the cost impact was analyzed for the contributory effects of the combination of all the value activities described. The TPIS list is:

- Elimination of Administrative Waste and Overtreatment (Telehealth Use);
- Implementation of Wellness and Prevention programs (Telehealth Use);
- Telehealth: Integrate EHR (a single national Electronic Health Record system, Telehealth Type);
- Telehealth: Videoconferencing and Remote Monitoring Implementation to the home (Telehealth Type); and
- A Combination of All of the Above.

There was no specific literature that dealt with the issue of combined benefits of telehealth, but the team used its knowledge of the residual value effect of technology synergies (Strassmann, 1997, 1999). Strassman calculates that the synergistic impact of technology projects beyond their initially planned investment cycle, typically 3 to 5 years. Strassman notes that technology scenarios need to account for residual value for twenty years or longer. He estimates that without considering residual values, a technology project typically has a cash benefit to cash expenditure ratio of around 31 percent. Considering residual values, however, the ratio jumps up to 81 percent.

The financial model developed is for the 1, 5, and 20 year scenarios, shown in a spreadsheet, along with documentation for the source for each of the assumptions. The outcomes of the various scenarios are discussed in the Results section.

Analysis Methods of Survey Data

The final phase was the aggregation and analysis of the survey data. The information from the surveys was organized and categorized. The data was reviewed, screened, and charted for review. The data were reported in three sections. The first provided the results on the questions that could be presented with the combination of the randomly controlled physician survey and the widely distributed role-based survey. The second showed results just for the randomly controlled physician survey, and the third showed results just for the widely distributed role-based survey. It should also be noted that, where ever possible, the data was broken out by urban and rural and the percentage of each was shown.

An explanation of which percentage was shown in each chart would be helpful. In many cases a decision had to be made about whether to show the percentage of the series or category. For example, in Figure 20 on Page 65, the percentages could reflect the percent of male and female, or the percent of urban and rural. In each case, the team determined which of the two seemed more meaningful, and presented the data that way. At the bottom of each chart a phrase identifies which way the percentage is represented with an example to help clarify. Additionally, when the percentages are vertical rather than horizontal, a connection line will indicate that the percentage represents the series. For example, in Figure 20, because

the team chose to include the percentages of urban and rural, the lines between the columns indicate that of the urban respondents, 69 percent were male and 31 percent were female (as opposed to saying that of the males, 20 percent were rural and 80 percent were urban). When there are no lines, usually the percentages in each bar or column will add up to 100 percent. When there are lines, the percentages in each series (color or pattern) will add up to 100 percent. When the chart displays responses for questions with multiple answers, none of the percentages will add up to 100 percent, in which case the percentage reflects the number of people who chose that response out of all subjects.

Additionally, when appropriate the data was tested for various hypotheses. One interest in particular for the randomized controlled sample was the interaction between use of telehealth and the locality of the physician or the age of the physician (or both). The hypotheses the team tested were the following:

- Is there a difference in whether or not physicians use telehealth between rural/urban physicians?
- Is there a relationship between the age of a physician and the percent of telehealth use?
- Is there a difference in whether or not physicians use telehealth based upon the "technology generation" age group of a physician?
- Is there an interaction between rural/urban and technology generation age group of a physician?

As can be seen by the hypothesis, the research team chose to compare the groups by rural/urban and age, but also by the level of technology available near the time they were transitioning from schooling/residency into practicing on their own, known as a "technology generation". There are three technology generations. People younger than 37 grew up in a mostly technical world, having used computers and mobile devices most of their lives, the *Mobile Generation*. Between age 38 and 47, the person would likely have learned how to use a computer as an adult, but not in school, the *Desktop Computer Generation*. Physicians older than 48 started their career long before computers, videoconferencing, smartphones, or any other mobile technology had become commonplace, the *Pre-computer Generation*. The team decided to find out if the "technology generation" of the physician would have an impact on their use of technology, something that is related to age but may provide additional insight. Perhaps those in the last two technology generations might not be as comfortable with technology as those in the first technology generation.

Additionally, the team was interested in how some of the current projects identified by the interviewees interacted with the physician location information from the sample. The location information was combined with data from broadband access maps and KINBER (Keystone Initiative for Network Based Education and Research) so that conclusions can be drawn. The rationale is that the location of the physician in conjunction with the KINBER map may reveal telehealth utilization insights as well.

After analyzing the data, this report describing the findings was written, including identifying the major obstacles to more widespread use, the estimation of the budget impact of more widespread use, and suggested policies that might address obstacles and encourage best practices.

RESULTS

Survey Results

Adding together the role based surveys and the physician random controlled sample survey, a response had been received from a total of 513 healthcare professionals. A summary of the survey counts is included in Figure 15. Where it was appropriate, the data from the different surveys were combined and are presented first. Next the specific data from the physician random controlled sample survey are presented - especially regarding the estimates of how much telehealth is occurring in Pennsylvania. The random sample was specifically designed to enhance the generalizability of that data. Following that, the information that was only available through the widely distributed role-based survey is presented.

Figure 15. Table of Survey Counts, combined survey data.

Category	Count of physician surveys	Count of role-based surveys
Number of surveys mailed	3,000	Not applicable
Number of surveys returned in the postal mail	206	4
Number of surveys completed online	117	186
Total number of surveys completed	323	190

The location of the respondents from the controlled sample physician survey was all known because the physicians were randomly chosen from a list of physicians in Pennsylvania. Twenty-three percent of the respondents were from rural counties as can be seen in Figure 16. The widely distributed role-based survey, however, was not as controlled. As a result about 55 percent of the respondents either did not

provide a county, or were not from a Pennsylvania county. The role-based data, therefore, cannot be considered to be representative of Pennsylvania alone. Nonetheless, there are several general questions where having a subset of the data from outside of Pennsylvania would have no impact, and in those cases the data from all the records were included in the analysis.

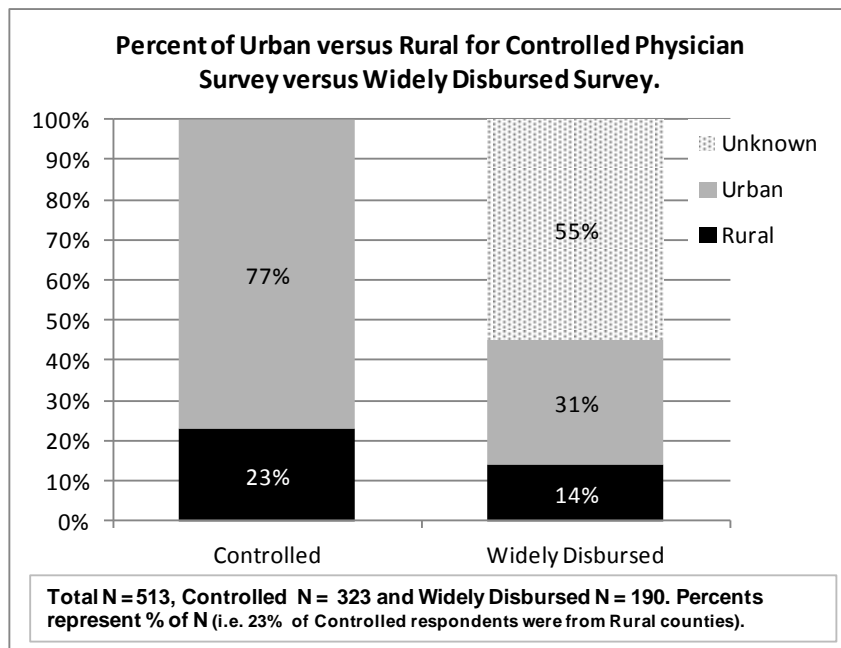


Figure 16. Percent of Urban versus Rural for All Survey Respondents, combined survey data.

The specific percentage of respondents from the controlled sample data from each county can be seen in Figure 17. The percentages reflect what portion of either rural or urban respondents responded. In other words, Franklin County represented 7 percent of rural respondents, and Philadelphia County represented 18 percent of urban respondents.

The majority of respondents worked in private practice. One of the repeated interview themes (presented in a later section) was an issue with the definition of private practice. According to several of those interviewed, "private practice" previously referred only to independent offices of physicians who may (or may not) have "privileges" in one or more area hospitals. However, according to many of those interviewed (and the data presented in the literature section regarding the issue), the model of healthcare provider has changed in the past few years. Physicians are more likely to be an employee of a larger health network, working in conjunction with a number of other physicians in an office that is managed by the health network, rather than an independent self-employed physician. The concern of the survey was not whether the physician was an employee or self-employed, but rather whether the physician was seeing patients outside of a hospital or clinic. However, confusion could be seen when reviewing the "other" category as many physicians working for a health network did not consider themselves in "private practice". Once this definitional problem was identified, the team reviewed the "other" category to recode those physicians who were employed by health networks in an office outside of a hospital as "private practice."

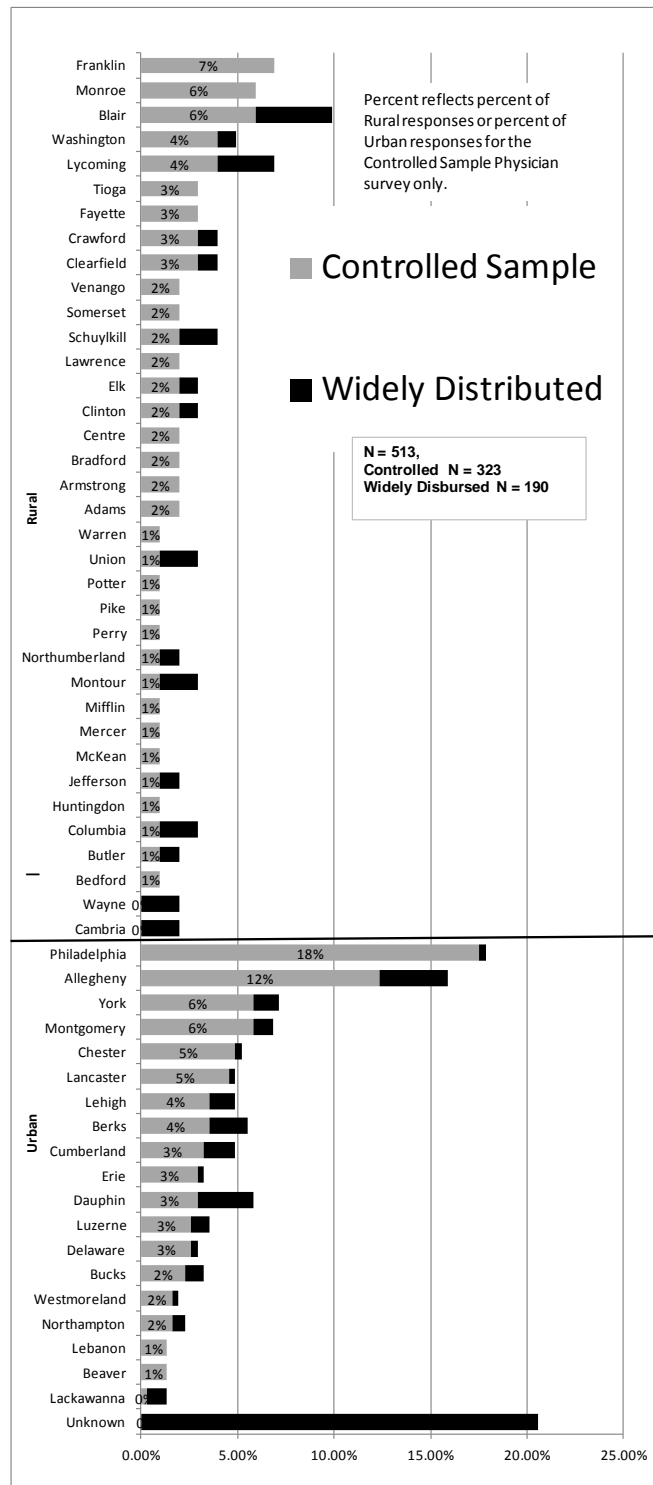
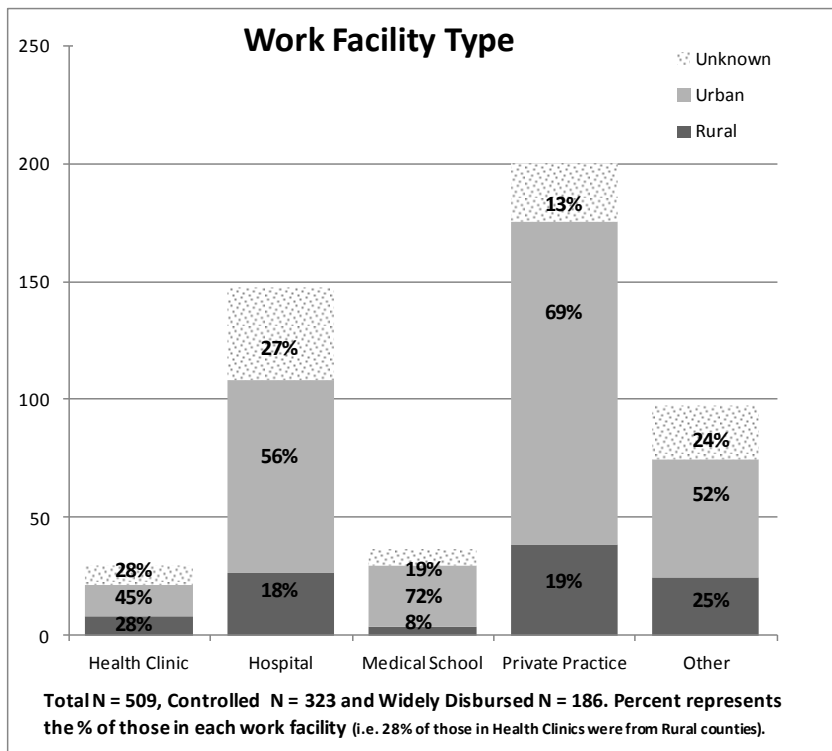


Figure 17. Respondents by County, combined survey data.

Figure 18. Work Facility Type, combined survey data.



Another point of confusion was the term "health clinic," which some respondents considered a term restricted to Federally Qualified Health Clinics and Regional Health Clinics, which are federal designations for health providers in certain areas. Others considered only "specialty clinics" such as a Cancer Clinic or a Diabetes Clinic. The team had intended both to be considered clinics, as well as Urgent Care centers, another relatively recent addition to the health care provider facilities.

The work facility breakout can be seen in Figure 18. The work facility type chart also reflects the percentage of respondents from each of the types of work facility. For example, 69 percent of the respondents in private practice were from urban counties, 19 percent were from rural counties, and 13 percent did not identify a county.

The respondents represented many specialties, as shown in Figure 19. The largest percentage, more than 25 percent of the combined respondents, came from family medicine. The percentage of respondents from emergency medicine, internal medicine, and psychiatry were about equal.

It should be noted that the specialties expected to be involved in telehealth were specifically targeted. Through reviewing the responses from the *Other* category, however, the team discovered that "specialty" is defined by physicians differently than the mailing list marketing companies. Physicians themselves generally define their specialty much more specifically. For example, there were at least three comments on the surveys that the survey missed "neonatal" and "pediatrics" because they did not appear on the list of specialties, but both of those were considered by the mailing list marketing company a subspecialty of family medicine. In this case, the team chose not to recode the specialties, but left them in the *Other* category, which is a reflection of *Other* being the second largest category of specialty.

Figure 19. Area of Specialties of Respondents, combined survey data.

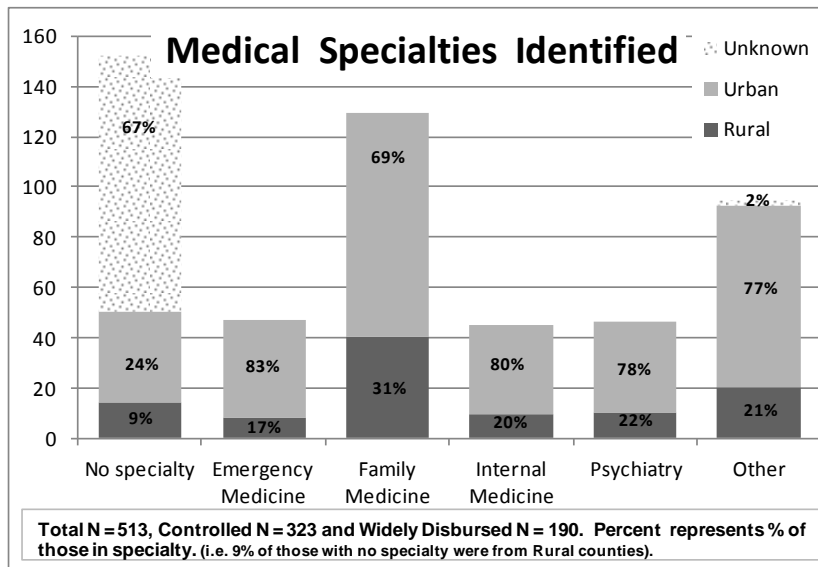
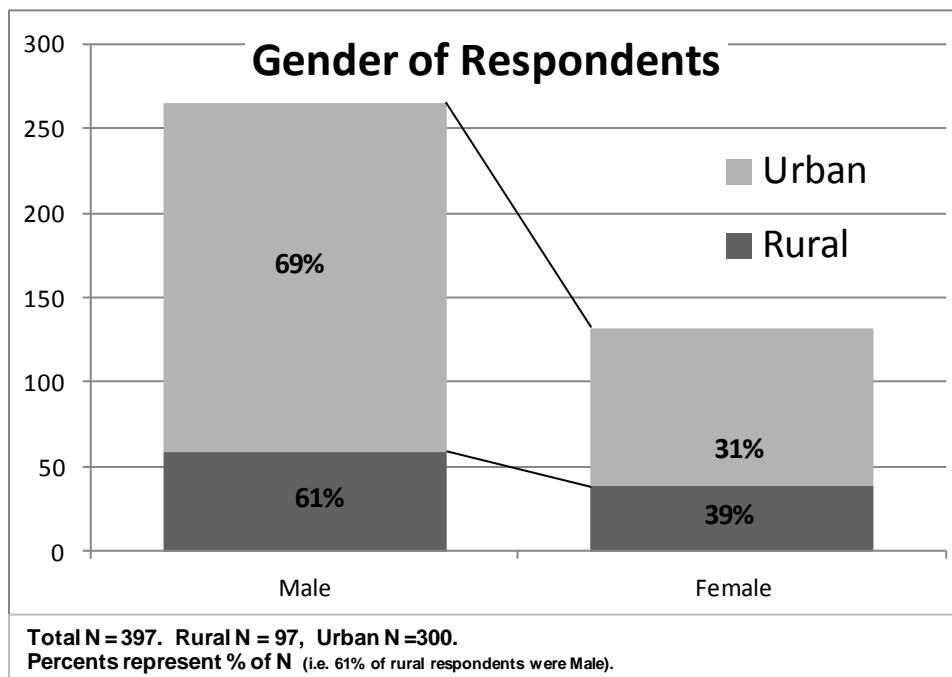


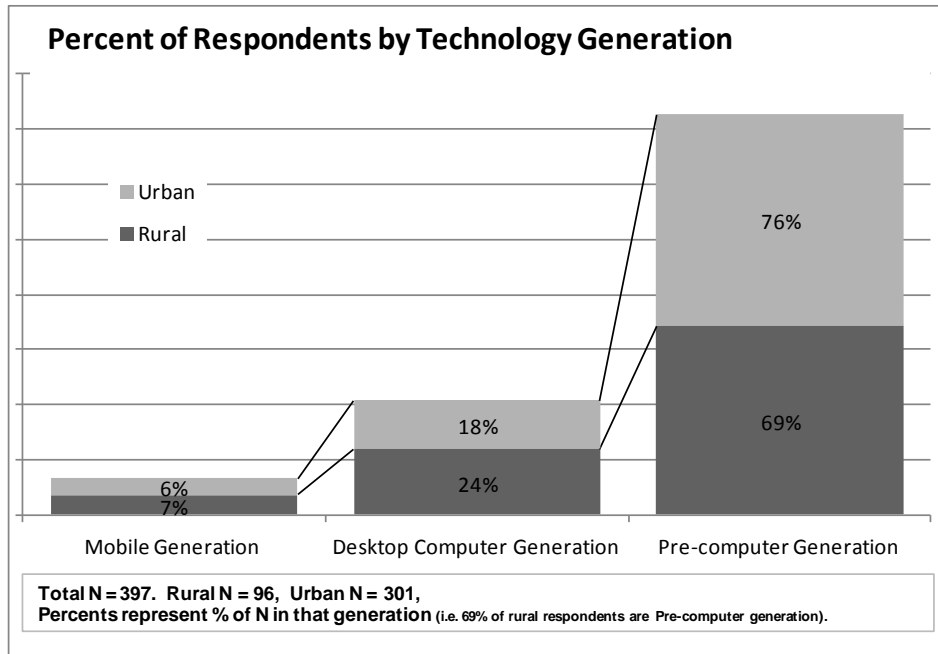
Figure 20. Gender of Respondents, combined survey data.



The majority of respondents were male (67 percent), with slightly more of them from urban counties. Figure 20 shows the gender by rural versus urban; 61 percent of the respondents from rural counties were male and 39 percent were female. Only 74 respondents from the widely distributed role based survey answered the gender question whereas all of the respondents from the controlled sample identified their gender (though they did have the option to choose "unspecified"). There was no statistical difference in the answers from either male or female respondents in the surveys.

As discussed in the *Analysis Methods of Survey Data* section, the research team wanted to test the assertion that the age of the physician made a difference in telehealth use. The team felt that what would be most influential would be in which *Technology Generation* the respondent grew up.

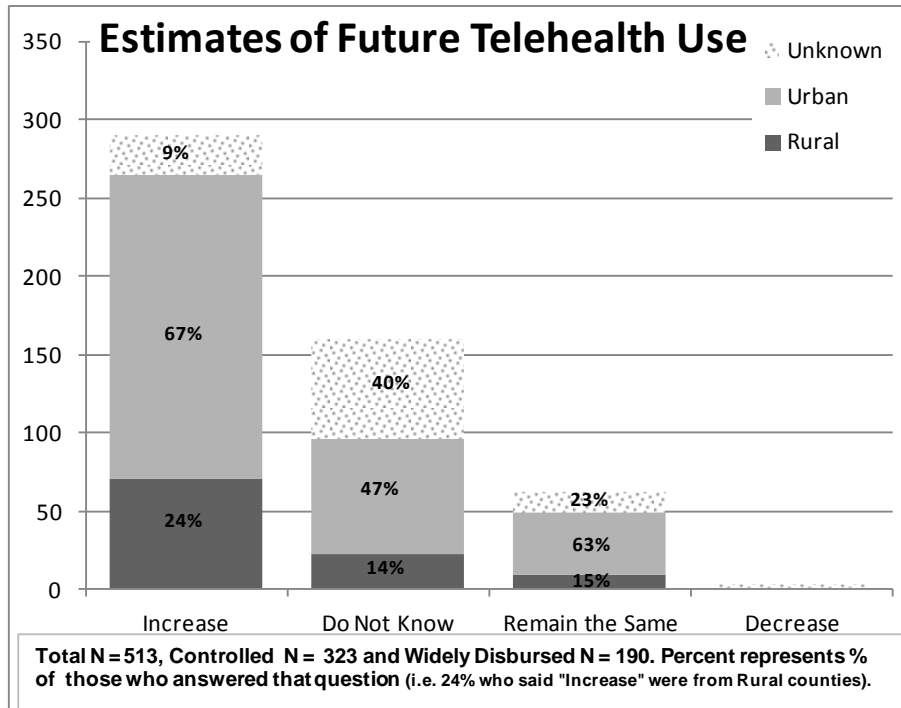
Figure 21. Percent of respondents by age of technology generation, combined survey data.



The respondents were (by an overwhelming majority) from the pre-computer generation. Most were over 48 years old, which meant that most graduated from college before computers and mobile devices were commonplace. Even so, the results showed no significant difference in the amount of telehealth experienced between the respondents of the different technology generations. Furthermore, there was no significant difference in the interaction between the respondents' technology age and whether the respondents came from a rural or urban county.

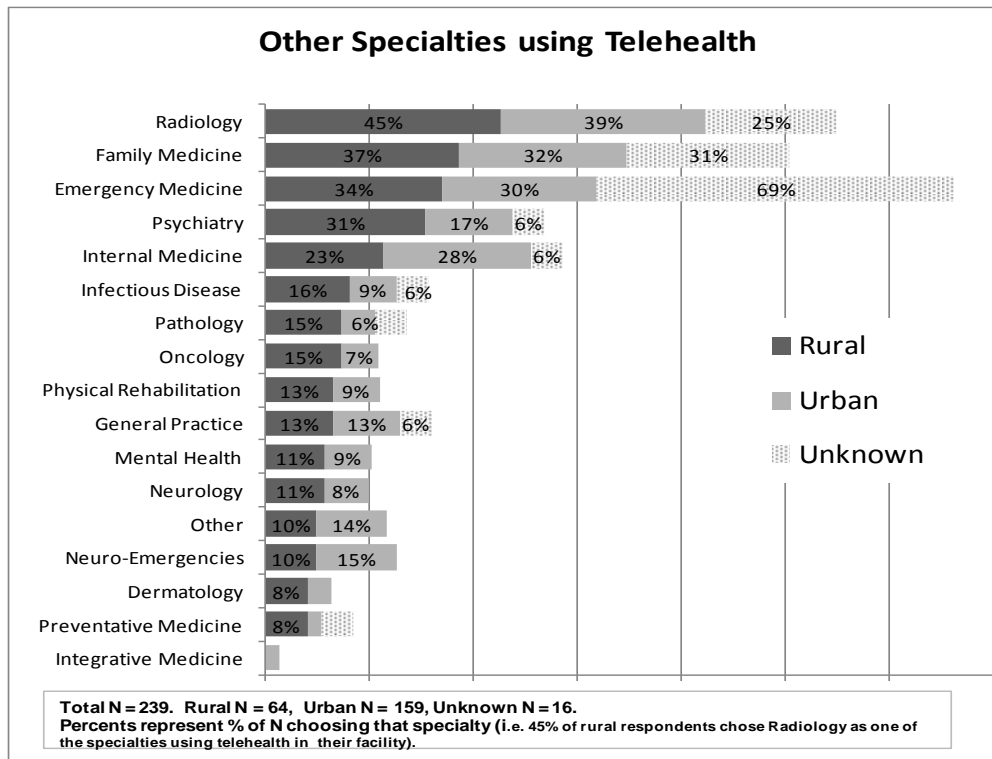
One of the questions that spanned both surveys was whether or not the respondent felt that telehealth would increase, decrease, or remain the same (Figure 22). Given the general growth of the use of technology in society, the research team expected nearly all respondents to say that the use of telehealth would increase. While the majority did so, a relatively large number of respondents answered that they expected telehealth use to remain the same, or did not know. It is also interesting to note that there was no significant difference between the answers of the respondents from rural counties and the answers of respondents from urban counties.

Figure 22. Estimates of Future Telehealth Use, combined survey data.



Respondents were also asked what specialties within their facilities were using telehealth. Of the rural (and the urban) respondents, the top specialty using telehealth was radiology, where x-rays, magnetic resonance images (MRI), and CT scans have been read by radiologists across telecommunication networks for years. Of the respondents from unknown counties, emergency medical department was the top usage, which was chosen the third most often by either rural or urban respondents. The other top users were Family Medicine, Psychiatry, and Internal Medicine. The rest of the specialties were chosen by less than 20 percent of the respondents. The other category tended to be pediatrics, neonatal, and dermatology. The results can be seen in Figure 23. Note that respondents could choose more than one specialty.

Figure 23. Specialties Using Telehealth in Facility, combined survey data.



Another question that would apply to both surveys was the obstacles. Respondents were asked to choose all the obstacles against more widespread use of telehealth. Figure 24 shows the obstacles in order of importance to the respondents from rural counties. As can be clearly seen, issues with reimbursement, both from private health insurance and government health insurance such as Medicare and Medicaid, topped the list. These two obstacles were chosen by over 50 percent of the respondents from rural counties (and almost 75 percent of respondents from unknown counties).

Telehealth also seems to bring out strong opinion among physicians, especially when it comes to reimbursement issues. One physician was quite frank in his comments on the survey:

Telehealth in medicine is bullshit until someone starts paying for the time involved. I put in too much unfunded/unreimbursed time on the telephone as it is. The last thing I need is emails from patients too.

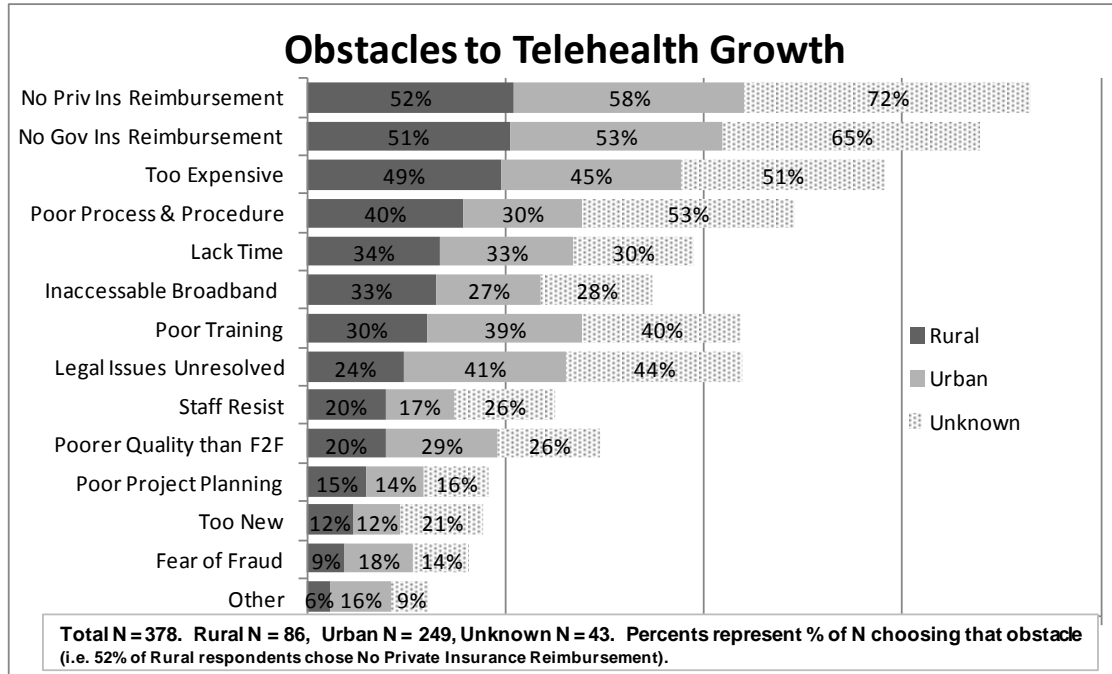
The high cost of technology is also high on the list. The next four obstacles, poor processes and procedures surrounding telehealth implementations, lack of time to implement it, problems accessing the required high speed broadband network, and lack of training on the technology were all chosen by about one third of the respondents. Legal issues are still unresolved, and are unlikely to be resolved until the regulations catch up to the technology. Poor training and unresolved legal issues were the two of the handful of obstacles chosen by more respondents from urban counties than from rural counties.

The other obstacle chosen by more urban than rural respondents was the issue of quality. Twenty-nine percent of urban respondents identified quality of telehealth not being equal to face-to-face as an obstacle, whereas only 20 percent of the rural respondents identified quality as an obstacle.

Resistance of staff was not chosen as often, confirming the earlier findings that the oft-stated concern about older physicians resisting technology was not evident in this data set. Fear of fraud, too-new technology, and lack of planning also did not appear to be major issues according to the majority of respondents. If respondents chose *Other*, they were asked to provide specific obstacle to which they

referred. Other obstacles included patient preference for human contact, lack of leadership and understanding of the medical issues, as well as a need for more solid evidence of the efficacy of telehealth.

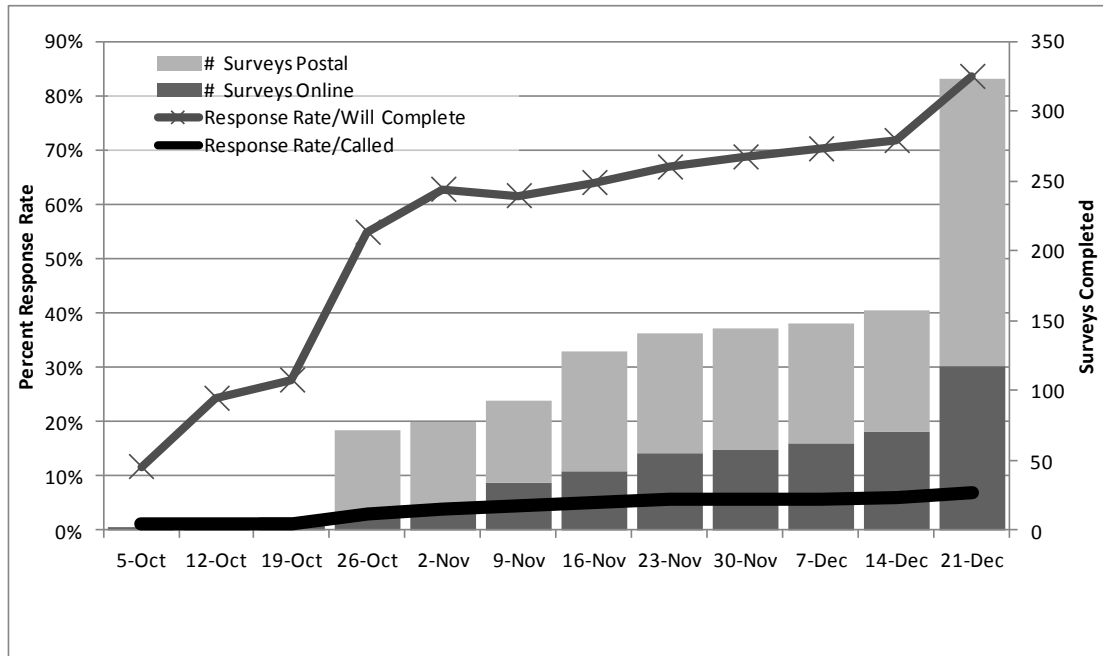
Figure 24. Obstacles to telehealth growth, combined survey data.



Controlled-Sample Physician Survey Responses

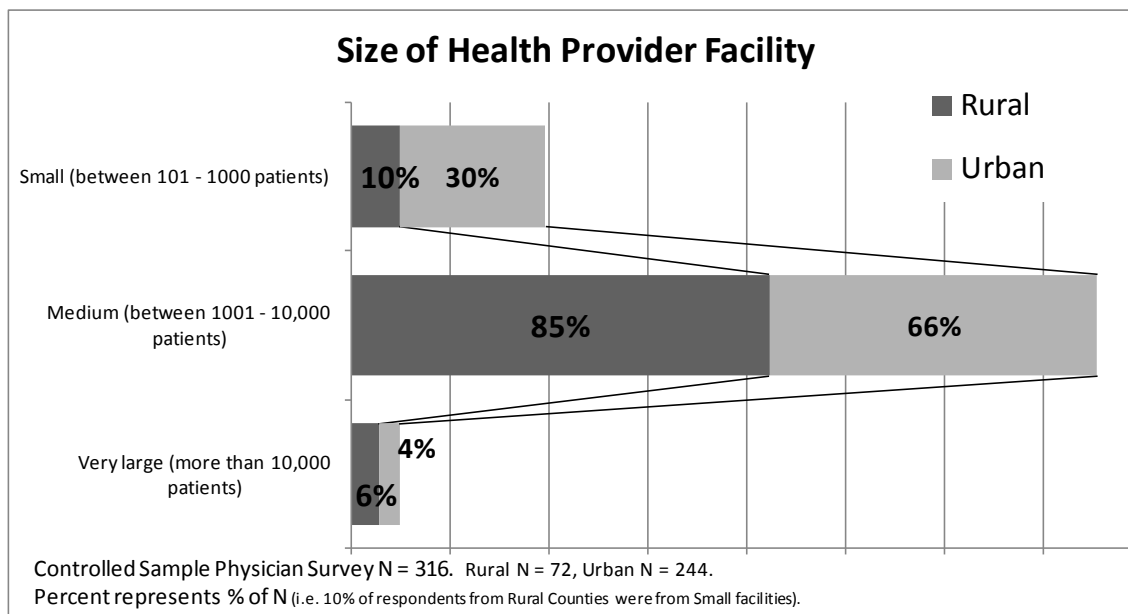
As noted earlier, the survey that targeted physicians in Pennsylvania was a random controlled sample. For that survey, 323 responses were received, a 5.8 percent response rate of the physicians who received surveys mailed, a 6.8 percent response rate of the 2515 physicians contacted by phone, and an 84 percent response rate of the physicians who responded on the phone that they would complete the survey. The survey response rates can be seen in the chart in Figure 25. The response rates are the lines, shown on the left axis, and the number of surveys completed is the columns, shown with the right axis. The majority of responses were received in the final week, after the notes were sent to notify the physicians of the close date of the survey.

Figure 25. Physician Call List Statistics Chart of Response Rates



The respondents were asked to estimate the number of patients they've seen within the last year, and from that the size of the practice or facility was estimated. The majority saw more than 1,000 and less than 10,000 patients. There were more medium and very large facilities from the rural counties, and fewer small facilities, but the difference was not significant.

Figure 26. Physician Controlled Sample Survey Size of Health Provider Facility.



Because of the nature of the random controlled sample, the physician survey can be used to estimate the amount of telehealth going on in Pennsylvania. Although the questions were specifically and simply asked, the answers became a bit more complicated because of Electronic Health Records (EHR). Many consider Electronic Health Records (EHR) a part of telehealth, and there is a great deal of activity in this field due to the regulatory changes and "meaningful use" requirements of CMS (Center for Medicare and

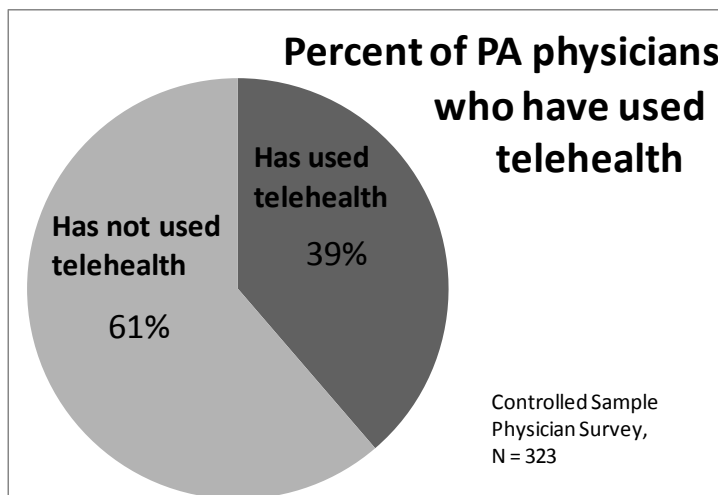
Medicaid Services) which require healthcare vendors to implement EHR systems by next year or be financially penalized. (Hoff et al., 2011; Ryan, 2009)

Furthermore, a single patient being referred to any health provider using an EHR would mean that the physician has "used" EHR. Therefore, the team felt the data was more meaningful if EHR were not included for this particular estimate. The data were adjusted. If respondents answered "yes" to whether or not they have ever used telehealth, and then in the type of telehealth question they only marked EHR, they were not included as a telehealth user for this estimate.

Data was adjusted the opposite way as well. Despite the team's attempts at clarity when first asking about whether or not they have used telehealth (by including the definition), some respondents may have said "no" to the early question because they might not have previously known about all the types of telehealth until they saw the list in a later question. Therefore, if they said "no" to whether or not they have used telehealth, but then went on to mark that they have used one of the telehealth types in a later question, they were included as a telehealth user.

With the exception of EHR, the majority of Pennsylvania physicians (61 percent) still have not used telehealth (Figure 27). If EHR were considered part of telehealth, then the percent would increase to 85 percent of physicians using telehealth.

Figure 27. Percent of Pennsylvania physicians who have used telehealth (random controlled sample, not including EHR).

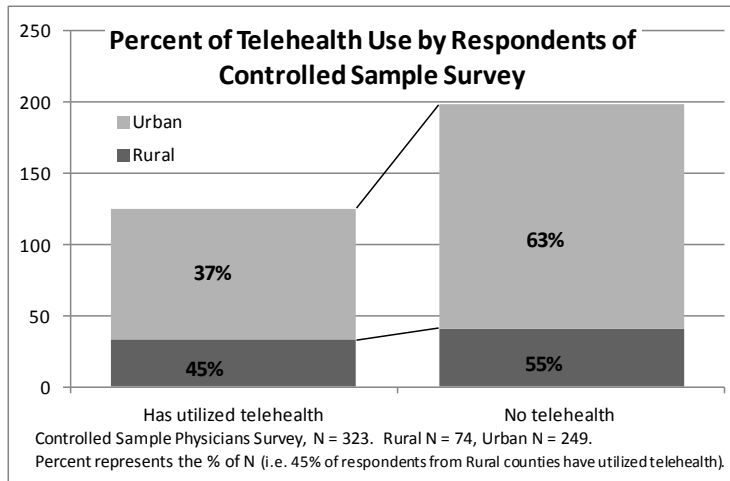


The breakout of physicians from rural or urban counties in Pennsylvania can be found in Figure 28. Proportionately, there is a larger percentage of rural physicians who have used telehealth, (37 percent urban physicians, 45 percent rural physicians despite there being three times as many urban physicians) but the difference is not significant (Chi square <1.5, p > .7). In the cases of both rural and urban, the majority of physicians have not used telehealth. This answers the second question of the four hypotheses the team chose to investigate. There was no difference between rural and urban physicians in whether or not they used telehealth.

The first, third, and fourth hypotheses were also found to be accepted. There was no relationship between the age of a physician and the percent of telehealth use. There was no difference in telehealth use based on age even when the "technology generation" ages of physicians were grouped together. There was no interaction between rural/urban and the technology generation age group of a physician in their use of telehealth. In general, all the hypotheses came back with insignificant results.

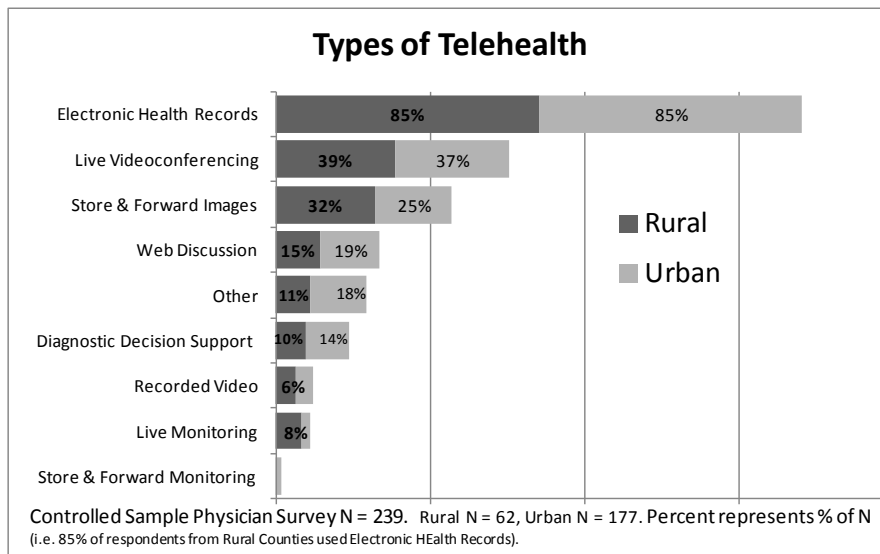
While no factors correlated highly enough with telehealth use that they would have any statistical significance, the factors that came closest to making a difference was whether or not the physician thought that telehealth use would increase (with those using it more often thinking that it would), and the number of obstacles they identified.

Figure 28. Rural versus Urban physicians who have used telehealth (random controlled sample, not including EHR)



Of those who have used telehealth (including EHR) the different types can be seen in Figure 29. The exact same number of rural physicians and urban physicians has used electronic health records at some point (85 percent). The number goes down precipitously when reviewing the other types with less than 40 percent of physicians using the next top telehealth type; live videoconferencing. Nonetheless, in every case there is no difference between the number of rural physicians and the number of urban physicians who have used any one type of telehealth.

Figure 29. Types of Telehealth Used (random controlled sample).

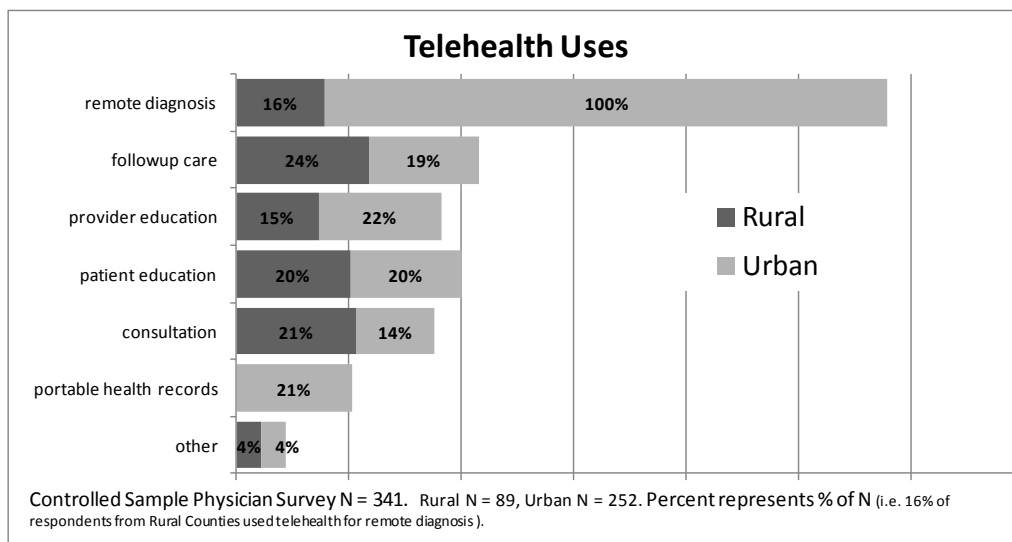


There seems to be a difference between the rural and urban physicians in how they have used telehealth. As shown in Figure 30, while 100 percent of the physicians from urban areas identified remote diagnosis

as the purpose for their telehealth use, only 16 percent of rural physicians identified remote diagnosis. They are more likely to identify follow-up care as the purpose for telehealth.

This would make sense given the existing "hub and spoke" model of telehealth use. Currently, rules and regulations of telehealth identify that reimbursement is dependent upon a hub (generally found in an urban health provider's facility) and a spoke (generally found in the rural health provider facility). If the hub is used to diagnose maladies that require the use of a specialist such as teleburn, telestroke, or some other highly specialized skill, then the physician at the hub would tend to regard the system as being used for diagnosis. Physicians at any one of the spokes, however, would be using a higher variety of telehealth types for a higher variety of uses as they spend more time dealing with more patients with issues. (Gamble, et al., 2004)

Figure 30. Uses of Telehealth (random controlled sample)



Physicians in the random controlled survey were asked to identify specific projects they knew about. Thirty-eight identified another project.

Widely Distributed Role Based Survey Demographics and Results

The role based survey was more widely distributed and the sample was not randomly chosen. The survey was distributed through several organizations associated with healthcare, some with a stated mission to increase new technologies in healthcare such as telehealth. Additionally, the survey was not directed only at physicians, though 50 percent of the respondents were physicians. The roles of the people who returned the role-based surveys can be found in Figure 31.

Figure 31. Roles of survey respondents in Role Based Survey (n = 190)

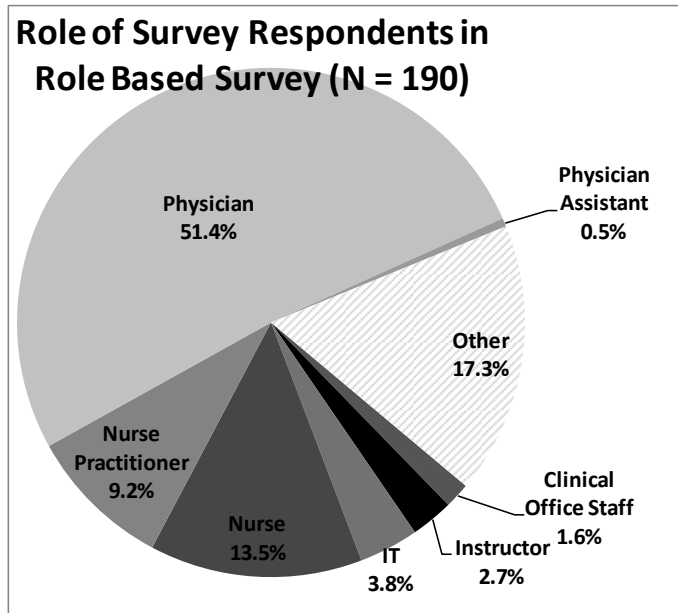
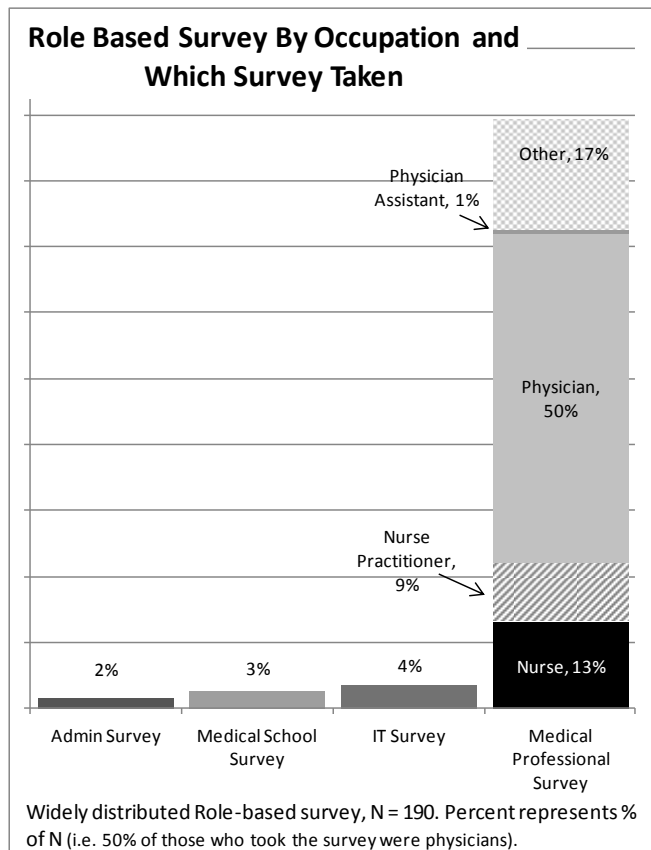


Figure 32. Which survey taken by role identified by respondents (widely distributed survey).



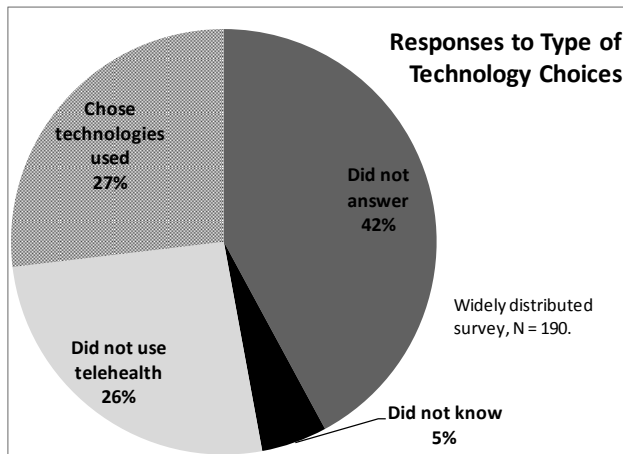
The role-based survey was actually four surveys in one; different questions appeared based upon which role the respondent chose when they began the survey. For example, information technology professionals were asked much more specific questions on the type and amount of technology used in the telehealth systems than the more general technology questions asked of the other respondents. Hospital administrators were asked specific questions about the funding sources of the facilities than other respondents.

Unfortunately, as shown in Figure 32, the percentage of respondents for some of those specialized surveys was not enough to form a sample. For example, only four hospital administrators took the admin survey. As a result, the team decided to restrict the presentation to the questions that were found on multiple roles of the survey in order to have a sample size that provides meaningful data.

One of the questions on the role-based survey on multiple roles was about the specific technology type used by those who did telehealth. Only 5 percent of the respondents indicated that they did not know the answer. The rest (66 percent) either

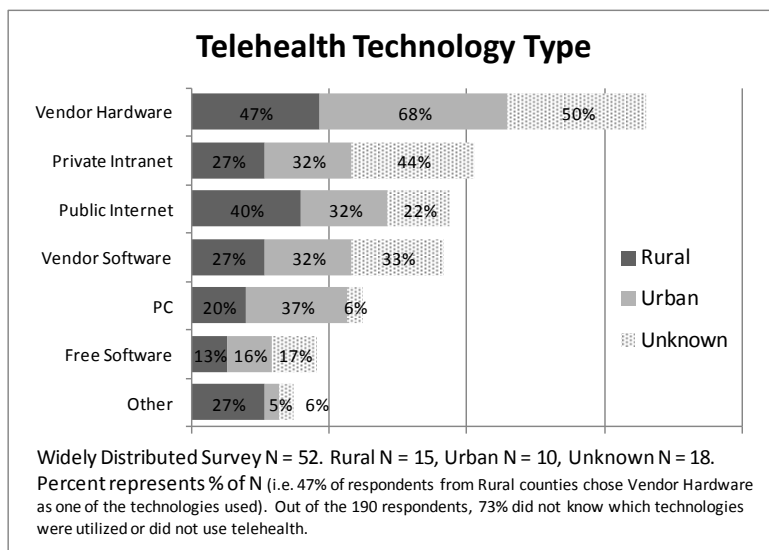
did not answer, or did not use telehealth (which means that they could not answer). A little more than a quarter answered the question, as can be seen in Figure 33.

Figure 33. Responses to Type of Technology Choice (widely distributed survey)



While the number of respondents who answered the question was not large (52), there were still enough of them to provide meaningful data. There was no significant difference between the rural and the urban respondents on the type of technology. The most common system was a vendor-based system for both hardware and software. Whether the system used a public or private network was about the same between rural and urban, with a slight increase in rural counties using public Internet. This would make sense since it would be much easier for an urban area to implement a private Intranet between two buildings on a campus, for example, than for a rural area.

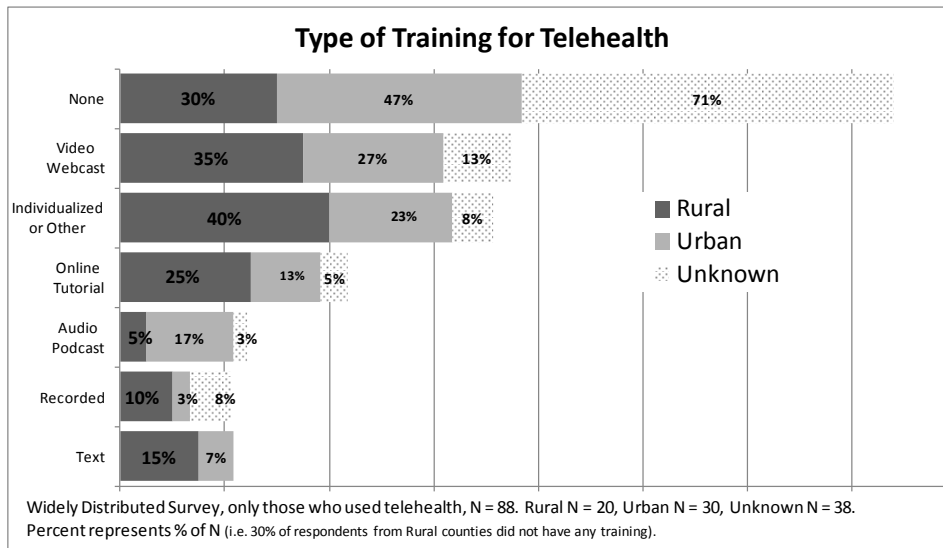
Figure 34. Type of Technology in Telehealth (widely distributed survey)



Many of the "best practices" such as training, support, quality, and other telehealth implementation issues were included in the longer role based survey. The type and amount of training involved in the telehealth implementations was reported by the respondents. The results indicate that the majority of those who have utilized telehealth received no training on it, though this was slightly less true for rural respondents than urban respondents. The majority overall (53 percent) did not receive training. Where the county was unknown, up to 71 percent of respondents did not get training.

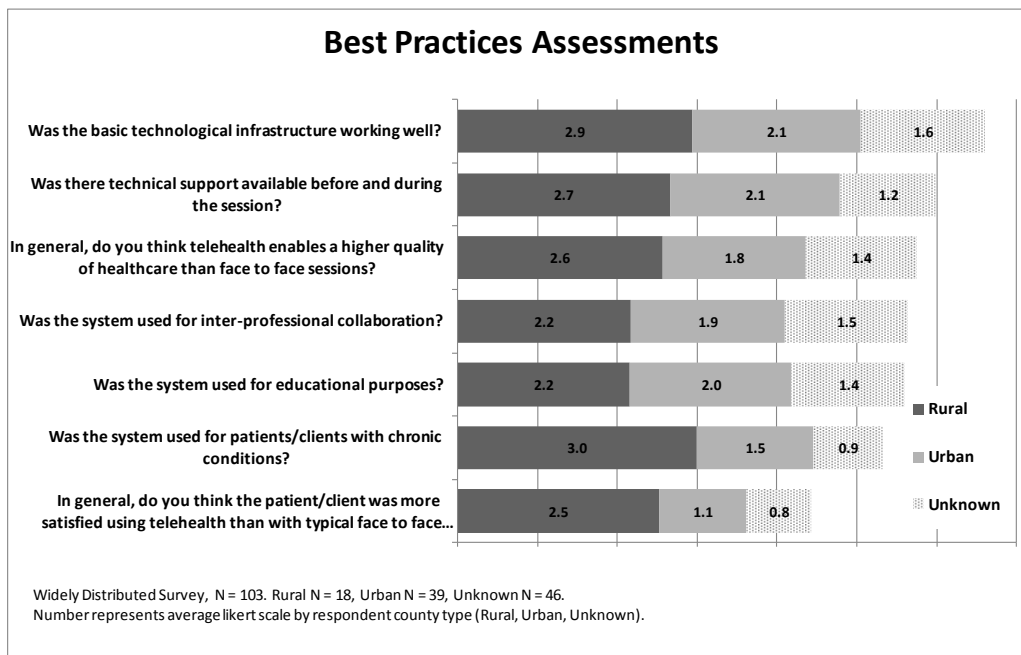
When there was training in the rural counties, it was most likely to be individualized, through video webcast and online tutorial are a close second and third choice.

Figure 35. Type of Training for Telehealth (widely distributed survey)



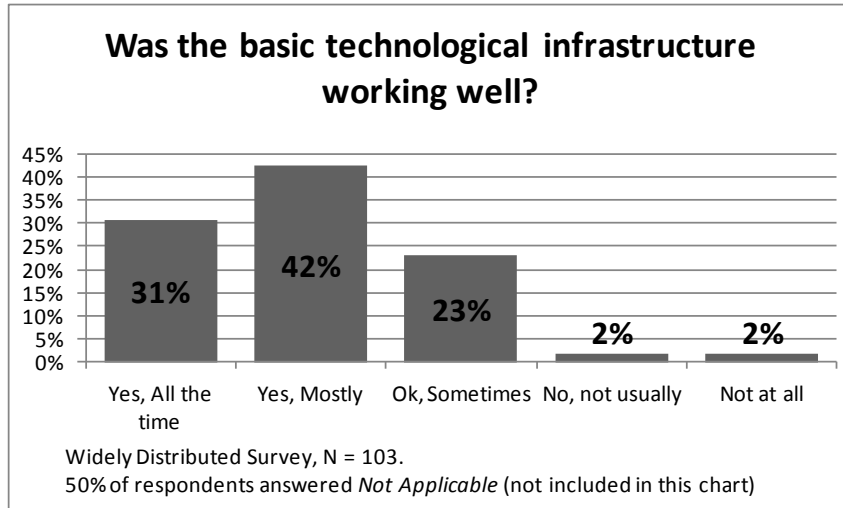
Some of the other best practices issues are found in Figure 36. There were no significant differences between the responses of respondents from rural, urban, or unknown counties, though there was a slight increase in the best practice of utilizing telehealth for chronic conditions in the rural counties that was not seen in the urban counties. That would mesh with the other findings; if the urban hub sites were more focused on diagnosis while the rural spoke sites were more focused on followup, it would make sense that they would see more use of telehealth for chronic illness care. The data results show a slightly higher opinion of the quality of telehealth as well, with the average being 2.5 on a Likert scale (which is the exact average between yes, all the time and not at all).

Figure 36. Best Practice Questions (widely distributed survey)



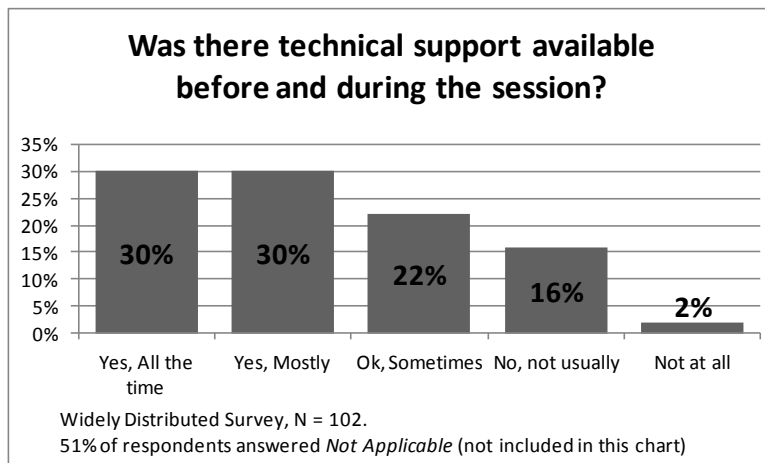
The specific answer profile of the individual questions reveals some insights into some of the quality issues. According to the respondents who answered, in general, the technological infrastructure was working well most of the time (Figure 37). Less than a third answered *all of the time*. Less than four percent said that it didn't usually work.

Figure 37. Assessment of technological infrastructure (widely distributed survey).



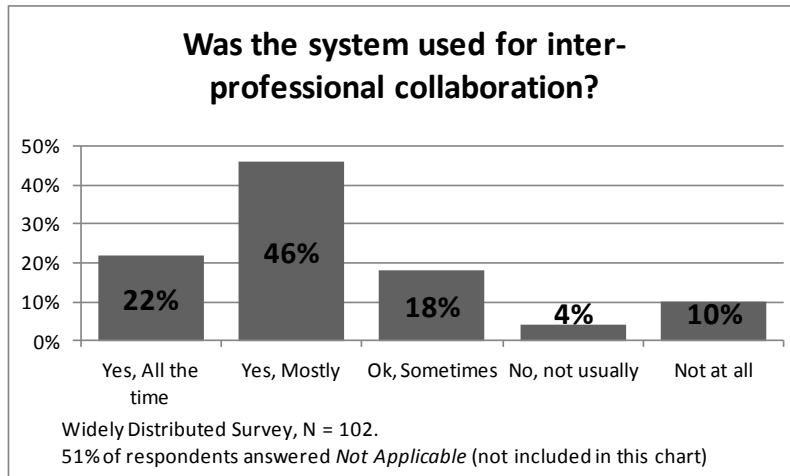
Technology support was generally available at least sometimes according to the respondents (Figure 38), though up to 18 percent noted that technology support wasn't usually available, or was not at all available. The remaining respondents were just about evenly split between All the time, Most of the time, and Sometimes.

Figure 38. Technical Support Availability (widely distributed survey).



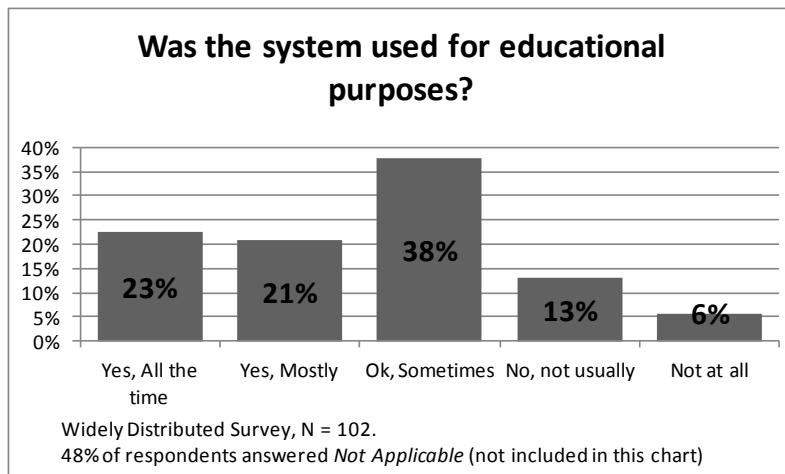
The system was used for inter-professional collaboration the majority of the time (Figure 39), with almost half of the respondents reporting Yes, Mostly. Fourteen percent chose not usually or not at all.

Figure 39. Inter-professional Collaboration (widely distributed survey).



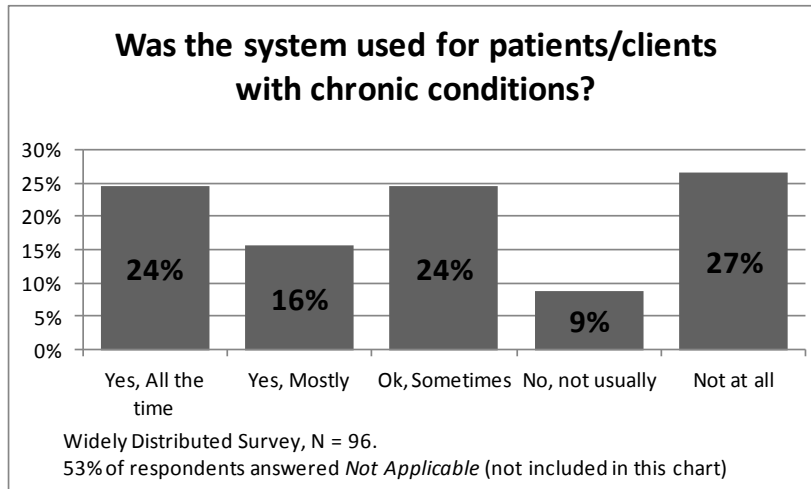
The respondents noted (38 percent) that the telehealth systems were used sometimes for educational purposes, and almost 50 percent said *yes* (either *all the time* or *mostly*). Less than 19 percent said the systems were not usually or never used for educational purposes (Figure 40). It should be noted, however, that mHealth is reportedly used by more than half of smartphone users and more than one-third of cell phone numbers. If these statistics are applied to rural counties in Pennsylvania, the number of people in rural counties who have used telehealth (mHealth component) in Pennsylvania are more than 1 million (almost 14 percent out of the 8 million Pennsylvanians in the state who used mHealth). Of course, patients were not included in the survey, and physicians are not necessarily involved in the educational mHealth that their patients use (though whether they should be is another question).

Figure 40. Educational Purposes (widely distributed survey).



The respondents were a mixed bag when it came to using the system for patients with chronic conditions. Twenty-eight (24) percent said *Yes, All the Time*, while 27 percent said *Not at all*. The rest were somewhere in the middle, with 24 percent saying *sometimes* (Figure 401).

Figure 41. Use with Patients for Chronic Conditions (widely distributed survey).



The questions related to quality, first from the health provider point of view and second from the patient point of view, were not very positive, as can be seen in Figure 42 and Figure 43. More than one third of the respondents (37 percent) said that telehealth *sometimes* enabled a higher quality of healthcare than more traditional face to face healthcare. Forty (40) percent said no, while only 23 percent said yes.

Figure 42. Quality of Telehealth as Healthcare (widely distributed survey).

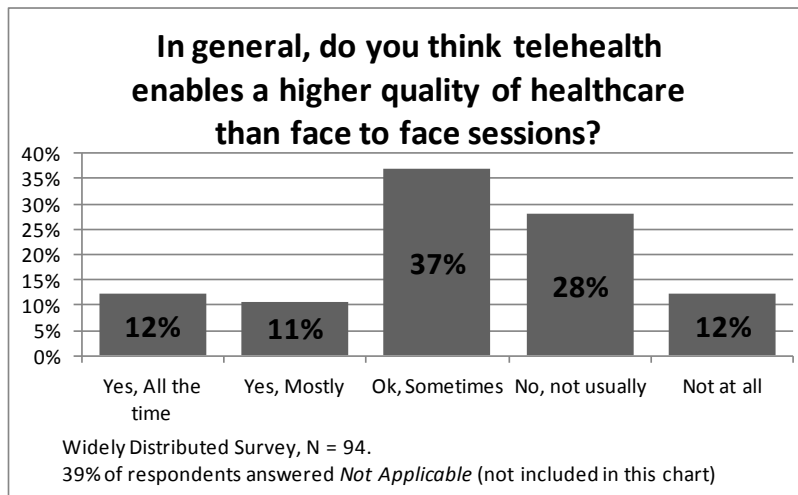
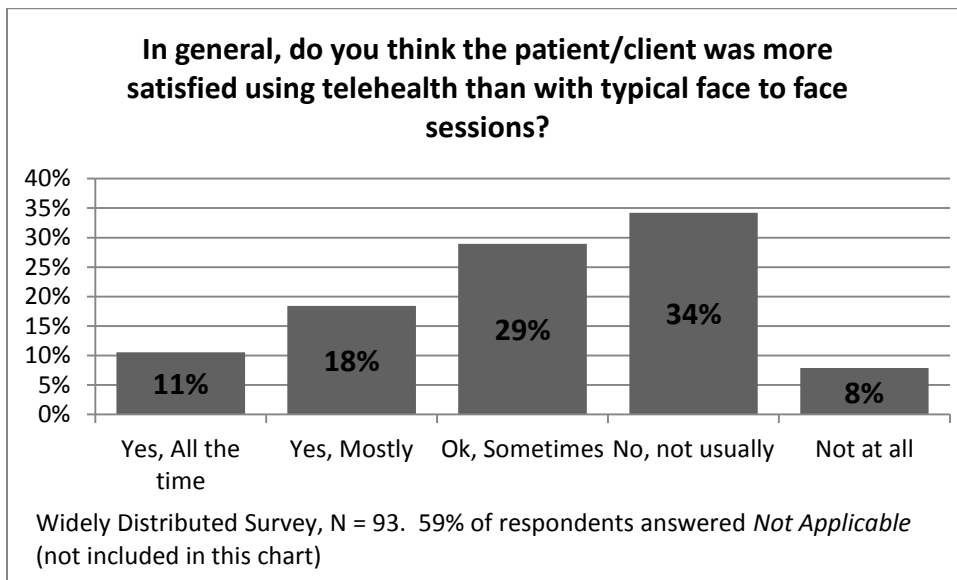
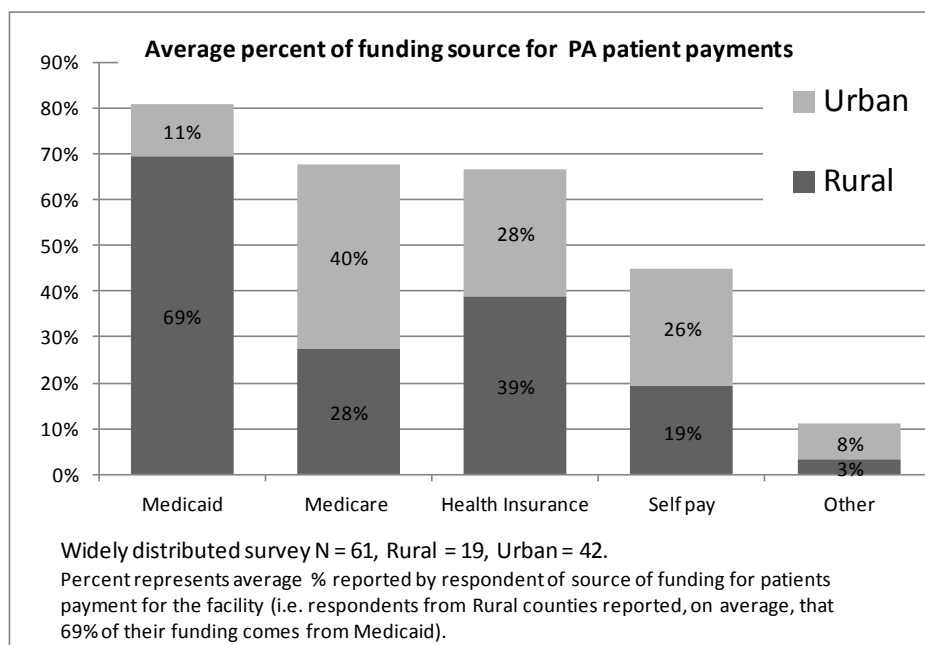


Figure 43. Patient Satisfaction (widely distributed survey).



The survey also asked questions about how the clients or patients paid for their health care services (Figure 44). Due to the non-random sample method, these numbers may not accurately reflect all of Pennsylvania, and would warrant further review. According to the responses, an average of 69 percent of the payment for healthcare from the facilities in rural counties was funded by Medicaid. Urban facilities, however, reported that only 11 percent of their funding came from Medicaid. Medicare accounts for 40 percent of the funding for urban facilities, but only 28 percent of the funding for rural facilities. Health insurance covers 28 percent of the costs for urban, and 39 percent of the costs for rural facilities. Fewer patients in rural counties pay for their healthcare out of their pocket, with respondents reporting that 19 percent of their funding comes from self-pay. In urban facilities, the percent is 26.

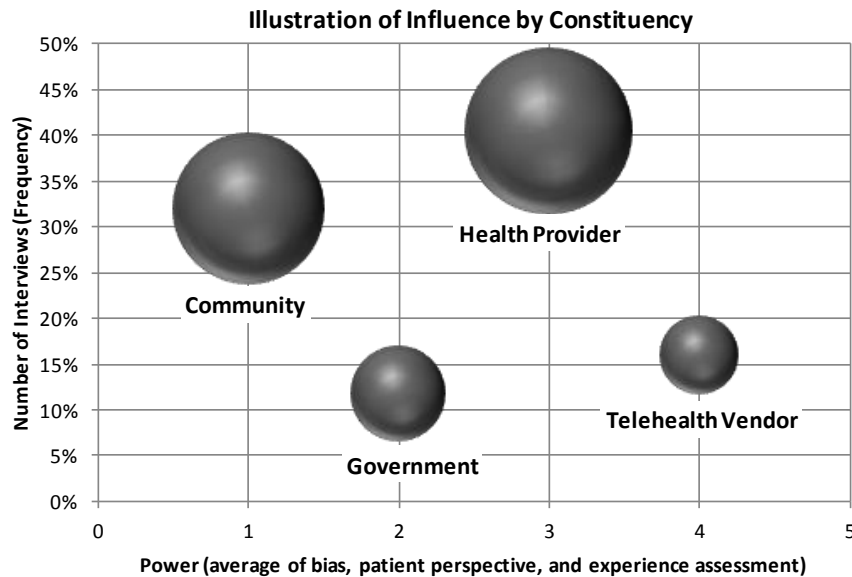
Figure 44. Average percent of funding source by payer (widely distributed survey).



Interview Results

As explained in the Methodology section, the interviews were coded based upon themes. The assessment system is explained in Figure 14. Each interviewee was also assigned a constituency (Health provider, Government, Community, or Vendor). The results of the assessment by constituency are shown in Figure 45. This chart visually illustrates the amount of influence each type of constituency had over the theme ranking in the analysis.

Figure 45. Illustration of Influence of Interviewees toward Themes.



Using this system of assessment, the health providers who had the most experience with telehealth had the most influence over the themes included in the ranking. The assessment of each individual person was multiplied by the theme count (the number of times that person brought up a theme, or identified a theme as an issue). The theme list (originally 53), then, was pared down to just the top themes based upon the influence of the constituents, using a cut-off theme power of 50. Items that did not receive a theme power of 50 or above were dropped from the list.

The final list of themes identified was:

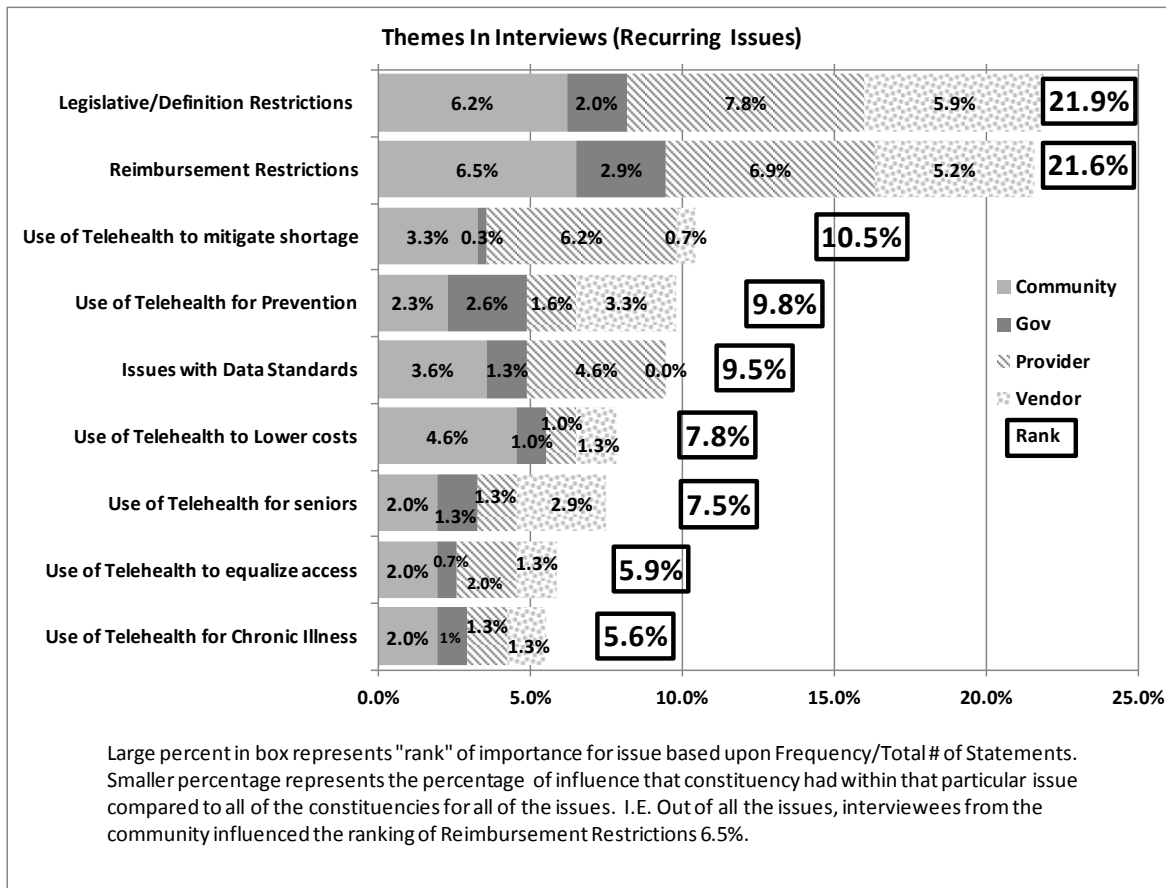
- Single Focus Telehealth
- Multi-focus Telehealth
- Use of Telehealth to mitigate shortage
- Use of Telehealth to lower costs
- Use of Telehealth to equalize access
- Use of Telehealth for chronic illness
- Use of Telehealth for seniors
- Use of Telehealth for prevention
- Legislative/definition restrictions
- Reimbursement restrictions
- Standards (interoperability or data standard issues)

The first two themes were not so much themes as characterizations; whether the interviewee was focused on a single aspect of telehealth (such as home-based remote monitoring for seniors or teleradiology or

EHR), or on multiple aspects of telehealth (using telehealth in as many ways as practical and useful). The majority of interviewees were involved in multiple aspects of telehealth.

The rest of the themes (9) were analyzed by dividing the number of times the theme was mentioned by the total number of instances (306) as presented in Figure 46. The themes were then rank ordered. To review the themes in light of the amount of influence of each constituent group, the number of times the theme was mentioned by that constituent member was divided by the total number of instances as well. The purpose of the constituency calculation was to be able to visually illustrate how influential each constituency was toward each theme.

Figure 46. Themes from Interviews - Ranks and Constituency.



As shown in Figure 46, the most common theme was the legislative or definition restrictions, followed by the closely related issue of reimbursement restrictions. Reimbursement restrictions generally referred to the limitations on reimbursements, or the complexity involved in getting reimbursed for telehealth activities. Legislative/Definition restrictions referred most often to the problem of licensing. Most states have laws against physicians from another state traveling to their state and practicing medicine, including Pennsylvania. A Pennsylvania patient is free to travel to New York and get diagnosed and treated from a physician in New York because the "treatment" occurs in New York, where the physician is licensed. But a New York physician cannot travel to Pennsylvania and treat a patient without getting a special waiver, for each occurrence, from the Medical Association in Pennsylvania.

In telehealth, however, there are two states involved in the diagnosis and treatment. If a patient is viewed, diagnosed, and treated while physically in Pennsylvania, while the physician is physically located in New York, which state legislates the licensing - the state of the patient or the state of the physician? Currently, most policies and regulation identify the state of the *patient* is the licensing state, which causes problems

according to those interviewed. This definition of jurisdiction of licensing effectively prevents a physician from using telehealth because he or she would need to get licensed in every state in which he or she would want to potentially have a patient.

Those two issues had general recognition from all four constituencies. Legislative/Definition had a ranking of 21.9 percent (i.e. 21.9 percent of all statements were about Legislative/Definition Restrictions). Reimbursement Restrictions had a ranking of 21.6 percent.

The third top rated issue was concern for perceived shortages of physicians. Shortages or lack of availability of certain specialties, especially in rural areas, was noted as a major motivation for implementing telehealth. Specifically mentioned most often were primary care physicians, burn specialists, stroke specialists, intensivists, and psychiatrists. This theme was least influenced by the Government constituency.

Many interviewees raised the issue of the use of telehealth for prevention. Many saw telehealth as a way of changing the healthcare model, which is currently focused on diagnosis and treatment rather than prevention. Because telehealth can cost effectively provide education and daily monitoring of healthful habits, many interviewees noted that it might be much more useful in decreasing healthcare costs in the long run than traditional methods. Two physicians who were interviewed talked about colleagues in other countries (Canada and the United Kingdom) who used telehealth quite effectively, focusing on prevention and not just treatment.

The fifth top rated issue was the issue of data standards, or lack thereof. Many interviewees, especially from the community and from the health providers, were concerned that electronic health record systems were being implemented without an already prescribed set of data standards, which would lead to expensive system rewrites when standards are finally published. None of the vendors mentioned this issue. Some health providers noted that the vendors would be the recipients of the contracts to rewrite the systems to accommodate new standards if they were to be published after implementation, so they would benefit in that situation.

The potential for telehealth to lower costs was discussed at length by many of those interviewed. The fact that the cost of equipment and infrastructure has lowered drastically in the past three years was discussed by those with the most experience in the field. There was also quite a bit of discussion of the cost of travel rising, which also improves the cost benefit analysis of telehealth. Although not included in the statistics because the interview took place after the interview tracking was complete, one ambitious emergency room physician calculated that by making telehealth available free of charge, American patients would save over \$25 billion in unnecessary emergency room visits each year.

Another common theme was the growing population of seniors, and the growing impact on Medicare and Medicaid. The use of telecare was often cited as a valuable use of telehealth. It was noted, however, that there is a gap between the availability of this service and its use.

For example, TelaDoc is a commercial service, available in most states including Pennsylvania, that allows patients to access a doctor licensed in their state via a videoconferencing (during the day) or over a telephone line (24 hours a day). But several physicians familiar with TelaDoc in the interviews indicated that the service is not often used. As one physician stated: *I have ... signed up to be a physician who takes calls for TelaDoc, but I have yet to complete a consult because the volume is so light and sporadic.*

One interviewee provided usage documentation from the Intra-Governmental Council on Long Term Care on the telecare that has been implemented in Pennsylvania counties. The actual use in 2012 can be seen in the graphs in Figure 47 and Figure 48⁴. Only 46 people used remote monitoring health status, and less than 400 people used remote monitoring prescriptions, though they've both been available since 2008. According to the interviewees, the major obstacles are the lack of training and the cost of the

⁴ Maps are courtesy of Paul McCarty, Executive Director, Intra-Governmental Council on Long Term Care, Pennsylvania Department of Aging and created by Phillip A. Windell, from Office of Long-Term Living and Office of Policy and Strategic Planning, from Department of Aging and Department of Public Welfare.

infrastructure (the connection). The field agents who would recommend the telecare services were not trained due to budget cuts. Furthermore, the patient must pay for monthly connections costs out of pocket.

Figure 47. Remote Monitoring Health Status- Office of Aging participants by county.
Health Status Measuring & Monitoring: Participants by County

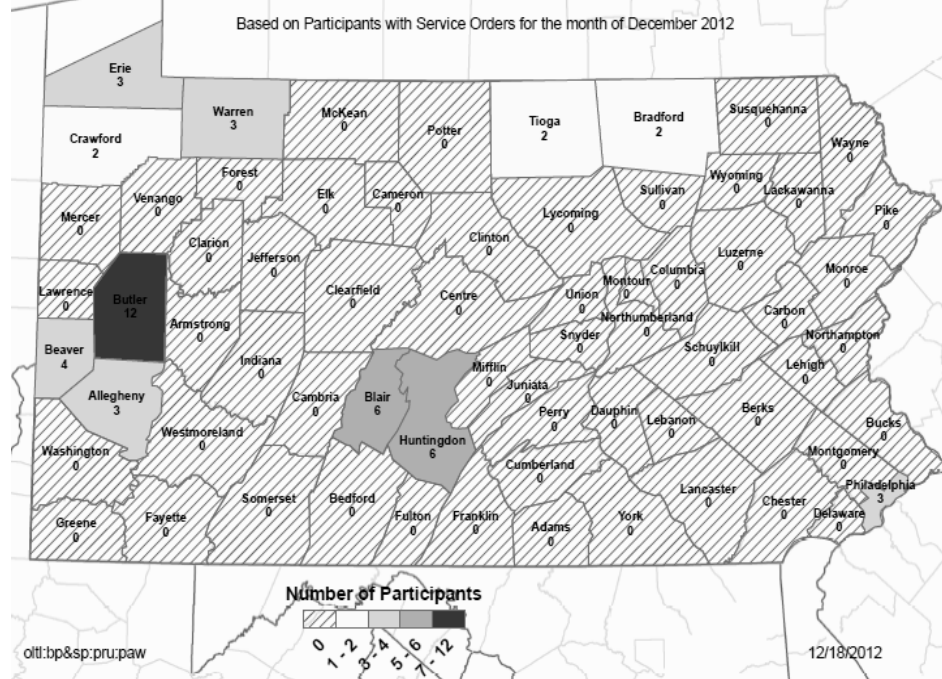
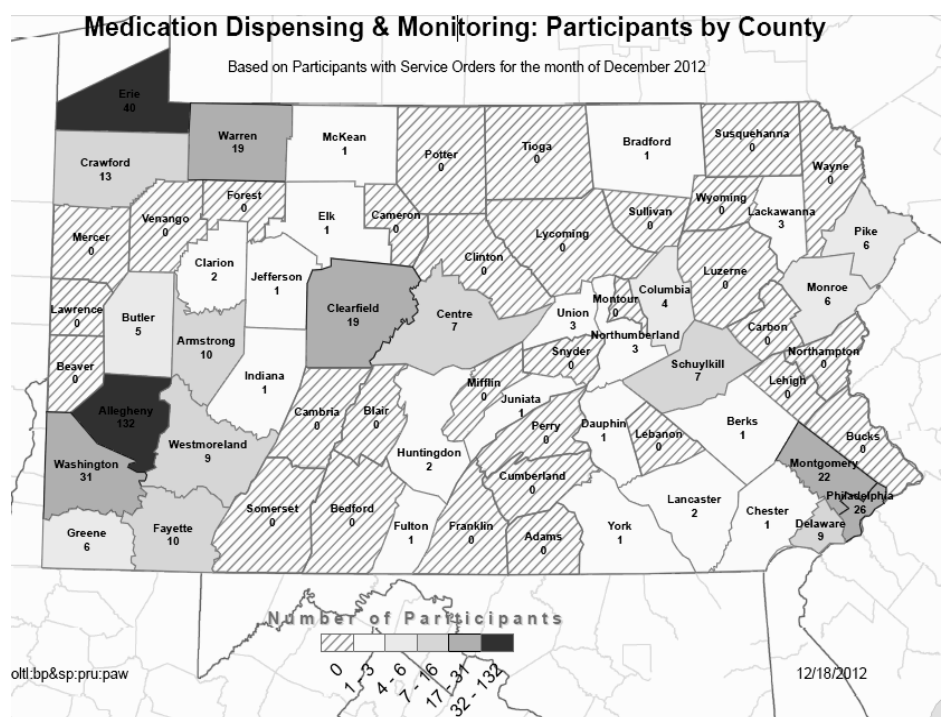


Figure 48. Remote Monitoring Prescriptions - Office of Aging participants by county.

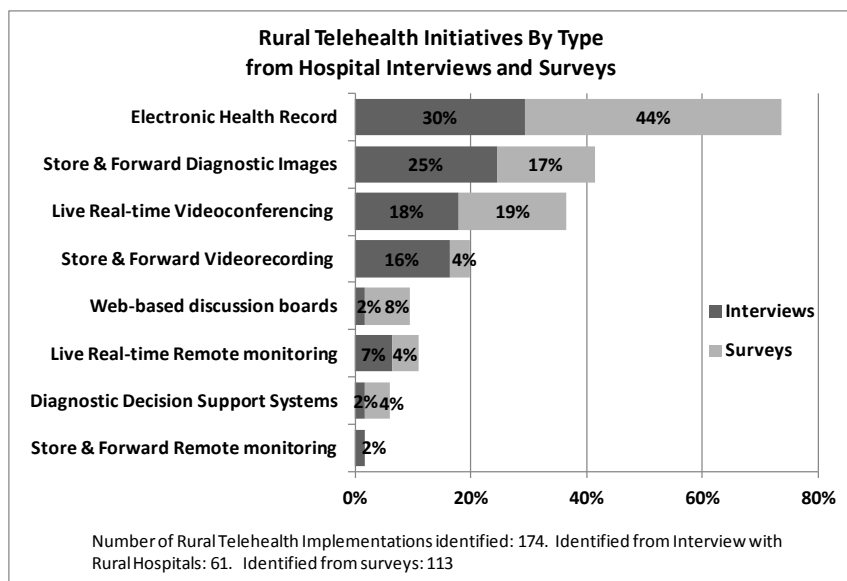


Several interviewees also noted that telehealth would be more effectively used to manage chronic illnesses such as diabetes, heart and lung problems, arthritis and other auto-immune disorders. This item is also related to the growing senior population because seniors have an increased number of chronic illnesses, and to the prevention issue, because chronic illnesses are more easily prevented and managed than treated.

Telehealth Initiatives in Rural Counties

The research team used two methods to identify telehealth implementation projects. First, calling 75 rural hospitals resulted in interviews with 16 individuals who identified 61 implementations (an average of 4.35 implementations per hospital). Second, both surveys asked about specific telehealth initiatives, and from that data the team identified 113 more telehealth implementations for a total of 174 telehealth implementation projects in the rural counties. The types of telehealth involved these implementations, along with the source, are shown in Figure 49. Electronic health records topped the list of telehealth initiatives followed by diagnostic imaging and live videoconferencing.

Figure 49. Rural Telehealth Implementation By Type (combined sources: interviews, controlled sample survey, and widely distributed survey).



The type of telehealth implementation least often reported was diagnostic decision support systems and store and forward monitoring, possibly due to limited reimbursement opportunities for those types of telehealth. Web-based discussion boards also had a very low telehealth implementation count among those interviewed, possibly because it is not often thought of as telehealth. Those answering the survey saw the option in the list, and may have been more likely to think of it.

One of the most influential issues that impacts telehealth project implementation in rural counties is broadband accessibility. The results of interviews with several knowledgeable professionals working to increase broadband access in rural counties revealed a major push for high speed access in Pennsylvania, with the Keystone Initiative Network Based Education and Research (KINBER) project. KINBER is a \$100 million project funded mostly through the U.S. Department of Commerce’s National Telecommunications and Information Administration (NTIA). The fiber optic cable network, called PennREN (Pennsylvania Research and Education Network) extends more than 1,600 miles through 39 Pennsylvania counties, 22 of which are underserved. It directly connects over 60 critical community anchor institutions, which include public and private universities, K-12 schools, public libraries, public broadcasting facilities and medical facilities. In Figure 50, the locations of the physicians in the sample list are juxtaposed against the completed KINBER network.

In Figure 51. KINBER as of February 2013 juxtaposed against the Broadband Map of PA as of June 2012. The darker the area, the faster the access. Lighter areas have none. ("PA Broadband Mapping Viewer," 2012) Despite the upgrade in broadband accessibility, it can be seen from the map that there are still large swathes of Pennsylvania without any broadband access, most notably in Clinton, Lycoming, Forest, and Somerset counties.

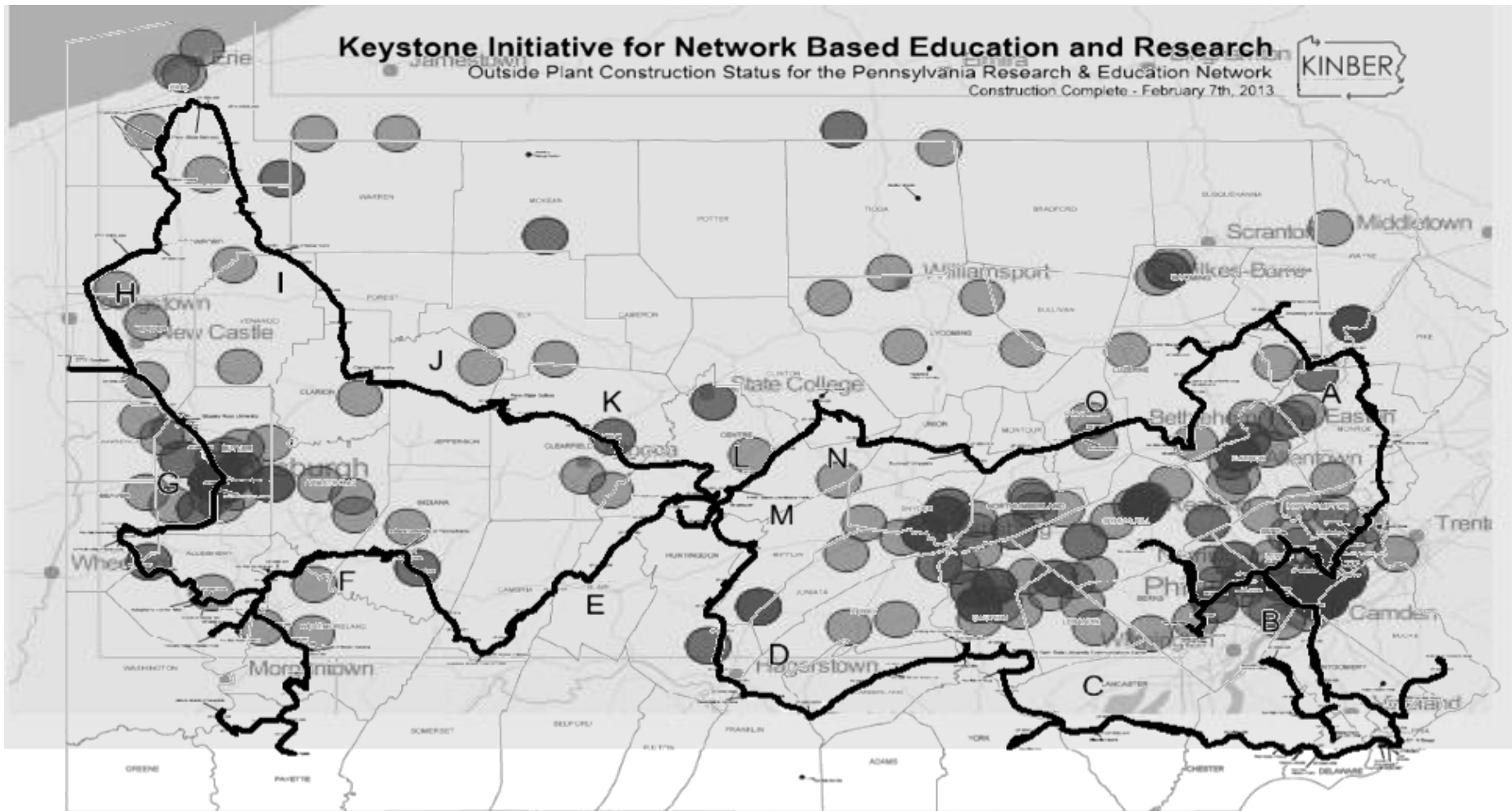


Figure 50. KINBER as of February 2013 juxtaposed against the locations of PA Physicians from the physician survey list (from which the random controlled sample was taken).

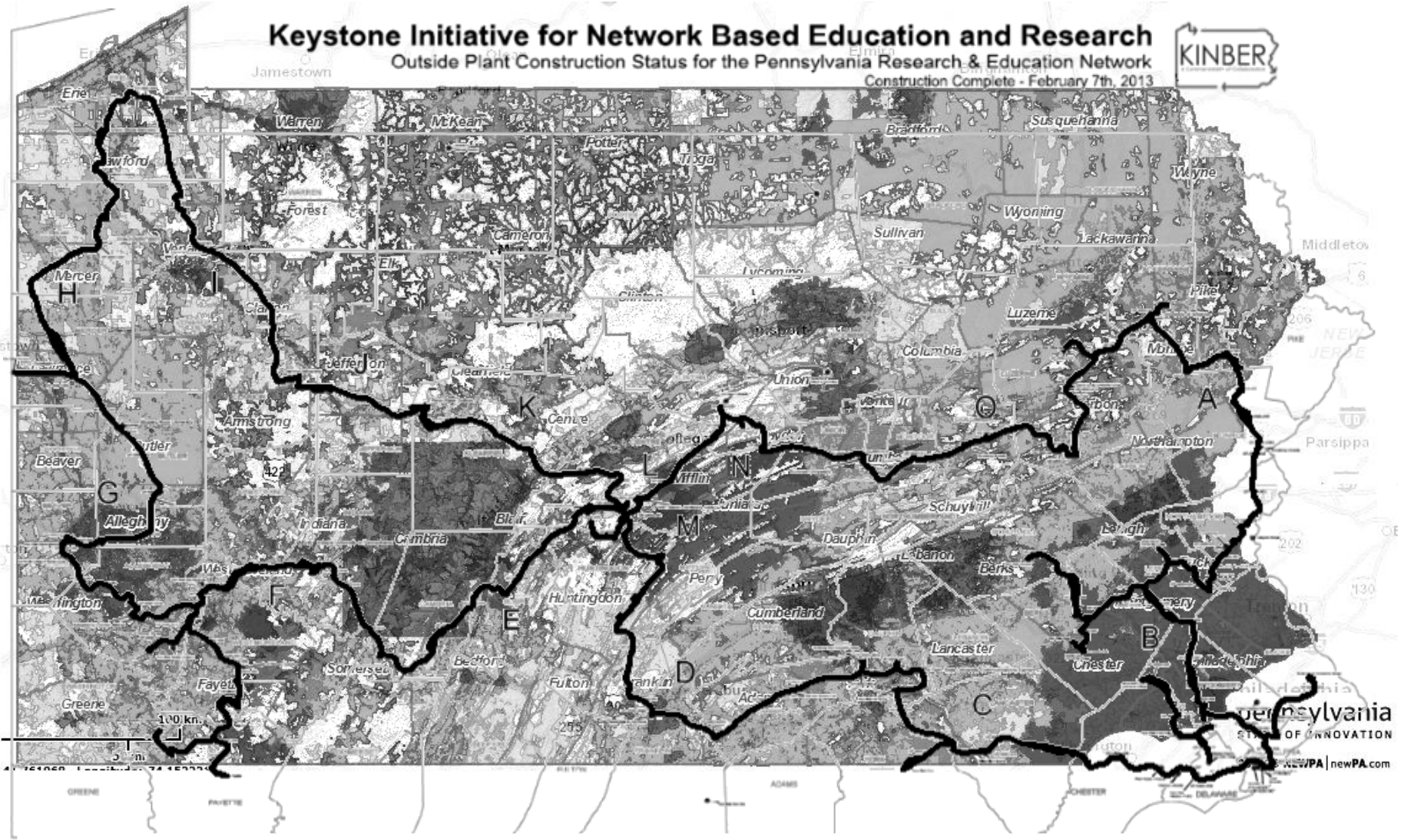


Figure 51. KINBER as of February 2013 juxtaposed against the Broadband Map of PA as of June 2012. The darker the area, the faster the access. Lighter areas have none. ("PA Broadband Mapping Viewer," 2012)

Healthcare Budget and Telehealth Costs

To estimate of the impact of telehealth on the healthcare budget in Pennsylvania, the team wanted to use the most recent numbers available for referencing within the model. Unfortunately, the lesson learned was that the numbers themselves are constantly changing. The initial model started with numbers gathered in July 2012, but then were updated in October 2012, January 2103, and finally April 2013. The problem with these frequent updates was that the websites often changed the numbers originally referenced, making it hard to backtrack when necessary. To avoid future issues, the team created a PDF document for the final model from the website page and stored it on a local drive so that changing numbers posted on websites would not make the model unstable. In any case, the specific numbers chosen weren't nearly as important as the development of the entire model, which automatically adjusts when updated numbers are entered.

To determine the number of people in Pennsylvania, the U.S. population, and the per person healthcare costs, the research team used several different sources, as shown in Figure 52. Using the Organization for Economic Cooperation and Development (OECD) calculation for the average healthcare costs, the cost for Pennsylvania healthcare was \$104,578,686⁵. The last column of the table in Figure 52 shows which cell reference in the model is directly impacted by the number, which can be found in the sources identified.

Figure 52. Sources for population estimates and per person health costs

Assumption Name	Source	URL	Static Local Link	Actual Number	Cell Reference
Total PA population Number of people	Source: U.S. Census Bureau, 2011 American Community Survey	http://factfinder2.census.gov/aces/tableservices/jsp/pages/productview.xhtml?pid=ACS_11_1YR_S070&prodType=table	SourcesForEconomicEstimates\C2_PA_Population_factfinder2.census.pdf	12,702,379	C2
Total US population	Source: U.S. Census Bureau, 2011 American Community Survey	http://factfinder2.census.gov/aces/tableservices/jsp/pages/productview.xhtml?pid=ACS_11_1YR_B01003&prodType=table	SourcesForEconomicEstimates\D2_US_Population_factfinder2.census.pdf	311,591,919	D2
Per person health costs (multiplied by PA Population to get 104,578,686)	Organisation for Economic Cooperation and Development (OECD)	http://www.oecd.org/unitedstates/BriefingNotesUSA2012.pdf	SourcesForEconomicEstimates\OECD_BriefingNotesUSA2012.pdf	8,233	E2

The estimates for the number of people impacted as well as the costs for Medicaid, CHIP, Medicare, private insurance, and the uninsured are listed in Figure 53. There is no single source for all of the information. Furthermore, several categories overlap, as it is possible to be covered by both Medicare and Medicaid, for example. Nonetheless, the total of all of the categories did not add up to the total population of Pennsylvania, so the final category (out of pocket and other) in cell C8 was simply the total population of Pennsylvania minus all the other categories. It is likely that a large portion of these people are uninsured but not counted as uninsured (children, for example, who are not served by CHIP, or recently uninsured due to job loss). The number of uninsured in Pennsylvania has not changed in several years, despite the number of private insurance going down as unemployment went up. It should be noted that private insurance included both employer paid and self-paid premiums.

⁵ An alternative would have been the Kaiser Foundation Reported number of \$97,414,000, but since that number was from 2009 and the \$104 billion was from 2012, the team decided to use the more updated number.

Figure 53. Sources of estimates for people and costs of Medicare, Medicaid, Private Insurance, and Uninsured.

Assumption Name	Source	URL	Static Local Link	Actual Number	Cell Reference
Covered by Medicaid (adults) - Number of People	Department of Public Welfare Publications	http://www.dpw.state.pa.us/publications/dpwybythenumbers/index.htm	SourcesForEconomicEstimates\C3_Medicaid.dpw.state.pa.us_publications_dpwybythenumbers_index.pdf	2,231,577	C3
Covered by Medicaid (adults) - Costs in Budget	State of Pennsylvania Portal	http://penbpc.org/sites/penbpc.org/files/PA-Senate-2012-13-Budget-Health-Care.pdf	SourcesForEconomicEstimates\PA_Budget_2012-13_Enacted_Budget_LineItem_Appropriations_.pdf	6,071,449,000	E3
Covered by Medicaid or CHIPS (children) - Number of Children	State of Pennsylvania Portal	http://www.performanceplans.state.pa.us/Dashboard2011-12/Performance2011Manager%20Dashboard.html	SourcesForEconomicEstimates\C4_CHIPSenrollment.performanceplans.state.pa.pdf	194,895	C4
Covered by Medicaid or CHIPS (children) - Costs for Children	State of Pennsylvania Portal	http://penbpc.org/sites/penbpc.org/files/PA-Senate-2012-13-Budget-Health-Care.pdf	SourcesForEconomicEstimates\PA_Budget_2012-13_Enacted_Budget_LineItem_Appropriations_.pdf	123,195,000	E4
Covered by State-Paid Insurance - Number of employees	Bureau of State Employment (PA)	http://www.employment.pa.gov/portal/server.pt/community/why_pa/17639	SourcesForEconomicEstimates\C5_NumEmployees.portal.state.pa.us_portal_server.pdf	80,000	C5
Covered by State-Paid Insurance - Costs for Healthcare (Average Insurance 5616 (Kaiser Est) minus empl contribution 1176)	Bureau of State Employment (PA)	http://www.employment.pa.gov/portal/server.pt/community/why_pa/17639	SourcesForEconomicEstimates\E5_HealthBenefits.employment.pa.gov_portal_server.pdf	355,200,000	E5
Covered by Private Insurance - Number of people In PA with Insurance	Healthcare.gov, website from US Health and Human Services	http://www.healthcare.gov/law/information-for-you/pa.html	SourcesForEconomicEstimates\C6_NumInsured.healthcare.gov_law_information-for-you_pa.pdf	3,151,000	C6
Covered by Private Insurance - Average per Person based on Kaiser estimate for 2012	PA Health Access & Kaiser Foundation Report	http://ehbs.kff.org/?page=charts&id=tsn=6&p=1	SourcesForEconomicEstimates\E6_PrivInsuranceCost_ehbs.kff.pdf	5,616	E6
Covered by Medicare - Number of people	Source: U.S. Census Bureau, 2011 American Community Survey & Kaiser Report	http://www.statehealthfacts.org/profileind.jsp?ind=290&cat=6&rgn=40	SourcesForEconomicEstimates\C7_NumMedicareBen.statehealthfacts.org_profileind.pdf	2,350,558	C7
Covered by Medicare - Cost of Healthcare	Source: U.S. Census Bureau, 2011 American Community Survey & Kaiser Report	http://factfinder2.census.gov/aces/tableselvices/jsf/pages/productview.xhtml?pid=ACS_11_1YR_S070&prodType=table	http://www.statehealthfacts.org/profileind.jsp?ind=290&cat=6&rgn=40	23,771,000,000	E7
Uninsured - Number of uninsured	Source: U.S. Census Bureau, 2011 American Community Survey & Kaiser Report	http://www.statehealthfacts.org/profileind.jsp?sub=40&rgn=40&cat=3	SourcesForEconomicEstimates\C8_Uninsured.statehealthfacts.org_profileind.pdf	1,358,700	C7
Uninsured - Cost of uninsured - Per person health costs time uninsured	Source: U.S. Census Bureau, 2011 American Community Survey & Kaiser Report	http://www.statehealthfacts.org/profileind.jsp?sub=40&rgn=40&cat=3	SourcesForEconomicEstimates\C8_Uninsured.statehealthfacts.org_profileind.pdf	11,186,177,100	E7

Figure 54. Estimated breakdown of healthcare dollar spent in Pennsylvania (Items in gray are state-funding and in the budget.)

	A	B	C	D	E
1	Line #	Assumption: Number of people in Pennsylvania...	Number of people impacted	Percent of Population	(all dollars in thousands) Base Cost (current)
2	2	Total PA population	12,702,379	(4.08% of US population)	\$104,578,686
3	3	Covered by Medicaid (adults)	2,036,682	16.03%	\$6,071,449
4	4	Covered by Medicaid or CHIPS (children)	194,895	1.53%	\$123,195
5	5	Covered by State-Paid Insurance	80,000	0.63%	\$355,200
6	6	Covered by Private Insurance	3,151,000	24.81%	\$17,696,016
7	7	Covered by Medicare	2,350,558	18.50%	\$23,771,000
8	8	Uninsured	1,358,700	10.70%	\$11,186,177
9	9	Out of pocket & Other	3,530,544	27.79%	\$45,375,649
10	10	Totals	12,702,379	100.00%	\$104,578,686

To determine the amount of telehealth dollars in Pennsylvania's budget, the research team first looked at the total budget for the Department of Public Welfare (DPW), where most of the health dollars are located. Health dollars are approximately 62 percent of DPW's budget; \$6.5 billion out of the \$10.6 billion budgeted. The categories that were counted along with their line numbers from the Governor's Enacted Line Item Budget of 2012-2013 (as of April 15, 2013) are listed in Figure 55.

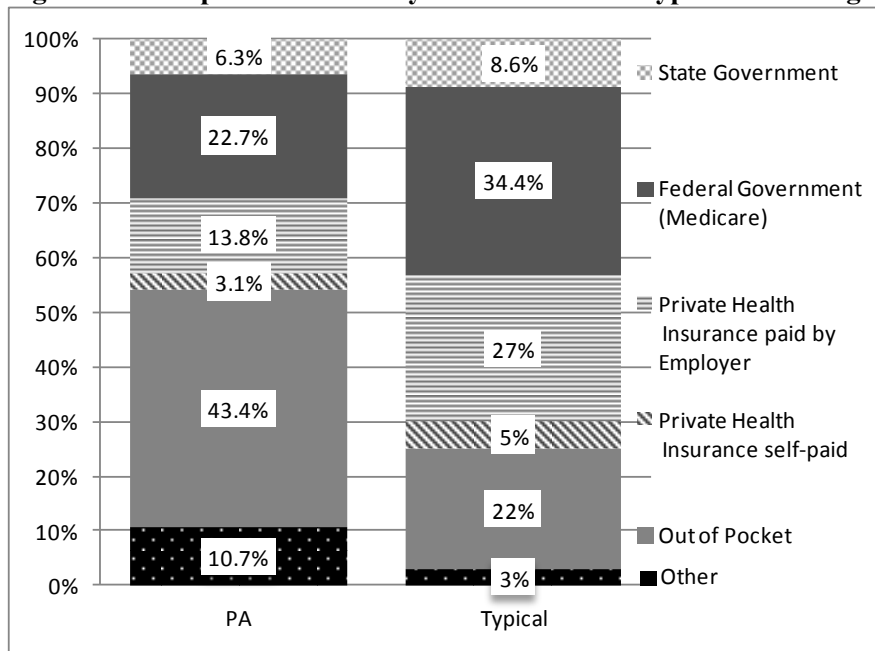
Figure 55. Line items chosen from PA DPW 2012-2013 budget.

Medicaid (Medical Assistance) from DPW budget (in thousands)	
326 Medical Assistance - Outpatient	\$ 360,137
327 Medical Assistance - Inpatient	\$ 204,667
328 Medical Assistance - Capitation	\$ 3,780,674
329 Medical Assistance - Obstetrics and Neonatal Services	\$ 3,681
330 Long-Term Care	\$ 765,923
331 Home and Community-Based Services	\$ 174,512
332 Long-Term Care Managed Care	\$ 75,872
333 Medical Assistance - Hospital-Based Burn Centers	\$ 3,782
334 Medical Assistance - Critical Access Hospitals	\$ 4,076
335 Medical Assistance - Trauma Centers	\$ 8,656
336 Medical Assistance - Academic Medical Centers	\$ 12,618
337 Medical Assistance - Physician Practice Plans	\$ 7,937
338 Medical Assistance - Transportation	\$ 72,799
339 Expanded Medical Services for Women	\$ 5,044
341 Special Pharmaceutical Services	\$ 2,545
342 Behavioral Health Services	\$ 43,117
362 Medical Assistance - Workers with Disabilities	\$ 33,494
363 Health Care Clinics	\$ 1,000
Payment to Federal Government - Medicare Drug Program	\$ 510,915
Total.....	\$ 6,071,449

The uninsured cost was assessed by taking the average cost of healthcare per person and multiplying by the number of insured. This number should be relatively conservative because, according to the Kiser Foundation, the uninsured tend to delay treatment and avoid prevention activities until they must go to the hospital, which results in increased costs for care. The \$45.38 billion for the Out of Pocket and Other category is simply the total healthcare costs minus the estimated costs for the other categories.

Using these numbers and the estimates of Roth (2010), it is possible to see how Pennsylvania stacks up against the average or typical state in "who pays for what" in terms of budget. In Figure 56, it may appear that Pennsylvanians spend much more out of pocket than is typical, and Pennsylvania employers spend a little less, but that may be a reflection more of the transition phase during high unemployment than an ongoing trend. The state and the federal government spent a little less in Pennsylvania than in the average state. Again, due to new legislation, the portions may change.

Figure 56. Comparison of Pennsylvania's Cost to "Typical" Funding for Healthcare.



Future Cost of Health Based Upon Modality

To effectively estimate the cost of telehealth, it is important to estimate the costs of specific lifestyles, conditions, and illnesses, especially chronic issues. As pointed out in the literature and the systematic review, not only do chronic illnesses and unhealthy lifestyles impact the healthcare dollar the most, they are also the dollars that are most impacted by telehealth overall. The healthcare costs based on lifestyle are shown in Figure 57, and the healthcare costs based on condition are shown in Figure 58.

Estimates of the impact of these healthcare dollars vary tremendously. The research team looked for estimates that were from a credible source (preferring government estimates over advocacy groups when available) and that were as up-to-date as possible. The estimates ranged from 2007 to 2012, with the majority in 2008 and 2009. It would be an impossible task to obtain estimates for all of these different issues from the same timeframe, and it would be ineffective to try and make adjustments for a 1 or 2 year difference. For purposes of the model, the estimates were determined to be sufficient.

Figure 57. Sources for Healthcare Cost Estimates by Lifestyle

Assumption Name	Source	URL	Static Local Link	Actual Number	Cell Reference
Healthy, with Healthy Lifestyles Number of People	Healthy People 2020	http://healthypeople.gov/2020/topics/objectives/2020/overview.aspx?topicid=33	SourcesForEconomicEstimates\C11_healthypeople.gov_2020.pdf	20%	C11
Healthy, with Healthy Lifestyles Costs	Kaiser Foundation Report: Healthcare Costs A Primer	http://www.kfi.org/insurance/upload/7670-03.pdf	SourcesForEconomicEstimates\KaiserHealthcareCostsPrimer_7670-03.pdf	5%	E11
Sedentary lifestyle Number of People	PA Dept of Health: Bureau of Health Promotion and Risk Reduction, Chronic Disease Burden Report Pg 15	http://www.health.state.pa.us/pdf/ChronicDiseaseBurdenReport.pdf	SourcesForEconomicEstimates\PA_ChronicDiseaseBurdenReport.pdf	26%	D12
Sedentary lifestyle Costs	Public Health, Research Practice Policy from CDC	http://www.cdc.gov/pcd/issues/2011/jul/pdf/11_0_0243.pdf	SourcesForEconomicEstimates\E12_Freudenberg_Olden_PreventingChronicDisease_10_0243.pdf	75%	E12
Poor nutrition Number of People	PA Dept of Health: Bureau of Health Promotion and Risk Reduction, Chronic Disease Burden Report Pg 15	http://www.health.state.pa.us/pdf/ChronicDiseaseBurdenReport.pdf	SourcesForEconomicEstimates\PA_ChronicDiseaseBurdenReport.pdf	76%	D13
Poor nutrition Costs	Public Health, Research Practice Policy from CDC	http://www.cdc.gov/pcd/issues/2011/jul/pdf/11_0_0243.pdf	SourcesForEconomicEstimates\E12_Freudenberg_Olden_PreventingChronicDisease_10_0243.pdf	75%	E13
Smokers Number of People	United Health Foundation: Americas Health Rankings	http://www.americashealthrankings.org/PA/2012	SourcesForEconomicEstimates\PA_Health.americashealthrankings.pdf	22%	D14
Smokers Costs	Pennsylvania Health Care Cost Containment Council Chronic Care Report Pg 31	http://www.phc4.org/reports/chroniccare/10/docs/chroniccare2010report.pdf	SourcesForEconomicEstimates\ChronicCare2010report.pdf	5,190,000,000	E14
Overweight or obese Number of People	Pennsylvania Health Care Cost Containment Council Chronic Care Report Pg 10	http://www.phc4.org/reports/chroniccare/10/docs/chroniccare2010report.pdf	SourcesForEconomicEstimates\ChronicCare2010report.pdf	64%	D15
Overweight or obese Costs	CDC Article on Obesity	http://www.cdc.gov/od/obesity/adult/causes/index.html	SourcesForEconomicEstimates\E15_cdc.gov_obesity_adult_causes_index.pdf	147,000,000,000	E15
Excessive drinkers Number of People	United Health Foundation: Americas Health Rankings	http://www.americashealthrankings.org/PA/2014	http://www.health.state.pa.us/pdf/ChronicDiseaseBurdenReport.pdf	22%	D16
Excessive drinkers Costs	CDC Article on Excessive Alcohol Costs	http://www.cdc.gov/features/alcoholconsumption/	SourcesForEconomicEstimates\E16_ExcessiveDrivingCosts_CDC.pdf	998,151,000	E16

Note that the numbers and costs are not mutually exclusive, and cannot be summed to gain a total cost. The last item itself, multiple conditions, was the estimate of costs for those with six or more conditions, so by definition is a repeat of several of the previous categories. Also note that the number in the table is the number reported from the source so that it could easily be backtracked if necessary. Adjustments (such as multiplying the percent times the Pennsylvania population or costs) were made within the model itself.

Figure 58. Sources for Healthcare Cost Estimates by Chronic Illness

Assumption Name	Source	URL	Static Local Link	Actual Number	Cell Reference
Diabetes or metabolic issues Number of People	United Health Foundation: Americas Health Rankings	http://www.americashealthrankings.org/PA/2012	SourcesForEconomicEstimates\PA_HealthAmericasHealthRankings.pdf	9.50%	D17
Diabetes or metabolic issues Costs	PA Chronic Care Report - PA Healthcare Cost Containment Council (Pg 10)	http://www.phc4.org/reports/chroniccare/10/docs/chroniccare2010report.pdf	SourcesForEconomicEstimates\ChronicCare2010report.pdf	10%	E17
Invasive cancer Number of People	An Analysis of Cancer Incidence by PA County from Pennsylvania Department of Health Bureau of Health Statistics and Research, Pg 20	http://www.portal.state.pa.us/portal/server.pt?open=8&objID=127125&mode=2	SourcesForEconomicEstimates\D18_Analysis_of_Cancer_Incidence_in_PA_Counties_2005_2009.pdf	371991	D18
Invasive cancer Costs	PA Dept of Health: Bureau of Health Promotion and Risk Reduction, Chronic Disease Burden Report Pg 90	http://www.health.state.pa.us/pdf/ChronicDiseaseBurdenReport.pdf	SourcesForEconomicEstimates\PA_ChronicDiseaseBurdenReport.pdf	4,000,000,000	E18
Cardiovascular Disease or Cardiac problems (heart or stroke) Number of People	PA Dept of Health: Bureau of Health Promotion and Risk Reduction, Chronic Disease Burden Report Pg 33	http://www.health.state.pa.us/pdf/ChronicDiseaseBurdenReport.pdf	SourcesForEconomicEstimates\PA_ChronicDiseaseBurdenReport.pdf	13%	D19
Cardiovascular Disease or Cardiac problems (heart or stroke) Costs	PA Dept of Health: Bureau of Health Promotion and Risk Reduction, Chronic Disease Burden Report Pg 30	http://www.health.state.pa.us/pdf/ChronicDiseaseBurdenReport.pdf	SourcesForEconomicEstimates\PA_ChronicDiseaseBurdenReport.pdf	11,000,000,000	E19
Asthma and chronic lower respiratory disease Number of People	PA Chronic Care Report - PA Healthcare Cost Containment Council (Pg 21)	http://www.phc4.org/reports/chroniccare/10/docs/chroniccare2010report.pdf	SourcesForEconomicEstimates\ChronicCare2010report.pdf	9.30%	D20
Asthma and chronic lower respiratory disease Costs	PA Chronic Care Report - PA Healthcare Cost Containment Council (Pg 21)	http://www.phc4.org/reports/chroniccare/10/docs/chroniccare2010report.pdf	SourcesForEconomicEstimates\ChronicCare2010report.pdf	683,500,000	E20
Alzheimers & Dementia Number of People	Alzheimers Association	http://www.alz.org/alzheimers_disease_facts_and_figures.asp#quickFacts	SourcesForEconomicEstimates\E21_alz_1-fstatesheets-39.pdf	211,120	C21
Alzheimers & Dementia Costs	Alzheimers Association	http://www.alz.org/alzheimers_disease_facts_and_figures.asp#quickFacts	SourcesForEconomicEstimates\E21_alz_1-fstatesheets-39.pdf	5,765,200	E21
Multiple chronic conditions Number of People	Public Health, Research Practice Policy from CDC	http://www.cdc.gov/pd/issu/2011/jul/pdf/10_0243.pdf	SourcesForEconomicEstimates\E22_Freudenberg_Olden_PreventingChronicDisease_10_0243.pdf	13%	D22

Using these sources, therefore, the estimated numbers of people and costs are shown in Figure 59. Sedentary lifestyle and poor nutrition have the highest impact on costs because they are the precursors to so many of the other chronic illnesses. As noted in the literature review, 80 percent of chronic illnesses are preventable through lifestyle changes, namely good nutrition and daily exercise. Chronic illnesses consume 75 percent of healthcare dollars, so the impact of changing this trend adds up to many dollars. Additionally, 50 percent of healthcare dollars are spent on less than 5 percent of the population, many of them spent on people with chronic illnesses and in end-of-life care where the additional spending does not translate into value for either quality or quantity of life. The majority of people, when asked, prefer palliative care, but less than 20 percent actually get palliative care.

The impact of chronic illnesses and the ability to prevent them is directly related to the economic impact of telehealth. As noted in the search of the literature (specifically the *Telehealth Cases and Projects: Focus on Prevention and Wellness* section starting on page 30) the impact that telehealth can have on implementing major changes in the current trends of healthcare is larger than any other impact telehealth could have. The resulting model of the economic impact of telehealth demonstrates the possibility for telehealth to provide education and information, implement changes in the behavioral risk measurements, and decrease the incidence of chronic disease.

Figure 59. Estimates of PA Healthcare Costs based on Lifestyle and Modality.

	A	B	C	D	E	F
1	Line #	Assumption: Number of people in Pennsylvania...	Number of people impacted	Percent of Population	(all dollars in thousands) Base Cost (current)	Percent of Costs
10	10	Totals	12,702,379	100.00%	\$104,578,686	100.00%
11	11	Healthy, with Healthy Lifestyles	2,540,476	20.00%	\$5,228,934	5.00%
12	12	Sedentary lifestyle	3,328,023	26.20%	\$78,434,015	75.00%
13	13	Poor nutrition	9,641,106	75.90%	\$78,434,015	75.00%
14	14	Smokers	2,845,333	22.40%	\$5,190,000	4.96%
15	15	Overweight or obese	8,180,332	64.40%	\$5,968,200	5.71%
16	16	Excessive drinkers	2,769,119	21.80%	\$998,151	0.95%
17	17	Diabetes and metabolic syndrome	1,206,726	9.50%	\$10,457,869	10.00%
18	18	Invasive cancer	371,991	2.93%	\$4,000,000	3.82%
19	19	Cardiovascular & Cardiac	1,651,309	13.00%	\$11,000,000	10.52%
20	20	Asthma and chronic lower respiratory disease	1,181,321	9.30%	\$683,500	0.65%
21	21	Alzheimers and dementia	211,120	1.66%	\$5,765	0.01%
22	22	Multiple chronic conditions	1,651,309	13.00%	\$5,684,000	5.44%

The rapidly growing cost of healthcare has been well documented. Most point to the cost of new treatments and technology as well as the growing senior population as the main cause for the growing cost. There is no way to change the growing demographics of the aging of the baby boomer generation. Applying new technologies to treatments without modifying methodology simply adds to costs.

But the review of the literature points to a way to change the different aspects of healthcare costs, especially in changing the financial funding sources for healthcare. The main ways that telehealth can impact healthcare is by mitigating the following: 1) Administrative Waste and Overtreatment; 2) Wellness, Healthy Lifestyle, and Prevention; 3) Electronic Health Record Integration, 4) Telehealth Implementations, and 5) the Combination of All of These Issues.

The research team felt that by applying telehealth specifically to these issues, society had the greatest chance of making an impact. Telehealth technology, properly implemented and following best practices, could possibly make inroads into intractable problems influencing the rapid rise in healthcare costs.

The team identified credible sources of estimates for the impact of making changes in the current trends of rising healthcare costs. Those sources are listed in Figure 60.

Figure 60. Sources for Baseline PA Healthcare Cost Estimate

Colum Letter	Change Made	Source of Estimate	URL of source	Local Link to Source
G	Base Next Yr Cost	Extrapolation from the Urban Institute estimates (1/5 of 5 year estimate)	http://www.urban.org/publications/412049.html	SourcesForEconomicEstimates\H_UrbanInstitute_412049_cost_of_failure.pdf
H	Base Cost Yr Five	Urban Institute Report, The Cost of Failure to Enact Health Reform. page 52.	http://www.urban.org/publications/412049.html	SourcesForEconomicEstimates\H_UrbanInstitute_412049_cost_of_failure.pdf
I	Base Cost Yr Twenty	Health Research and Educational Trust, Aging adds 20% to cost.	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1955745/	SourcesForEconomicEstimates\I_20Yr_ncbi.nlm.nih.pdf

Using the overarching estimates described, the research team used a trend analysis that provides one potential answer to the question about using telehealth more widely to specifically combat these issues?

To provide a baseline, the research used estimates from the Urban Institute regarding the costs of healthcare should healthcare reform fail. Those estimates are shown in Figure 61. The Urban Institute provided three scenarios; worst case, best case, and intermediate case. The team chose the intermediate case to be on the conservative side. However, the Urban Institute estimates are based on the *non-elderly* population. The elderly population will grow, in actuality, and the costs are going to increase much faster than the estimates due to that fact. Therefore, based upon the estimate from the Health Research and Educational Trust, another 20 percent was added to account for the rising population of the baby boomers in the ranks of the elderly.

Figure 61. Health Cost Impact of No Change: Aggregate Health Spending for Non-Elderly Population (in billions) from Urban Institute.

	2010	2015	% change 2010-2015	2020	% change 2015-2020	% change 2010-2020
Worst Case						
Medicaid/SCHIP	\$278	\$403	45.1%	\$576	43.1%	107.6%
Uncompensated Costs	\$64	\$97	52.3%	\$140	43.5%	118.5%
Employer	\$430	\$608	41.5%	\$851	40.0%	98.1%
Individual and Family	\$315	\$422	34.1%	\$564	33.6%	79.2%
Intermediate Case						
Medicaid/SCHIP	\$278	\$375	35.0%	\$509	35.7%	83.2%
Uncompensated Costs	\$64	\$90	41.4%	\$121	33.6%	88.9%
Employer	\$430	\$596	38.6%	\$820	37.6%	90.8%
Individual and Family	\$315	\$408	29.6%	\$529	29.6%	68.0%
Best Case						
Medicaid/SCHIP	\$278	\$353	27.2%	\$442	25.2%	59.3%
Uncompensated Costs	\$64	\$84	31.6%	\$111	32.1%	73.9%
Employer	\$430	\$560	30.3%	\$719	28.4%	67.3%
Individual and Family	\$315	\$387	22.8%	\$471	21.8%	49.6%

Source: Urban Institute analysis, HIPS M 2010.

Because the Urban Institute did its research using 2010, 2015, and 2020 numbers, the team had to extrapolate the percentages for 1, 5, and 20 years. The extrapolated numbers are shown in Figure 62.

Figure 62. Percent Change Extrapolated from Urban Institute Estimates

	1 Yr Change	5 Yr Change	20 yr Change
Medicaid/SCHIP	8.40%	42.00%	199.68%
Out of Pocket	9.94%	49.68%	213.36%
Private Insurance	9.26%	46.32%	217.92%

The goal of providing the baseline is to show the impact of the different *Telehealth Program Impact Scenarios* on the baseline (what the numbers would be if no changes were made). The *Telehealth Program Impact Scenarios (TPIS)* are the potential different scenarios for the value added activities from a wider implementation of telehealth.

The baseline numbers are shown in Figure 63, with the total cost of the 1st year being \$114.4 billion, the 5th year being \$153.6 billion, and the 20th year being \$324.4 billion.

Figure 63. Baseline PA Healthcare Costs for 1, 5, and 20 years. Gray numbers indicate Pennsylvania budget base cost.

A	B	E	F	G	H	I
Line #	Pennsylvania Healthcare Costs	(all dollars in thousands) Base Cost (current)	Percent of Costs	Base Next Yr Cost	Base Cost Yr Five	Base Cost Yr Twenty
2	Total PA population	\$104,578,686		\$114,388,048	\$153,625,495	\$324,431,607
3	Covered by Medicaid (adults)	\$6,071,449	5.81%	\$6,581,451	\$8,621,458	\$18,194,918
4	Covered by Medicaid or CHIPS (children)	\$123,195	0.12%	\$133,543	\$174,937	\$369,191
5	Covered by State-Paid Insurance	\$355,200	0.34%	\$388,106	\$519,729	\$1,129,252
6	Covered by Private Insurance	\$17,696,016	16.92%	\$19,335,375	\$25,892,811	\$56,259,174
7	Covered by Medicare	\$23,771,000	22.73%	\$25,767,764	\$33,754,820	\$71,236,933
8	Uninsured	\$11,186,177	10.70%	\$12,297,636	\$16,743,470	\$35,053,005
9	Out of pocket & Other	\$45,375,649	43.39%	\$49,884,174	\$67,918,272	\$142,189,134
10	Totals	\$104,578,686	100.00%	\$114,388,048	\$153,625,495	\$324,431,607

Lines 3, 4, and 7 received the percent increase from Medicaid/SCHIP. The thinking for Medicare was that it would more closely follow Medicaid increases rather than private health insurance or out of pocket increases. Lines 5 and 6 used the private insurance cost increase, and the uninsured and out of pocket and other used the out of pocket increases. The baseline to the Pennsylvania Governor's budget if reform were not implemented would be healthcare costs going from \$6.5 billion to \$7.1 billion the 1st year, \$9.3 billion a year by the 5th year, and \$19.7 billion annually by the 20th year.

Figure 64. Healthcare costs of various modalities based upon estimate increases.

A	B	E	F	G	H	I
Line #	Pennsylvania Healthcare Costs	(all dollars in thousands) Base Cost (current)	Percent of Costs	Base Next Yr Cost	Base Cost Yr Five	Base Cost Yr Twenty
10	Totals	\$104,578,686	100.00%	\$114,388,048	\$153,625,495	\$324,431,607
11	Healthy, with Healthy Lifestyles	\$5,228,934	5.00%	\$5,719,402	\$7,681,275	\$16,221,580
12	Sedentary lifestyle	\$78,434,015	75.00%	\$85,791,036	\$115,219,122	\$243,323,705
13	Poor nutrition	\$78,434,015	75.00%	\$85,791,036	\$115,219,122	\$243,323,705
14	Smokers	\$5,190,000	4.96%	\$5,676,816	\$7,624,080	\$16,100,795
15	Overweight or obese	\$5,968,200	5.71%	\$6,528,010	\$8,767,252	\$18,514,984
16	Excessive drinkers	\$998,151	0.95%	\$1,091,776	\$1,466,278	\$3,096,537
17	Diabetes and metabolic syndrome	\$10,457,869	10.00%	\$11,438,805	\$15,362,550	\$32,443,161
18	Invasive cancer	\$4,000,000	3.82%	\$4,375,195	\$5,875,977	\$12,409,091
19	Cardiovascular & Cardiac	\$11,000,000	10.52%	\$12,031,787	\$16,158,937	\$34,125,000
20	Asthma and chronic lower respiratory disease	\$683,500	0.65%	\$747,612	\$1,004,058	\$2,120,403
21	Alzheimers and dementia	\$5,765	0.01%	\$6,306	\$8,469	\$17,885
22	Multiple chronic conditions	\$5,684,000	5.44%	\$6,217,153	\$8,349,764	\$17,633,318

The healthcare cost increases based upon the modalities are shown in Figure 64. These numbers are based on the percentage of costs, and have not been adjusted in any other way.

Telehealth Program Impact Scenarios

To assess the more wide spread impact of telehealth adoption, the research team had to consider the use of those technologies and not necessarily the technologies themselves. Based on the literature review and the interview analysis, the team determined that four major areas could be separated into different *Telehealth Program Impact Scenarios* (TPIS):

- Telehealth to lower Administrative Costs and Overtreatment Practices.
- Telehealth for Wellness and Prevention programs.
- Telehealth to integrate EHR into a single national Electronic Health Record system.
- Telehealth for Videoconferencing and Remote Monitoring Implementation

Then the cost impact was analyzed if all of the activities were combined, adding a 5th TPIS to the list:

- Combination of All of the Above

The research team independently assessed the cost of each TPIS based on the impact to the baseline annual costs estimated in the model. First, each of the different aspects were assessed as if the other TPIS were not implemented, and then the combined impact was assessed as if all TPIS were implemented together. The source of the assumptions used for each TPIS is in Figure 65.

Figure 65. Source of assumptions for Telehealth Program Impact Scenarios.

Column Letter	Change Made	Source of Estimate	URL of source	Local Link to Source
J	Telehealth to lower Administrative Costs and Overtreatment Practices. 1 Year	Berwick & Hackbarth, Journal of American Medical Association: 20 % savings from administrative waste.	http://www.ncbi.nlm.nih.gov/pubmed/22419800	SourcesForEconomicEstimates\J_ncbi.nlm.nih.pdf
K	Telehealth to lower Administrative Costs and Overtreatment Practices. 5 & 20 Years	Elizabeth Wikler, Peter Basch, and David Cutler from American Progress center on cutting administrative costs. 25% savings (ranging from 18% to 30 %) from administrative waste.	http://www.americanprogress.org/wp-content/uploads/issues/2012/06/pdf/paper_cuts_final.pdf	SourcesForEconomicEstimates\NO_AdminCostSavings_americanprogress.pdf
L				
M	Telehealth for Wellness & Prevention programs.	Leonard L. Berry, Ann M. Mirabito, and William B. Baun, Hard Return on Wellness programs, Harvard Business Review, ranging from \$2.71 per dollar invested to \$6 per dollar invested.	http://hbr.org/2010/12/whats-the-hard-return-on-employee-wellness-programs/ar/1	SourcesForEconomicEstimates\MNO_HealthcostImproveLifestyle_hbr.pdf
N				
P	Telehealth to integrate EHR into a single national Electronic Health Record system. 1 Year	David St. Clair, chief executive of health tech company MEDecision, conducted Christiana Care study: \$100 per patient per year. Sudhakar Ram, CEO of health IT firm Mastek, put that figure as high as \$200 per patient per year. David Goldman article from CNN Money.	http://newamerica.net/publications/policy/the_cost_of_connectivity	SourcesForEconomicEstimates\P_CostOfConnectivity_newamerica.pdf
Q	Telehealth to integrate EHR into a single national Electronic Health Record system. 5 & 20 Years			
R			http://money.cnn.com/2009/08/21/technology/electronic_health_record_cost_savings/index.htm	SourcesForEconomicEstimates\Q_EHR_Savings_money.cnn.pdf
S	Telehealth for Videoconferencing & Remote Monitoring Implementation to the home	Mohit Kaushal, Digital Healthcare Director for the Federal Communications Commission (FCC), said at the hearing that one study claimed remote patient monitoring could generate net savings of roughly \$200 billion over 25 years from just four chronic conditions.	http://www.executivevm.com/article/Telehealth-and-e-care-The-next-generation-of-healthcare-technologies/	SourcesForEconomicEstimates\K&L_SaveOnChronic_executivevm.pdf
T				
V	Combination of all	Paul Strassman discussion of residual values for IT projects that allow synergistic impacts beyond the original investment window. A 31% benefit to expense ratio jumps to 81% when residuals are taken into account. Pg 331)	http://books.google.com/books/about/The_squandered_computer.html?id=wICofXSOtJQC	SourcesForEconomicEstimates\VWX_Strassman.PDF
W				
X				

Telehealth to Lower Administrative Costs and Overtreatment Practices.

As discussed earlier, telehealth has been proposed as a solution to the problem of administrative costs and overtreatment. While there is some overlap with this TPIS and the others (because an EHR is one of the major telehealth technologies that would impact administrative costs, and wellness and prevention programs is one factor in eliminating overtreatment practices) there are many telehealth technologies that could be used to lower administrative costs and eliminate overtreatment practices outside of those two. For example, telehealth can be used to gather more statistics on treatment effectiveness. This is not necessarily part of EHR (though it might make that data gathering easier), but it can go a long way toward eliminating less successful treatments. Telehealth could be used for physicians to share the results of diagnostic tests rather than having each one order their own. Finally, telehealth could be used to eliminate much of the time investment in scheduling by allowing patients to schedule themselves for appointments, which would lower the cost of administrative personnel.

Based on the research, wider telehealth implementation focused on these activities would conservatively lower overall costs by 20 to 25 percent. The team chose to build into the model the lowest percentage the 1st year, the highest percentage the 20th year, and extrapolate the 5th year in between the two. The numbers are shown in Figure 66.

Figure 66. Impact of Eliminating Overtreatment and Administrative Waste in PA Healthcare

A	B	G	H	I	J	K	L
e #	Pennsylvania Healthcare Costs	Base Year One Cost	Base Cost Yr Five	Base Cost Yr Twenty	Lower Admin & Overtreatment Year One Cost	Lower Admin & Overtreatment Year Five Cost	Lower Admin & Overtreatment Year Twenty Cost
2	Total PA population	\$114,388,048	\$153,625,495	\$324,431,607	\$91,510,438	\$118,291,631	\$243,323,705
3	Covered by Medicaid (adults)	\$6,581,451	\$8,621,458	\$18,194,918	\$5,265,161	\$6,638,522	\$13,646,189
4	Covered by Medicaid or CHIPS (children)	\$133,543	\$174,937	\$369,191	\$106,835	\$134,701	\$276,893
5	Covered by State-Paid Insurance	\$388,106	\$519,729	\$1,129,252	\$310,485	\$400,191	\$846,939
6	Covered by Private Insurance	\$19,335,375	\$25,892,811	\$56,259,174	\$15,468,300	\$19,937,464	\$42,194,381
7	Covered by Medicare	\$25,767,764	\$33,754,820	\$71,236,933	\$20,614,211	\$25,991,211	\$53,427,700
8	Uninsured	\$12,297,636	\$16,743,470	\$35,053,005	\$9,838,109	\$12,892,472	\$26,289,753
9	Out of pocket & Other	\$49,884,174	\$67,918,272	\$142,189,134	\$39,907,339	\$52,297,069	\$106,641,851
10	Totals	\$114,388,048	\$153,625,495	\$324,431,607	\$91,510,438	\$118,291,631	\$243,323,705

Telehealth for Wellness and Prevention programs.

The impact of telehealth on the Wellness and Prevention programs used the estimates from a December 2010 Harvard Business Review article by Leonard L. Berry, Ann M. Mirabito, and William B. Baun on the hard dollar return on wellness programs, ranging from \$2.71 per dollar invested to \$6 per dollar invested. Again, the team chose to use the lower estimate in the 1st year assumption, the larger estimate in the 20th year assumption, and an extrapolation number in the 5th year assumption (Figure 67).

Figure 67. PA Healthcare Cost Impact of Wellness, Health Lifestyle, and Prevention

A	B	G	H	I	M	N	O
Line #	Pennsylvania Healthcare Costs	Base Year One Cost	Base Cost Yr Five	Base Cost Yr Twenty	Wellness & Healthy Lifestyle Prevention Year One Cost	Wellness & Healthy Lifestyle Prevention Five Yr Cost	Wellness & Healthy Lifestyle Prevention Twenty Yr Cost
2	Total PA population	\$114,388,048	\$153,625,495	\$324,431,607	\$94,942,080	\$94,479,680	\$129,772,643
3	Covered by Medicaid (adults)	\$6,581,451	\$8,621,458	\$18,194,918	\$5,462,604	\$5,302,196	\$7,277,967
4	Covered by Medicaid or CHIPS (children)	\$133,543	\$174,937	\$369,191	\$110,841	\$107,586	\$147,676
5	Covered by State-Paid Insurance	\$388,106	\$519,729	\$1,129,252	\$322,128	\$319,633	\$451,701
6	Covered by Private Insurance	\$19,335,375	\$25,892,811	\$56,259,174	\$16,048,361	\$15,924,079	\$22,503,670
7	Covered by Medicare	\$25,767,764	\$33,754,820	\$71,236,933	\$21,387,244	\$20,759,214	\$28,494,773
8	Uninsured	\$12,297,636	\$16,743,470	\$35,053,005	\$10,207,038	\$10,297,234	\$14,021,202
9	Out of pocket & Other	\$49,884,174	\$67,918,272	\$142,189,134	\$41,403,864	\$41,769,737	\$56,875,654
10	Totals	\$114,388,048	\$153,625,495	\$324,431,607	\$94,942,080	\$94,479,680	\$129,772,643

While the topic was covered in the literature, it should be reiterated that the wellness and prevention programs are the optimum use for telehealth, a way of cost effectively providing the health education necessary to the patient, something that is not currently possible. Most of the wellness programs involve an intense one-on-one healthy lifestyle coaching situation with biomarker monitoring, which has been shown to be very effective at modifying the behavior of the patient. The coaching can be cost effective when using telehealth, but if this program were to rely on individual face-to-face physical meetings with physicians, the cost would be prohibitive, and the savings would be much less.

Telehealth to integrate EHR into a single national Electronic Health Record system.

According to the literature review, telehealth adoption would accelerate if data standards were published so that all the different EHR systems could be integrated into a single EHR system. While EHR systems can provide a tiny modicum of savings just through saved time when accessing patient records, the cost

benefit analysis doesn't actually show a positive until the systems integrate. The U.S. government recognizes that, and has made the process financially beneficial for hospitals and health providers by providing incentive payments in the short term, and applying punitive fees and costs in the long term for those who don't implement them. This assessment makes the assumption that national standards are published and enforced, which it should be noted is currently not the case. The team estimated that the \$100 to \$200 per person savings used in this model would decrease by 90 percent, down to \$10 or \$20 per person savings if a national standard at the field level is not published before more than 75 percent of the systems have been implemented.

Figure 68. PA Health Cost Impact of Integrated Electronic Health Records

A	B	G	H	I	P	Q	R
Line #	Pennsylvania Healthcare Costs	Base Year One Cost	Base Cost Yr Five	Base Cost Yr Twenty	EHR Integration Year One Cost	EHR Integration Cost Yr Five	EHR Integration Cost Yr Twenty
2	Total PA population	\$114,388,048	\$153,625,495	\$324,431,607	\$113,117,810	\$144,098,711	\$273,622,091
3	Covered by Medicaid (adults)	\$6,581,451	\$8,621,458	\$18,194,918	\$6,377,783	\$7,093,946	\$10,048,190
4	Covered by Medicaid or CHIPS (children)	\$133,543	\$174,937	\$369,191	\$114,054	\$28,766	-\$410,389
5	Covered by State-Paid Insurance	\$388,106	\$519,729	\$1,129,252	\$380,106	\$459,729	\$809,252
6	Covered by Private Insurance	\$19,335,375	\$25,892,811	\$56,259,174	\$19,020,275	\$23,529,561	\$43,655,174
7	Covered by Medicare	\$25,767,764	\$33,754,820	\$71,236,933	\$25,532,708	\$31,991,902	\$61,834,701
8	Uninsured	\$12,297,636	\$16,743,470	\$35,053,005	\$12,161,766	\$15,724,445	\$29,618,205
9	Out of pocket & Other	\$49,884,174	\$67,918,272	\$142,189,134	\$49,531,119	\$65,270,364	\$128,066,958
10	Totals	\$114,388,048	\$153,625,495	\$324,431,607	\$113,117,810	\$144,098,711	\$273,622,091

If the national standard gets published, in 5 years Pennsylvania would be able to save over \$10 billion a year by using the EHR systems. By the 20th year, the savings would be over \$50 billion each year.

Telehealth for Videoconferencing and Remote Monitoring Implementation

The quintessential use for telehealth is being able to provide regular, frequent, and ongoing healthcare to everyone through videoconferencing and remote monitoring, saving in-person appointments for just those issues that can't be diagnosed or treated through a videoconference link. Some programs show great promise. Currently these programs are not feasible due to all of the reasons discussed earlier, including broadband access, definition of telehealth, and legal issues involving licensure. However, if these obstacles were removed, telehealth would save between \$4 billion and \$8 billion each year by the 20th year. This assumes that the current method of treatment (and not a switch to prevention methods) has continued, accounting for the relatively low rate of savings. Simply adding telehealth technology to the current healthcare model does not save a tremendous amount. Indeed, earlier versions of the healthcare estimates using a slightly different set of assumptions indicated that healthcare costs would go up if telehealth were simply added to the already existing healthcare treatment model.

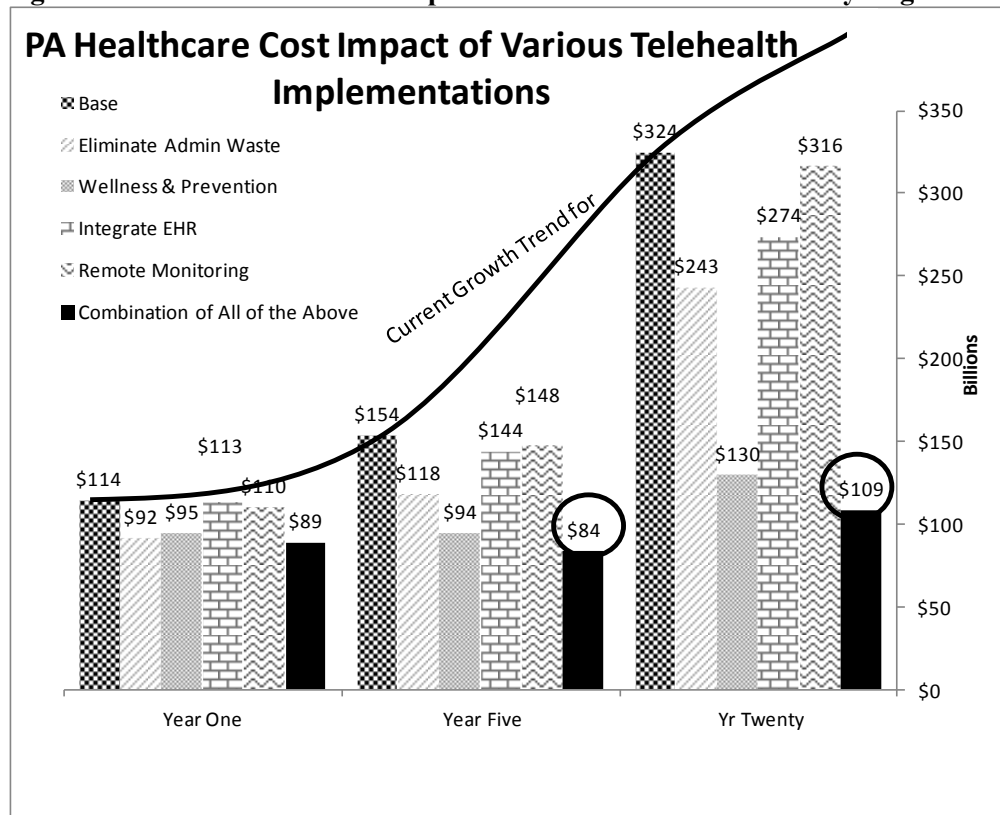
Figure 69. PA Health Cost Impact of Videoconferencing and Remote Monitoring

A	B	G	H	I	S	T	U
Line #	Pennsylvania Healthcare Costs	Base Year One Cost	Base Cost Yr Five	Base Cost Yr Twenty	Telehealth Implemented Year One Cost	Telehealth Implemented Cost Yr Five	Telehealth Implemented Cost Yr Twenty
2	Total PA population	\$114,388,048	\$153,625,495	\$324,431,607	\$110,328,048	\$147,535,495	\$316,311,607
3	Covered by Medicaid (adults)	\$6,581,451	\$8,621,458	\$18,194,918	\$2,521,451	\$2,531,458	\$10,074,918
4	Covered by Medicaid or CHIPS (children)	\$133,543	\$174,937	\$369,191	-\$3,926,457	-\$5,915,063	-\$7,750,809
5	Covered by State-Paid Insurance	\$388,106	\$519,729	\$1,129,252	-\$3,671,894	-\$5,570,271	-\$6,990,748
6	Covered by Private Insurance	\$19,335,375	\$25,892,811	\$56,259,174	\$15,275,375	\$19,802,811	\$48,139,174
7	Covered by Medicare	\$25,767,764	\$33,754,820	\$71,236,933	\$21,707,764	\$27,664,820	\$63,116,933
8	Uninsured	\$12,297,636	\$16,743,470	\$35,053,005	\$8,237,636	\$10,653,470	\$26,933,005
9	Out of pocket & Other	\$49,884,174	\$67,918,272	\$142,189,134	\$45,824,174	\$61,828,272	\$134,069,134
10	Totals	\$114,388,048	\$153,625,495	\$324,431,607	\$110,328,048	\$147,535,495	\$316,311,607

Combination of All Telehealth Program Impact Scenarios

The true benefits of telehealth only come out when all of the different impacts work together synergistically. While not exactly the same as the synergistic effect of multiple telehealth programs, the team used Strassman's residual impact of technology projects ratio as a stand-in for the synergistic impact described earlier. The savings started at 31 percent (divided by three for a typical 5-year telehealth project) for the 1st year, estimated at 81 percent (divided by five) for the 20th year, and extrapolated the 5th year.

Figure 70. PA Healthcare Cost Impact of Different Activities with Synergistic Effect



All of the different values for the various TPIS are in Figure 70. The final estimate of the Pennsylvania healthcare costs if all of the various TPIS were fully implemented are in Figure 71. The synergistic effect provides the most savings over all other methods, lowering the cost of healthcare in the 20th year to below what Pennsylvania is spending each year on healthcare today.

Figure 71. Health Cost Impact of All Combined Telehealth Program Impact Scenarios

A	B	G	H	I	V	W	X
Line #	Pennsylvania Healthcare Costs	Base Year One Cost	Base Cost Yr Five	Base Cost Yr Twenty	Combination Year One Cost	Combination Cost Yr Five	Combination Cost Yr Twenty
2	Total PA population	\$114,388,048	\$153,625,495	\$324,431,607	\$89,055,671	\$83,897,956	\$108,749,475
3	Covered by Medicaid (adults)	\$6,581,451	\$8,621,458	\$18,194,918	\$5,123,923	\$4,708,350	\$6,098,937
4	Covered by Medicaid or CHIPS (children)	\$133,543	\$174,937	\$369,191	\$103,969	\$95,537	\$123,753
5	Covered by State-Paid Insurance	\$388,106	\$519,729	\$1,129,252	\$302,156	\$283,834	\$378,525
6	Covered by Private Insurance	\$19,335,375	\$25,892,811	\$56,259,174	\$15,053,363	\$14,140,582	\$18,858,075
7	Covered by Medicare	\$25,767,764	\$33,754,820	\$71,236,933	\$20,061,235	\$18,434,182	\$23,878,620
8	Uninsured	\$12,297,636	\$16,743,470	\$35,053,005	\$9,574,201	\$9,143,944	\$11,749,767
9	Out of pocket & Other	\$49,884,174	\$67,918,272	\$142,189,134	\$38,836,825	\$37,091,527	\$47,661,798
10	Totals	\$114,388,048	\$153,625,495	\$324,431,607	\$75,953,664	\$75,583,744	\$103,818,114

Figure 72. Average Per Person Cost for PA Healthcare for TPIS

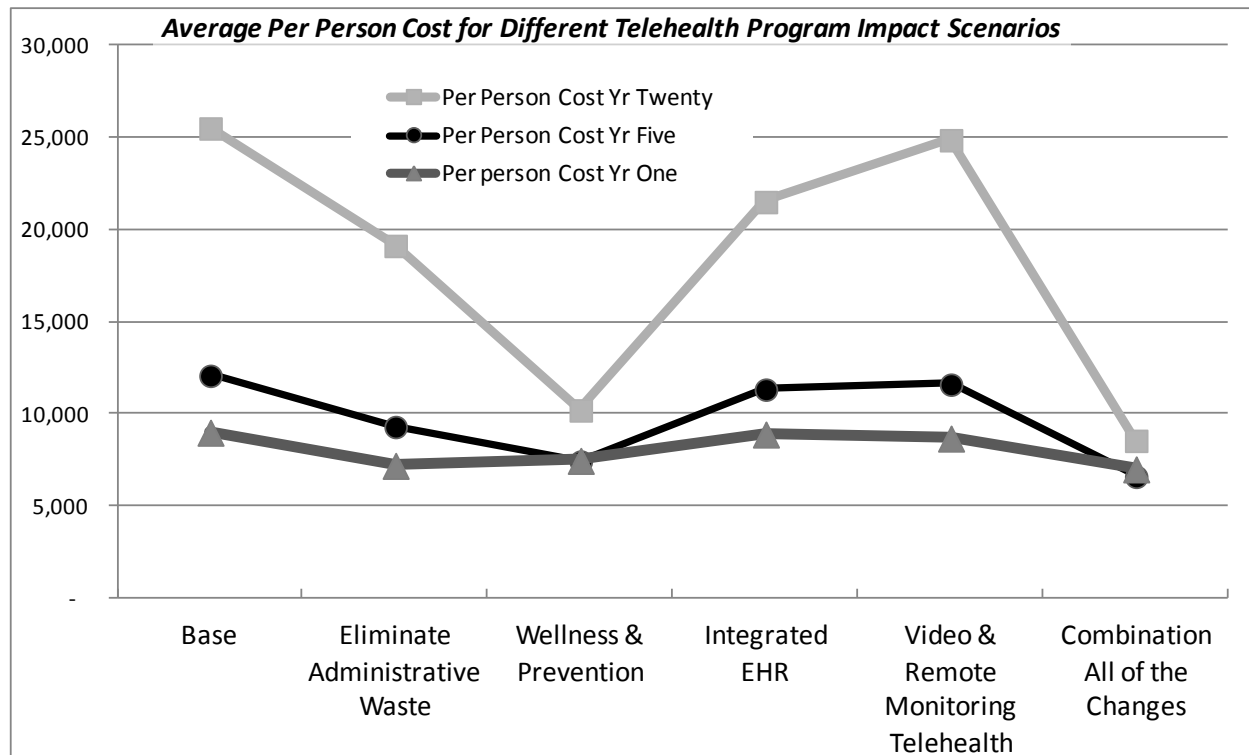


Figure 73. Contribution of Telehealth Purposes toward Savings on the Average Per Person Cost of Healthcare (\$8233).

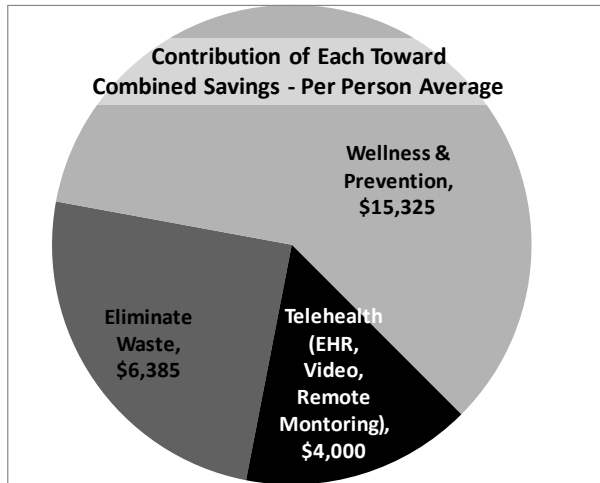


Figure 73 illustrates how much each activity of the combined estimate contributes to the average healthcare per-person cost, which in 20 years is estimated to be \$25,541 per person per year if no changes are made. (Garrett, et al., 2010; Martini, et al., 2007) Some savings come from eliminating administrative waste and overtreatment - over \$6,385. Wellness and prevention gives the largest savings - more than \$15,000 if successful. The different types of telehealth are actually contributing around \$4,000, though it should be kept in mind that EHR systems may be a major motivator for the process improvement that eliminates administrative waste, so it is difficult to separate them.

Limitations of the Economic Cost Model and Research

As is necessary with any complex problem such as the cost of healthcare, there are many assumptions in this model, and anyone could argue with any specific assumption the team made. Furthermore, some aspects of the financials were simplified for the model. For example, the team used a simple extrapolation instead of calculating a trend analysis, ignoring the non-equidistant time frames of the 1 to 5 year, and the 5 to 20 year estimates. Additionally, the model was built without including the population change assumptions (a growing population of baby boomers and a shrinking population of the most recent generation of workers). There was no attempt to calculate specific project costs, or specific savings based on specific numbers (other than the fact that some of the overarching statistics being utilized came from studies that did just that). Furthermore, these assumptions require best practices be implemented in every telehealth program. The model expects that the personal lifestyle behaviors of Pennsylvania residents are modified at the rates seen in past studies. The influence of the constituencies needs to be balanced, and the targeted purpose of the telehealth would need to be successful for the model to match reality in 5 and 20 years. The chances that all of these assumptions will come to fruition are very low. Nonetheless, this model is a good starting point, and hopefully will do what it is designed to do; help policy makers and other decision makers in the field of healthcare understand all the issues and how they impact the costs.

This economic impact model enables the reader to see the options and issues regarding telehealth. Even more powerfully, researchers can use the actual spreadsheet upon which the model is based (available upon request directly from the principle investigator), and can adjust the outcome, making up for any concerns by revising the formulas and assumptions upon which the outcomes are based.

There are many other limitations of this research as well. The definition issues interfered with many aspects of the research. For example, the estimates of percent of use of telehealth could not be relied upon (and the team chose not to report them for this reason) because those that implemented EHR systems typically answered 100 percent because all patients in the system used the EHR system. The EHR

percentage estimate obscured the actual percentage of videoconferencing and remote monitoring systems use. In retrospect, the question should have been split into two.

Additionally, while every attempt was made to survey a random sample of physicians from Pennsylvania, in an attempt to keep that survey short there were several questions that were only addressed on the longer survey that was more widely distributed, and which had many different persons involved, not just physicians. Furthermore, the inability to track the location of the majority of respondents of the widely distributed role-based sample limited the validity of the evaluations of rural versus urban comparisons for those questions. Minor variations in the questions asked of different roles may also have introduced a small amount of variability that influenced the results.

For the portion of the research that was qualitative, the research methods relied heavily on the knowledge, experience, and background of the research team members in the fields of technology and healthcare. As in any qualitative research, the assessment of themes, the analysis of interviews, and the application of the findings are always subject to bias, both conscious and subconscious.

Furthermore, the interviewee population was not randomly chosen. While there was an attempt made to include representatives from different constituencies, the high number of healthcare providers over government representatives and vendors may subtly alter the results.

This research extensively reviewed related existing literature about telehealth, surveyed the current attitudes of physicians, listened to a wide variety of people involved in the field, delved deeply into the issues via interviews, and quantified the results through a cost estimate model. This is uncharted territory, and often the team felt they were inching toward the abyss, fearing a drop over the cliff of the unknown. Hopefully the results are fully explained so that, whether the reader agrees with them or not, at least it can be said that the methods were fully transparent. Transparency, the team believes mitigates the limitations of this study, so that the findings can help decision makers make the right decision.

CONCLUSIONS

The research team has drawn many conclusions from the analysis of the results of the search of the literature, the survey data, and the interviews. The conclusions focus on 1) the estimate and description of the telehealth services and practices used in rural Pennsylvania, 2) the documentation of how telehealth use impacts healthcare access, cost and outcomes in Pennsylvania, and 3) identifying the barriers to the optimal use and benefit of telehealth services in rural Pennsylvania.

While the focus of this research study was on rural Pennsylvania, telehealth is one of those issues that cannot be sequestered by state, or by rural versus urban. There are always two sides to telehealth, and it cannot be regulated from just one of the two sides. Trying to do so decreases the value of telehealth. The research team chose to use a macro approach to investigate the cost benefit issue of telehealth. It is only by looking at the whole picture, not the individual granular pieces, that telehealth can be evaluated.

Many policy makers are at a pivotal point in history regarding telehealth. Making mistakes or delaying critical decisions can be very costly. On the other hand, properly balancing all the factors will lead to higher and higher quality healthcare at lower and lower costs.

Estimate and Description of Telehealth in Rural Pennsylvania

Telehealth implementation in Pennsylvania, based upon the results of the data, is a bit schizophrenic. On one hand, Pennsylvania has some wonderfully supportive projects such as KINBER. The interviews revealed some up and coming government groups such as the PA eHealth Partnership Authority. There is the waiver program for seniors to try to allow them to get care at home and new opportunities for psychiatrists to provide services over video links. There are some really exciting telemedicine programs available for small rural hospitals such as teleburn, telestroke, neonatal and emergency room support, etc. Educational programs for nurses are taking advantage of telehealth for distance learning.

On the other hand, due to the lack of federal standards and support, there is very little mainstream telehealth going on anywhere in Pennsylvania, least of all rural areas. Other than radiology, which has been around for a long time, and HER, which is being incentivized by CMS, the projects are few and far between. Calling every hospital in rural counties provided a list of just 61 occurrences of telehealth. Medical schools in Pennsylvania have not been big promoters of distance education. Aging in place and chronic disease home health care is barely seen beyond a few pilot projects. The majority of physicians (less than 40 percent) are not currently using telehealth, and the ones that do don't use it for anywhere near the majority of their practice. Rural, urban, old, young, male, female; none of it seems to matter. There is no single group widely adopting telehealth for the majority of its practice, though the technology exists for them to do so should they so desire.

But being a bit behind other states, such as California and Texas, when it comes to public and private health insurance coverage of telehealth is not necessarily a bad thing. The data show that grants and one-time project funding are not very sustainable due to the many roadblocks to wider implementation of telehealth. Investing in too much technology too soon may not be the best long-term strategy. The technology itself is changing so fast that any system that is purchased currently will need to be replaced in a matter of months. Any investment spent on private infrastructure may be unnecessary in a few years due to the availability of public infrastructure.

What the data only hint at but don't directly show, but what the research team members felt secure about predicting, is that very soon will come a time when telehealth will move from the trickling project here and there to the waterfall over which every process, every physician, every hospital, and every patient will be forced to navigate. The difficulty is predicting exactly when that turning point will occur. The factors that determine that point are not under the control of any hospital or health network, any patient or advocacy organization, any physician or health provider; not even a state legislature.

Impact of Telehealth on Costs and Outcomes of Healthcare

Healthcare in the United States, it appears from the literature, is in trouble. The perfect storm of problems is building. Rising prices, increased administration complexity, physician shortages, rising senior population, rising chronic conditions caused by poor nutrition/sedentary lifestyles, and the ethics regarding the practices of end of life care; these are problems. Patients, employers, and some agencies (especially government involved in funding public insurance such as Medicare, Medicaid, and CHIP) are looking for solutions. The VHA and many pilot projects throughout the world have determined that telehealth may be one part of the solution.

The research team reviewed the available literature, used the most credible up-to-date information, and interviewed the most knowledgeable people to devise a model to predict the unpredictable; how will telehealth impact the costs of healthcare in the future?

The findings suggest that the purpose to which telehealth is put is a fundamental factor that determines whether its impact is positive, negative, or just about even. Other factors that determine its impact are whether or not the tipping point for healthcare is in the future or in the past (i.e. whether or not the legislative and feasibility obstacles have been removed), and whether or not the multi-layer payer system typical of healthcare in the United States has changed.

Consider some of the most current uses of telehealth; providing expertise where necessary for stroke victims, or providing hospitalists and intensivists in more locations, providing round-the-clock care for premature infants, adding more opportunities for near-life-end surgeries, increasing the number of heart treatments, or expanding the number of cancer treatments. Adding these capabilities (via telehealth) that were not available before will end up costing more money. And because of the relatively small volume of people who find themselves in these special circumstances, telehealth will help fewer people at added cost.

Using telehealth only in these high-priced, low-volume situations is not the best use of telehealth. Using telehealth only in diagnosis and treatment allows the existing model of healthcare to continue on its

current path of rising prices. The impact of telehealth on healthcare would be to increase quality, but also to increase costs overall.

But the data reveal that it doesn't have to be that way. Most of the literature and most of the interviewees emphasized that telehealth can be used to promote healthy lifestyles, good nutrition, cardiovascular exercise, gentle mind-body exercise, meditation and other practices that have been scientifically proven to reduce chronic conditions and diseases such as diabetes, heart failure, cardiopulmonary problems, autoimmune diseases, and cancer. Telehealth can be used effectively to educate the public and provide help, support, and guidance in using the methods. Telehealth can also be used to effectively educate more healthcare clinicians; physicians, physician assistants, nurses, nurse practitioners, psychiatrists, psychologists, social workers, nutritionists, health coaches, physical therapists, exercise specialists, and others. Telehealth can be employed to enable seniors to remain in their homes, and age in place instead of moving to a nursing home.

Putting telehealth to work on prevention will have a huge positive impact not only on the quality of healthcare, but also on the cost of healthcare. The research team estimated the cost impact of focusing telehealth on prevention and wellness at a savings for each year that would start at 17 percent and grow to 60 percent. That means that after 20 years, healthcare costs would average just \$7,400 per person instead of the estimated \$25,500 per person.

Another telehealth type that will impact costs positively (i.e. lower costs) and may improve quality is electronic health records. The data show that 85 percent of all physicians are involved in electronic health record (EHR) system development, due (undoubtedly) to the current incentives of CMS. But getting physicians involved is just one part. Only 30 percent of hospitals in rural counties are developing EHR systems.

Furthermore, there are risks involved in investing in an EHR system. An EHR system applied to healthcare administration can simplify and standardize, or it can proliferate poorly designed processes and make it even more complex and expensive.

For example; an automated EHR system can "remember" many more codes than a human being, so automating the process puts it in danger of allowing the already unwieldy number of codes to increase even more. A concentrated effort is needed to simplify the process when automating it, which is often very difficult for system developers or content specialists to know how to do.

Another risk is in completing the EHR development project before detailed standards for data exchange have been published (as is currently the case). If standards that are not congruent with the data standards of the system get published after development has been completed, expensive reprogramming becomes necessary. The impact of the EHR telehealth, in that case, would be highly negative rather than positive. However, it may also be the case that even if the EHR system must be rewritten, the *process improvements* that often accompany a system development project such as this cause a positive financial impact. If currently high administrative costs were cut through universal use of EHR and elimination of other unnecessary procedures, the research team estimated the impact of between 20 and 25 percent.

Another positive impact for telehealth, in quality if not necessarily in costs, would be health education material available online. Imagine if the medical community were to come together and organize a single well-defined and controlled index for medical information that can be used by patients. Currently it is up to each individual health network or community organization to publish its own health and medical information. This might cause confusion and information overload for the patient because he/she wouldn't necessarily know which to believe if there were contradictions. But a single source for medical information, well-accepted by the medical community, would go far toward enabling and empowering patients. Videos, books, and articles on medical information, vetted by the medical community, could be provided in an easily navigable format. This same system could be used to provide source knowledge for the medical practitioner. The medical knowledge would be different in terms of level of specificity and technical detail, but it would be a valuable resource to everyone in the health community.

The true value of telehealth lies in the combination of all of the above. If telehealth became the primary method of healthcare whenever possible, then the combined savings would grow from 22 percent for the 1st year to 66 percent for the 20th year. That would mean that instead of \$25,500 per person, per year for healthcare, the cost would be a little more than \$8,500 - which is about the cost of healthcare today, but with a much higher quality than available today. But this combined savings will only come to fruition if the barriers and obstacles to telehealth are removed.

Eliminating Barriers to Widespread Telehealth Use

The literature, the survey, and the interview data clearly show that several barriers to healthcare are a major concern. The top two issues (related to one another) are definition/licensure of telehealth, and reimbursement of services using telehealth.

In the United States, a multi-layer payer scheme for healthcare exists where health insurance pays for the services that patients get, and the patient, the government, or the patient's employer pays for the health insurance. Currently, most reimbursement policies (if they reimburse services provided via telehealth at all) restrict telehealth to certain geographic areas such as rural counties without enough doctors, and to certain specialties such as psychiatry, radiology, dermatology, etc. The impact of these complex and limiting policies is that the cost of telehealth is raised. The technology and process/procedures/training of telehealth is a fixed price, so volume impacts the cost of telehealth services. If telehealth were widely used (i.e. used in every case where physical presence was not required for healthcare services to be provided) the cost would go down quite drastically.

Imagine if a hospital had invested in an MRI machine, and then was told they could only use it for patients who lived near a river, were between the ages of 34 and 36, and who had a concussion. Because the number of patients who fit that very limited definition are so few, the cost to implement the MRI would outweigh the benefit. That is the impact of the current regulatory limitations on telehealth.

Furthermore, current regulations identify the state of the patient as having jurisdiction over licensing, which causes problems because it would mean that any health provider using telehealth methods would need to be licensed in the state of the patient. Changing those regulations so that the state of the provider has jurisdiction will remove a major barrier to telehealth.

The reasons for the previous limitations are historical; when the regulations were written telehealth involved expensive dedicated hardware, software, and leased line connections. Today, however, the type of technology that could be used in telehealth is general, easily available, and cheap. But because it is still restricted by geography, type of patient, and state of licensing, the limited volume wreaks havoc with the cost benefit analysis.

Another noted barrier is training. Training is essential for successful implementation of telehealth. Furthermore, the best training is individualized, just-in-time, on-going, and comprehensive. In addition, telehealth technology needs to be a lot more innovative regarding the ease of use. Currently, few people beyond the young and the technical have the wherewithal to download the apps and set up the connections to videoconference over the Internet, or can easily navigate websites to find educational videos. Telehealth will be most useful when the interface is so easy that anyone can use it.

Conclusion Summary

The United States is on the brink of change regarding telehealth. How quickly the change occurs, and how early the nation can begin reaping the benefits of that change, depend upon several factors:

- 1) Elimination of definitional issues regarding telehealth, establishing that it is a method, not a treatment, and mandating coverage by public and private health insurance.
- 2) Establishment of the state of the health provider as the jurisdiction for licensing (rather than the state of the patient).
- 3) Elimination of the restrictions of telehealth based on geography or medical modality.
- 4) Use of telehealth for prevention and wellness, focusing on chronic diseases and aging in place (rather than end-of-life and expensive treatments for low-volume diseases).

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- 5) Availability of high speed access to the Internet throughout the nation, especially rural areas.
 - 6) Development of standards, processes, procedures, and training to encourage telehealth.
 - 7) Development of easier-to-use interfaces and equipment.
 - 8) Adoption of a secure standardized health information exchange framework.

Most of these are national issues. Though solving these factors will determine the type and use of telehealth in rural areas, the solutions go beyond the influence of rural areas.

Despite its limitations, the findings of this study add much to the existing body of literature on this topic, and provide a much more integrated view of the issues than most other research. The trends are obvious. Healthcare costs are going up precipitously - there is complete agreement on that point. Quality of care seems to be going down, though agreement on that point depends upon the definition of quality. Rural Pennsylvanians have a tougher time staying healthy and accessing the healthcare system, though difficulties exist for all Americans accessing and paying for healthcare. Telehealth could potentially help rural Pennsylvanians, as well as all Americans. Telehealth could mitigate both the cost and the quality issues. But many changes need to be made before that can happen. This research is just the beginning.

POLICY CONSIDERATIONS

Federal or National Policy Considerations

Many of the issues that impact rural counties' use of telehealth must be solved at the federal level by a clarification of telehealth as a method, not a treatment, removing the restrictions of telehealth (which currently allow telehealth only in rural areas from provider to provider, and do not allow all the different types of telehealth). It is also important to establish the jurisdiction for licensure as the region of the provider (or establish national licensing for medical professionals of all types). Additionally, the federal government should mandate highly detailed health information technology data standards, (preferably before the majority of EHR systems are already implemented to comply with the incentives provided by CMS so that they don't have to spend extra dollars on revisions after the standards have been published).

Model regulations such as the Telehealth Promotion Act of 2012 (H.R. 6719, 112th Congress) are recommended. The Telehealth Promotion Act of 2012 has been referred to the subcommittee on Health, and if it is passed in Congress, it will do more than anything else to encourage the use of telehealth. It would then be up to the state agencies, health providers, insurance companies, and patients to make the most of the capability. They can do that by using telehealth to focus on prevention activities to maintain health and wellness instead of thinking only of treatment through drugs and surgery.

The government can also do much more to ensure that broadband is available in all areas of the country to gain the cost saving benefits of telehealth.

Training and support is another obstacle where state and federal government can help; by providing grants and funding for publicly available, easily accessible, and proven-effectively-useful training videos and documents to be made available on a number of telehealth technologies, procedures, and processes. Videos and articles would be especially important regarding the most beneficial uses of telehealth, best practices, and information about how to improve quality while decreasing costs. A whole series can be devoted to taking care of senior populations that may prevent future hospitalizations because friends and family would get more support and be more knowledgeable in how to handle issues common with seniors.

More importantly, however, live individualized support could be made available through telehealth - to patients, physicians, and healthcare providers of all types. This support could connect quickly and seamlessly to specialists who can provide the expertise needed to save lives and properly diagnose issues. Support could be available 24 hours a day, 7 days a week for people trying to use any of the telehealth options available - much less expensively than a physical presence support system.

Policy changes impacting telehealth growth need to be balanced so that the largest impact for the lowest cost of technology should be encouraged, and the use of telehealth should be nudged toward general

prevention (including behavioral medicine and healthy lifestyle support) and not provided only for high-cost procedures and modalities. Especially important is enabling telehealth to empower seniors to stay in their own homes and avoid hospitals and nursing homes. The legislature can implement policies that encourage standards of care that include remote monitoring without the necessity of a previous hospitalization, which would provide seniors more dignity and a higher quality of life in their final months.

While each state can support these efforts and try to implement them locally, the true value of telehealth does not come to fruition until those issues have been resolved. Until then, few telehealth implementations would be self-sustainable, or cost effective, even in rural counties in Pennsylvania.

State Government Policy Considerations

Despite the reliance on federal leadership for wholesale changes in telehealth, the state can foster the right environment for telehealth, and ensure that when the conditions are right, the state can quickly and easily get up to speed to take advantage of the new capabilities. Each department or agency for which the team developed policy recommendations is discussed below, along with the description of what is currently going on within the department related to telehealth, followed by the considerations.

Since telehealth is newer for the commonwealth, a certain amount of authority and agility are needed. Finding the balance between legislative law and rulemaking/promulgation authority will not be easy. The process has begun, as evidenced by the creation of the Pennsylvania eHealth Partnership Authority, and now it is up to the legislature to find the balance in managing the role of the new agency. The agency needs the flexibility to incorporate technical expertise, find common standards, and work with other agencies including those outside the commonwealth to create rules that are appropriate, timely, and in sync with how telehealth is delivered elsewhere. Matching rules closely with those who have already successfully implemented telehealth allows the piggybacking of other efforts and helps with consistency. Within Pennsylvania, Geisinger and the VA are good examples. Outside Pennsylvania, healthcare systems in California, Texas, and European countries are good examples. Having rules and standards that align with others who deliver telehealth offer patients the ability to access care without having to learn a new set of rules or forego treatment that used to be available to them.

The Departments of Health and Public Welfare

The Pennsylvania Departments of Health and Public Welfare are the most influential in this issue. The Department of Health's mission is to promote healthy lifestyles, prevent injury and disease, and to ensure the safe delivery of quality health care for all commonwealth citizens. The Department of Health is responsible for planning and coordinating health resources throughout the commonwealth including licensure of medical facilities. It is currently very active in focusing on healthy lifestyles and providing consumers with information necessary to encourage prevention. It provides a bounty of resources for researchers to use in searching for solutions to current health issues in the state. It published the Chronic Disease Burden report, which provided many of the assumptions for the cost estimates in this research.

The Department of Health should continue its excellent work in focusing on prevention and making resources available regarding that topic, but it may be missing many opportunities to encourage the raising of quality and lowering healthcare costs with telehealth. Decision makers may not be seeing the sweeping change that could occur with the addition of behavioral therapy, personal coaching, and lifestyle changes made more financially feasible with telehealth than otherwise possible. The research team would make the following recommendations for the department:

- Use more avenues (social media, online videos and webcasts, i.e. telehealth education to providers and patients) to publicize reports and findings, and support people in their quest for healthy lifestyle.
- Work more closely with other departments to implement regulations and legislation that will encourage prevention and healthy living as well as using telehealth options when expedient.

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- Implement regulations that will encourage the use of telehealth in remote monitoring, which can help in establishing guidelines for avoiding overtreatment and managing near-end-of-life practices more effectively for seniors.
 - Become more active in planning for a future where preventing injury and disease and the safe delivery of quality healthcare is done using telehealth technology (when appropriate).
 - Define telehealth as a method of providing face-to-face healthcare and not a treatment, and remove all restrictions on use and location.
 - Accept that the location of the provider has jurisdiction for licensing requirements; there is no need to get recertified in every location where potential patients live.
 - Eliminate the barriers between behavioral and medical healthcare so that medical doctors can oversee lifestyle activities implemented through telehealth.
 - Shape the future of telehealth initiatives. Support legislation that would provide an environment that is more receptive to the increased use of telehealth for prevention and as a supportive technology to combat waste and overtreatment.
 - Provide leadership and cooperate with national efforts to simplify and standardize health standards.
 - Provide leadership and cooperate with national efforts to provide a centralized repository of health information for consumers and medical professionals, especially regarding prevention practices and research. Share with other states best practices and tools currently available on Pennsylvania sites.

The Department of Public Welfare (DPW) is also highly involved. The Medical Assistance Health Information Technology Initiative (MAHITI) has provided funding to assist in the meaningful use of EHRs at hospitals and for professionals involved in healthcare. The Pennsylvania Health Information Exchange (PHIE) has a goal to create a secure statewide network for sharing electronic health information for Pennsylvania's health care providers and patients.⁶

One of the highlights in the telehealth world is the support of DPW for waivers to help elderly Pennsylvanians stay in their homes longer and require less nursing care. The Department of Aging also offers a monthly webinar series, called Caregiver Support Program, for caregivers who provide unpaid care for an elderly relative or friend. The Department of Aging provides telehealth remote monitoring, although it is not used as well as it could be.

The Department of Public Welfare has recently expanded its Medical Assistance coverage of telehealth, but much more needs to be done. Restricting public funding so that it is not used for near-end-of-life treatments beyond palliative care would greatly increase quality while safeguarding resources for more optimum use. Telehealth can play a major role in changing the current necessity for a dying patient to transfer to a hospital to meet comfort needs. With remote monitoring of near-end-of-life treatment and palliative care in the home, healthcare costs could be drastically reduced. Physicians could be required to have POLST (Pennsylvania Orders for Life Sustaining Treatment) discussions as recommended by the Department of Health. The Department of Health should emphasize the process, and regulate where necessary to ensure that patients and doctors understand all the near-end-of-life issues.

The research team would recommend:

1. Modify processes and procedures to make remote monitoring in the senior Waiver program easier to implement, more acceptable to clients and physicians. Provide more training for caseworkers and assessors. Include broadband costs as part of the service.

⁶ The Pennsylvania Health Information Exchange should not be confused with the Healthcare Exchange, which Governor Corbett chose not to provide at the state level, but rather to use the federal exchange. They are two different initiatives.

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2. Encourage more variety in remote support services which can help reduce the number of trips to medical facilities and allow individuals to remain longer in the comfort of their own homes/communities.
 3. Ensure quality care criteria under capitation, and enable unrestricted use of preventative telehealth practices.
 4. Discourage high near-end-of-life medical expenditures, discouraging artificial life extensions that provide low quality of living. Encourage reasonable palliative care where appropriate. Enforce use of Pennsylvania Orders for Life Sustaining Treatment by recipients of medical assistance of any sort.
 5. Continue to lead with efforts to require EHRs to comply with a single unified data standard. Share lessons learned in developing a state health information exchange with other states and share code and programming.
 6. Cooperate with efforts to develop a national unified standard for Medicare, Medical Assistance, CHIP and other programs to simplify administration.
 7. Set standards in place for healthy lifestyle requirements as prerequisite for services. Help support prevention efforts financially and through coaching.
 8. Focus more on coordinating and aligning efforts of all departments, commissions, and offices of Pennsylvania government toward prevention and away from high cost low value treatments.

Health Care Cost Containment Council and the Insurance Department

Two influential agencies from the Governor's office related to this issue are the Health Care Cost Containment Council and the Insurance Department.

The Health Care Cost Containment Council is an independent state agency responsible for addressing the problem of escalating health costs, ensuring the quality of health care, and increasing access for all citizens regardless of ability to pay. They currently serve the cause of telehealth by collecting, analyzing, and making available data from Healthcare Utilization Project about the cost and quality of healthcare in the Commonwealth. The agency reviews and makes recommendations about healthcare practices.

The research team recommends that it continue its efforts to rein in costs while providing quality care, and focus on prevention rather than treatment. However, there are other actions it could take:

1. Be more aggressive with the legislative and executive branches of the Commonwealth about proposed mandated public and private health insurance benefits.
2. Investigate the effectiveness of more widely distributed telehealth use, and encourage ways for telehealth to reach rural populations.
3. Expand beyond the hospital focus and include behavioral and healthy lifestyle programs to cut costs.
4. Work with the Department Of Health And Human Services' Centers for Disease Control and Prevention and the National Center for Health Statistics to allow "natural causes" or "old age" to be used as a code on a death certificate without requiring a secondary or specific diagnosis.

The Department of Insurance currently regulates the insurance industry in the state, requiring licensing, annual reporting, and ensuring that services provided are high quality. It is their role to protect Pennsylvania residents from unscrupulous practices or misleading insurance advertising. They have not, to date, made any regulations regarding telehealth. However, the Insurance Department could clarify the definition of telehealth as a method of providing face-to-face healthcare, which cannot be denied simply based upon the method of transmission. The regulations impacted specifically include §89.451. Insurance coverage, December 23, 1981 (P. L. 583, No. 168) (40 P. S. § 3001—3003); Chapter 150 Uniform Health Insurance, July 2, 1993, effective July 3, 1993, 23 Pa.B. 3133; Claim Form, Statement Of Policy 31, Chapter 150, Sections 150.1-150.5 , and Chapter 152 Preferred Provider Organizations, 31 Pa. Code Chapter 152, Sections 152.101-152.105; among others. The research team would recommend the following actions:

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1. Legislate coverage of prevention (healthy lifestyle support and guidance) by insurance companies (to avoid high costs of unhealthy people when they transition to Medicare and Medical Assistance) and encourage use of telehealth to do so feasibly.
 2. Define telehealth as a method of providing face-to-face healthcare, not a treatment, and remove restrictions on use and location.
 3. Accept that location of provider has jurisdiction for licensing requirements; there is no need to get recertified in every location where potential patients live.
 4. Eliminate the barriers between behavioral and medical healthcare so that medical doctors can oversee lifestyle activities implemented through telehealth.
 5. Shape the future of telehealth initiatives. Support legislation which would provide an environment which is more receptive to increased use of telehealth for prevention and as a supportive technology to combat waste and overtreatment.
 6. Provide leadership and cooperate with national efforts to simplify and standardize health standards.
 7. Provide leadership and cooperate with national efforts to provide a centralized repository of health information for consumers and medical professional, especially regarding prevention practices and research. Share with other states best practices and tools currently available on PA site.

Pennsylvania eHealth Partnership Authority

Another agency that has been highly involved is Pennsylvania eHealth Partnership Authority, which formed out of the Pennsylvania eHealth Collaborative. This organization is a blended public/private stakeholder collaborative with a goal of bringing a Health Information Exchange online by working together to form standards, goals, policies, and other measures. It currently provides DIRECT, a secure communication channel for health information. It should continue its important work, but become more aggressive in ensuring that the public understands the financial picture and dire consequences of continuation of non-standard, disparate systems. DIRECT also needs to be a secure channel for clients and patients, not just providers. It also should share lessons learned and work more specifically toward a national health information exchange and not just a state network.

Pennsylvania State System of Higher Education

The Pennsylvania State System of Higher Education (PASSHE) could provide a valuable resource for modeling healthy lifestyle programs as well as implementing innovative and entrepreneurial activities. It could also be instrumental in the development of educational resources for both physicians and patients.

PASSHE already provides a rudimentary Healthy Lifestyles program to employees and encourages distance learning educational programs. Some state universities are also involved in KINBER implementation. However, there are many further activities that could move telehealth forward in Pennsylvania:

1. Communicate involvement in KINBER more widely among universities and encourage planning for use and optimization of the resource.
2. Coordinate with healthcare facilities through internships, partnerships, and recruiting.
3. Provide a link between educational institutions and healthcare facilities that serve citizens.
4. Refine and improve the healthy lifestyle program currently available to PASSHE employees. Enable online telehealth apps to track goals, exercise, weight, nutrition, etc. Improve the assessment tool. Provide more live support over videoconferencing links and discussion boards. Provide more "credit" for prevention activities and less "credit" for diagnostic tests, simple reading, and going to the doctor.
5. Seek out policies and regulations that discourage job creation and entrepreneurial ventures involving telehealth. Modify the wording, if necessary, to encourage rather than discourage entrepreneurship and innovation.

Pennsylvania Higher Education Assistance Agency

Incentives offered through loans, grants, loan forgiveness, and targeted residency retention awards from the Pennsylvania Higher Education Assistance Agency (PHEAA) can also aid in different ways to ensure individuals and institutions involved in telehealth continue to benefit the commonwealth. PHEAA might consider offering loan forgiveness for telehealth-related fields and prevention-related fields of study. It can use videoconferencing and webcasts to provide assistance in navigating the loan and grant programs available for students in Pennsylvania.

Departments of Community and Economic Development and Labor and Industry

The Department of Community and Economic Development (DCED) and the Department of Labor and Industry (L&I) work together to encourage entrepreneurial endeavors that focus on innovative uses of technology in the healthcare industry.

There are some efforts underway. In DCED, there is a Kick Start program, where organizations have the opportunity to participate in a 2-year intensive training, technical assistance, and implementation program to increase the organization's use of broadband to maximize the impact they can have on their constituencies. But DCED could also encourage, through advertising and support, the awarding of grant and loan programs to healthcare providers in rural communities as well as businesses looking to develop telehealth. It could look into providing funding opportunities that involve telehealth and establish technology centers in rural areas that need it most.

L&I is tasked with preparing the commonwealth's workforce for the jobs of the future - and telehealth is a large part of the future. It uses technology for unemployment claims and other tasks, but it could also use telehealth to provide services for worker compensation claims and rehabilitation efforts for disabled workers requiring medical care. It could use telehealth (education) for training programs for Keystone Works and Shared Work programs. It could standardize and simplify insurance policies that cover worker compensation claims so that it has the same health coverage rules as traditional employee medical care. It could also provide grants, loans, and funding to encourage workforce development in telehealth related jobs.

As these changes start to occur, broadband access may become an issue, and the Public Utility Commission (PUC) might want to plan for even more wide range broadband at faster speeds than is currently planned. The current lack of infrastructure is an obstacle to more widespread use.

All three agencies (PUC, DCED, L&I) are involved in planning and implementing broadband throughout Pennsylvania, and they need to coordinate and synergize efforts. Some projects are already underway. The Enhancing Connectivity in Northern Pennsylvania (ECNP), a part of Executive Office of Administration (EOA) was awarded \$28.8 million by National Telecommunications and Information Administration (NTIA) through the Broadband Technology Opportunities Program (BTOP), to expand middle mile broadband infrastructure throughout northern Pennsylvania. The Keystone Initiative for Network Based Education and Research (KINBER) is implementing PennREN, providing 1,700 miles of high speed fiber connectivity between 70 anchor communities. What is unclear is how much coordination is going on. Are these duplicate efforts? Are they synergizing for maximum impact?

The PUC could consider working more directly with other agencies to ensure broadband connectivity is optimized more thoroughly and used more frequently, especially in rural areas. It might want to consider cooperative programs with other industries (electric, gas, transportation) to synchronize resources across Pennsylvania to make telehealth more accessible. It is also in the best position to study the impact on electric and transportation industries if telehealth were more widely used throughout Pennsylvania.

Though projects such as BTOP and PennREN are a great start, they may not necessarily be taking into consideration the needs of telehealth. A videoconferencing-capable infrastructure means greater than 2 megabits per second both ways and QOS (Quality of Service, a way of separating videoconferencing traffic from static traffic on the Internet) provisioning on *every* router. To be effective as telehealth the infrastructure needs to be available in 99 percent of the state, especially in rural areas where such access is not currently competitive. Changing this may require government intervention.

Other Departments Involved in Telehealth

There are several ways other departments and committees at the state level could encourage the growth of telehealth.

Department of Aging

Remote monitoring and waiver program is available for seniors, but not often used. Caregiver Support Program offers a monthly webinar series for caregivers who provide unpaid care for an elderly relative or friend as well.

The team recommends that the department continue its current programs, but modify the processes and procedures to make remote monitoring easier to implement, and more acceptable to clients and physicians. Provide more training for caseworkers and assessors. Include broadband costs as part of the service. A variety of remote support services can help reduce the number of trips to medical facilities and allow individuals to remain longer in the comfort of their own homes/communities, which saves significant money downstream.

Department of Corrections

The Department of Corrections is already using telehealth medical services via video conferencing, along with other remote monitoring and diagnostic services. This use reduces the cost of transportation and the security risk of transporting inmates outside of the correctional facility.

The team recommends that the department continue its existing use of telehealth, and share lessons learned with other facilities and areas. Expand services provided whenever possible, using generalized technology that could help with the development of other telehealth services in other places instead of only relying on point-to-point, leased-line infrastructure and specialized technology. For example, instead of relying on specialized purchased security, spend the money to develop VPN technologies that could be used by other organizations and agencies in Pennsylvania for telehealth. The Direct Protocol, a project attempting to do just that, is underway but would need government endorsement to be widely adopted.

Department of Drug and Alcohol Programs

The Department of Drug and Alcohol Programs currently provides a webinar of information and training, treatment administration, and outcomes reporting via the STAR system for the treatment of conditions related to drug and alcohol. The team recommends that it expands the use of the system beyond webinars. It could conduct virtual meetings and interactive videoconferencing sessions of educational topics. It could also develop a highly organized and indexed resource for information related to prevention of drug and alcohol problems.

Department of Environmental Protection

The Department of Environmental Protection (DEP) currently provides webinars and tools such as eNotice, (an electronic notification system, allow users to track permit applications, check the status of environmental regulations and notify users of technical guidance document postings). Another tool, eLibrary, provides online access to key documents and mapping and GIS tools to allow DEP to display environmentally relevant data to contractors and the public.

DEP could support telehealth efforts. For example, it could estimate the environmental impacts of automobile traffic related to healthcare if telehealth were used more widely. This would involve reviewing issues such as impact of cell tower installation, laying fiber, and other environmental issues related to increasing broadband access. It could also work through future estimates of technology waste (PCs, smartphones, tablets, monitors) when the devices reach their end of life cycle.

Additionally, it could redouble efforts to ensure clean air and water so that chronic health issues do not arise from VOCs (volatile organic chemicals), which have been linked to cancer, autoimmune disorders, and chronic illnesses. DEP could take a more proactive approach to ensuring children and elderly people are not impacted by toxic chemical sites.

Department of Military and Veterans Affairs

Delivery of federal and state health benefits is provided in part through telehealth services. Ongoing and developing programs were frequently mentioned as a model of successful telehealth service delivery by survey respondents.

This department could share more lessons learned more widely regarding the use of telehealth to provide services. It could lead efforts to standardize and simplify healthcare system at the national level and combine systems with civilian systems to provide seamless support for all veterans (not just combat veterans) and their families.

Pennsylvania Emergency Management Agency

The Pennsylvania Emergency Management Agency (EMA) provides online resources for first responders and local agencies responsible for dealing with emergency situations. If necessary, PEMA can coordinate among different groups of volunteers to better respond in the event of a disaster. The team recommends that the agency use telehealth education more widely to ensure that all members of the emergency response organization receive the necessary training and that there is a program that provides a means to evaluate and test plans, people, procedures and equipment. It could plan for the use of telehealth via videoconferencing to "bring in" specialized medical staff to areas that may be physically inaccessible. The agency can communicate via videoconferencing with medical facilities serving affected areas. It could use telehealth via webpage and a central repository for information in the event of an emergency, focusing on mobile capabilities (which may be the first access). Telehealth could be part of a state backup plan that ensures access to critical healthcare services during an emergency.

Office of Administration

The Office of Administration was awarded \$28.8 million by NTIA through the Broadband Technology Opportunities Program (BTOP), to expand middle mile broadband infrastructure throughout northern Pennsylvania. What is not clear is the relationship between this work and KINBER and PennREN. The office could work more closely with KINBER and PennREN projects to coordinate and synergize efforts to use this new capability, which has not been highly publicized or made available beyond those directly involved.

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