RIDER 55 REPORT

Report on Telemonitoring in the Texas Medicaid Program

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Table of Contents

Executive Summary ***1***

Introduction ***2***

Background 2
Terms and Definitions 3

Diabetes Home Monitoring Pilot within the Enhanced Care Program ***3***

Introduction 3
Scope of Program 3
Program Recruitment Activity 4
Pilot Program Clinical Outcomes Overview 5
Pilot Program Financial Outcomes Overview
Conclusion 5

Feasibility and Cost-Effectiveness of Adding Potential Telemonitoring to Wellness Program . ***6***

Current State of the Literature 6
Evidence for Telemonitoring for Children 7
Effectiveness of Telemonitoring for Children with Autism 8
Effectiveness of Telemonitoring for Chilren with Asthma 11
Feasibility and other Considerations for Pilot Programs 15

Summary of the telemonitoring activities used by STAR and STAR+PLUS MCOs ***17***

Conclusion ***18***

Appendix ***19***

Executive Summary

H.B. 1, 82nd Texas Legislature, Regular Session, 2011, Rider 55, directed the Health and Human Services Commission (HHSC) to identify how telemonitoring has been used in the Texas Medicaid program, and to examine the possibility of expanding the use of this technology program-wide. To analyze the cost-effectiveness and feasibility of telemonitoring activities, HHSC reviewed the results of a Diabetes Home Monitoring Pilot Program that was conducted by McKesson Health Solutions on selected clients in the Enhanced Care Program. HHSC also contracted with McKesson Health Solutions to complete an analysis on the estimated cost-effectiveness and feasibility of adding future telemonitoring pilot programs for conditions other than diabetes to clients of the Texas Medicaid Wellness Program (formerly known as the Enhanced Care Program). Finally, HHSC gathered information from the STAR and STAR+PLUS managed care organizations (MCOs) on their experiences with telemonitoring activities and the cost-effectiveness of those efforts through Medicaid Managed Care.

In November of 2009, the Enhanced Care Program (ECP) launched a Diabetes Home Monitoring Pilot Program. The Enhanced Care Program vendor, McKesson Health Solutions, enrolled ECP clients who had a type 2 diabetes diagnosis and were on a prescribed plan of oral medication for blood sugar control. All clients in this pilot received diabetes disease management services through the ECP, and the clients in the treatment group were given a device to transmit their blood glucose data to a centralized clinical management system. The pilot continued through October 2010. However, the low enrollment and participation rates in the program contributed to a lack of measured program effectiveness. There were no statistically significant improvements in any utilization, cost or clinical categories.

HHSC partnered with McKesson to complete an analysis on the feasibility and cost-effectiveness of adding a telemonitoring pilot program to the Texas Medicaid Wellness Program (formerly the Enhanced Care Program). In March 2011, when the adult transition to Medicaid managed care was completed, the population of the Texas Medicaid Wellness Program (TMWP or Wellness Program) participants became primarily children under age 21 who are disabled and receive SSI benefits. The prevalent diagnoses of children in this population include asthma, attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD), depression, bipolar disorder, and developmental disabilities, including autism. The analysis of past and current national telemonitoring programs related to these conditions resulted in potentially mixed results on the feasibility and/or cost-effectiveness of using telemonitoring to reach the TMWP clients in these disease categories.

When the adult transition to Medicaid Managed Care was completed in March 2011, the STAR and STAR+PLUS programs were administered by 20 managed care organizations. HHSC surveyed all MCOs on past and current telemonitoring activities, and requested their feedback on the cost-effectiveness of the telemonitoring activities. The results showed few telemonitoring activities have been implemented among the MCOs, and cost-effectiveness has been achieved by only one MCO.

While HHSC's overall analysis suggests that telemonitoring activities are not likely to yield net cost savings to the state, the lack of data on this subject makes it difficult to draw any valid

conclusions about telemonitoring. Additional studies may be needed to fully assess the cost effectiveness and feasibility of expanding telemonitoring activities in Texas.

Introduction

HHSC submits this report in compliance with requirements of Rider 55 (H.B. 1, 82nd Legislature, Regular Session). This report is designed to:

1. Provide the data and results from the Medicaid Enhanced Care diabetes telemonitoring pilot program.
2. Provide an analysis of the estimated cost-effectiveness and feasibility of adding telemonitoring pilot programs to the Texas Health Management Program for other conditions.
3. Provide a summary of the telemonitoring activities and their cost-effectiveness used by health maintenance organizations in STAR and STAR+PLUS and a summary of the steps taken by HHSC to disseminate that information.

Background

History of Disease Management in Texas Medicaid

In 2003, the Texas Legislature directed HHSC to implement a disease management (DM) program for Medicaid clients with chronic diseases. From 2004-2010, HHSC contracted with McKesson Health Services to provide chronic disease services, under the name Enhanced Care Program, statewide to certain clients with a primary diagnosis of one or more of the following diseases:

- asthma;
- chronic obstructive pulmonary disease (COPD);
- congestive heart failure (CHF);
- diabetes; and
- coronary artery disease (CAD).

In 2011, the new Texas Health Management (THM) Program was initiated, taking the place of the Enhanced Care Program. The new program, renamed the Texas Medicaid Wellness Program (Wellness Program), was launched on March 1, 2011, and is based on a chronic care model that addresses the whole person, and it is not disease specific. The Wellness Program focuses on high-cost/high-risk clients, and provides self-management and education as well as care coordination to actively managed members.

On March 1, 2012, with the implementation of Medicaid managed care, the target population of the Wellness Program changed significantly when the majority of the adult Medicaid population was enrolled into Medicaid Managed care. Due to this shift of most adults into managed care, Wellness Program participants are now primarily children (under 21 years of age) with

disabilities who receive SSI benefits. Of the approximately 12,000 actively managed participants in the Wellness Program, more than 90 percent are younger than 21 years of age.[1]

Terms and Definitions

It is important to note that within the context of this report, telemonitoring is defined as, "the use of devices that measure patient health data and may include video-conferencing, messaging reminder, surveillance questioning, and one or more sensors, such as electrocardiogram, pulse oximetry, vital signs, weight, and glucose. The patient health data is submitted to nurses or doctors for monitoring. Submission may occur automatically through a phone or via the internet, or submission may occur by the patient manually submitting data over the phone, through a device, or on a website." [2]

Diabetes Home Monitoring Pilot within the Enhanced Care Program

Introduction

McKesson Health Solutions (MHS) contracted with Diabetech, LP in order to conduct a Diabetes Home Monitoring Pilot Program. The goal of the pilot program was to determine the effectiveness of a social support-based diabetes intervention program that targeted adults with diagnosed type 2 diabetes with the goal of monitoring improvement of their A1c levels. The program began in November 2009 and concluded in October 2010.

Scope of the Program

Inclusion criteria for entry into the Diabetes Home Monitoring Pilot Program were as follows:

- Clients who were already enrolled in the Texas Medicaid Enhanced Care Program;
- Clients who had type 2 Diabetes as a primary diagnosis; and
- Clients who were on a prescribed plan of oral medication for blood sugar control.

The Diabetes Home Monitoring Pilot Program provided the Treatment Group clients with an enhanced tool set for simplifying their self-management skills. Education about the benefits of strategic blood glucose checks and the cause and effect from activity and food choices were reinforced upon entry into the pilot program. Individualized "Quick Tip" educational materials were provided to each client that emphasized their specific areas of focus.

Diabetech's educators helped the Treatment Group clients establish a patient-centric team of lay and professional supporters, with the goal of increasing their supporters' (friends and family) knowledge of diabetes and enabling them to be a positive influence on the client and their efforts to adhere to their own prescribed care plan. Treatment group clients were given a device to transmit their blood glucose data to a centralized clinical management system. Educational

[1] McKesson's Business Intelligence Tool using monthly Medicaid data received from the Texas Health and Human Services Commission, 2012
[2] Legislative Budget Board Performance Review team through the Health and Human Services Commission

messages derived from analysis of the client record were delivered to each of the treatment group clients and their supporters (friends and family) approximately two times per week.

The system in turn automatically assessed each blood glucose value along with the entire client record to determine which "Quick Tip" educational materials to be communicated with the client in an effort to modify their behavior. The system sent a weekly printed copy of the blood glucose trend chart to each treatment group client and to participating providers, along with educational information that allowed the client to recognize how their daily activities are affecting their blood sugar levels. In the event that the blood sugar levels reached a critical value this information would generate a risk alert that then transferred to McKesson Health Solutions (MHS) for their Care Management team to intervene.

Throughout their participation in the pilot program, clients in both the treatment and control groups received diabetes disease management services through McKesson Health Solutions' Enhanced Care Program (ECP). The ECP was aimed toward working with clients and their healthcare providers to stabilize their health status and assist in improving the self management of their Diabetes. The program used a personalized approach to assessing a client's health risks and needs, health behaviors and barriers related to achieving self management of their condition. Both telephonic and face to face interventions were utilized and focused on medication and treatment plan adherence along with coordination of care with providers.

MHS had two registered nurse (RN) care managers dedicated to the pilot program. Once the care manager was notified of a risk alert they would make a call to the client and provide the appropriate level of intervention to resolve the alert. The care manager would also relay the information to the provider and coordinate follow-up care as appropriate.

Program Recruitment Activity

Once identified for program inclusion, McKesson created client lists and the clients were separated into either the treatment group or the control group through randomization. Recruitment efforts began in November 2009. Initial results were less than optimal due to timing of the enrollment campaign (2009 holiday season) and a complex enrollment process. Recognizing the insufficient number of completed enrollments, the enrollment protocol was redesigned and recruitment efforts were re-launched in March 2010.

As part of the enrollment redesign the initial client lists were utilized several times in various orders in an attempt of boosting enrollment. As a result, 32 clients that started in the control group crossed over into the treatment group. Conversely, one client crossed from the treatment group into the control group. This recruitment redesign was discussed and approved by HHSC.

Table 1 of the Appendix outlines the levels of participation in the treatment group. The analysis by Diabetech was based on a total of 51 participants in the treatment group, as these were the participants that completed all necessary program steps.

Pilot Program Clinical Outcomes Overview

The following clinical results were taken from the analysis completed by Diabetech. Although participation rates were lower than anticipated, staff from HHSC, MHS and Diabetech worked diligently to try and increase the number of clients enrolled in the pilot program. The primary outcomes of the pilot program assessed the changes in A1c values of the clients, as well as the changes in blood glucose control of the treatment group clients. Table 2 of the Appendix depicts independent t-test results that show the treatment group clients mean A1c changes over the duration of the pilot program compared with the control group. The main outcome measure and goal of the pilot, to change A1c levels, was neither clinically nor statistically significant.

- There were 51 people in the treatment group.
- No metrics were statistically significant, indicating that there was no detectable difference between the intervention group and the control group, including the change in A1c levels which had a non-statistically significant p-value of 0.16.
- Given total program costs of $110,000 and a sample size of 51 members, this translates in to a cost per person managed of $2,157. This is in comparison to the per member per month medical and pharmacy claims costs of $1,078, which, over the study period, averages $7,762 per person. To be cost effective, the intervention would have to have reduced claims costs by 28 percent ($2,157/$7,762).

Pilot Program Financial Outcomes Overview

Administrative claims were used to compare the treatment group to the control group. In the baseline period, as expected, both groups had similar utilization and cost patterns with no statistical difference (p-value < 0.05) between the two groups. Each group was then compared during the program period (November 2009 through July 2010, based on available claims with three months run out through October 2010). This was done for each of the levels of analysis 1-4 in Table 1 of the Appendix, as described above, ranging from the original intervention and control group assignment (intent to treat randomized control trial #1) to the level of analysis where only people returning a signed consent form (#4) were included. This analysis is included in Tables 3-6 of the Appendix and the results showed no statistically-significant clinical or cost outcomes.

Conclusion

The low enrollment and participation rates in the pilot program contribute to the lack of measured program effectiveness. There were no statistically significant (p-value < 0.05) improvements in any utilization, cost or clinical categories. The relatively small sample size in terms of actual member interventions contributes to the difficulty in obtaining statistical significance for variances in cost or utilization metrics. Less than 11 percent of the treatment group clients provided a valid blood sample at entry and exit (at baseline and at least six months post enrollment) which indicates the low participation rate.

The pilot program enrollment rates may have been negatively impacted because of the multiple steps required to enroll and submit blood samples. Nominal incentives were provided to both the

treatment and control groups in an effort to achieve higher participation results, and this amount was not included in program costs or savings. Even with participation incentives, enrollments dropped significantly between the verbal consent phase and the submission of blood samples. To increase the sample size in future pilots, enrollment processes that involve fewer steps may need to be considered.

Feasibility and Cost-effectiveness Analysis of Adding Telemonitoring Pilot Programs to Wellness Program

HHSC was tasked with determining whether it is feasible and cost-effective to add a telemonitoring pilot program to the Texas Medicaid Wellness Program (the "Wellness Program"), specifically to serve the active majority population (younger than 21 years of age) suffering from the following top five conditions: asthma, developmental disabilities (e.g., autism), attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD), depression, and bipolar disorder. This section provides a summary of the evidence base and provides an impact analysis for two specific conditions, asthma and autism. This report also offers key considerations for policymakers when assessing the feasibility of telemonitoring implementation and expansion, especially for Medicaid populations.

Current State of the Literature

Telemonitoring is considered a potentially innovative way to slow the growth of healthcare spending without comprising access, effectiveness and safety. However, the level of clinical effectiveness, economic evaluation, and cost-effectiveness research remains scarce and thus creates a gap in understanding the full impact of a telemonitoring program. The inconclusiveness of the evidence base is due in part to the heterogeneous nature of telemonitoring programs (i.e., systems, methods, software, hardware) as well as the challenges innate to studying intervention effectiveness in a demographically-diverse patient population with unrelated medical conditions caregiver needs, and care availability/settings.[3] For example, studies vary depending on:

- the technology (e.g., spirometer vs. blood glucose device),
- medical condition (e.g., asthma vs. diabetes),
- application (e.g., daily symptom diary vs. diabetes management plan),
- patient population (e.g., adolescents vs. elderly), and
- geographical context (e.g., rural vs. urban).

Randomized controlled trials (RCTs), which are considered the gold standard of clinical effectiveness studies, are even more limited. Study time periods included in existing RCTs present challenges. It is unlikely that telemonitoring interventions will show full effect during the short study time-points, and it is difficult to determine whether short term health benefits will persist (especially for chronic conditions). Many studies also have small study populations. Small study populations challenge the ability of researchers to draw conclusions in terms of statistical and clinical significance, reliability, and ability to generalize findings. Given the lack

[3] Davalos et al. Economic Evaluation of Telemedicine: Review of Literature and Research Guidelines for Benefit-Cost Analysis. Telemedicine and e-Health. 2009; 15.

of well-designed and robust studies, it is clear that clinical and cost effectiveness of telemonitoring is still an area ripe for further research and study.[4]

Despite these study design challenges, the evidence base related to telemonitoring does provide key insights. The evidence on telemonitoring is dominated by those focused on chronic condition and indicates that telemonitoring has the greatest potential in monitoring chronic disease that have "hard data" and vital signs and indicators that lend itself to data capture and telemonitoring. For example, telemonitoring devices can be used by patients with chronic heart failure (CHF) to make daily measurements of their heart rate, blood pressure and oxygen saturation which is directly transmitted to their physician for faster diagnosis and monitoring. For patients with diabetes, telemonitoring devices can be used to monitor their blood glucose levels and weight fluctuations. That information can be sent to their endocrinologists for review and management. In these cases, patients, caregivers and clinicians can immediately track improvements in blood sugar levels. For complex conditions or technologies, the impact is not immediately visible.

The literature evaluating the cost-effectiveness of telemonitoring is also limited. Rigorous economic evaluation is complicated by rapidly changing costs of the underlying technology. To date, some short-term cost-effectiveness studies have been conducted. However, the long-term cost savings and benefits are not taken into account. Despite these challenges, many experts consider telemonitoring as an innovative way to reduce healthcare costs and provide efficient care.[5,6]

Evidence for Telemonitoring for Children

There is a substantial amount of literature related to the role of telehealth and telemonitoring for a pediatric population. However, most fell outside of the definition of telemonitoring used in this report (e.g., child abuse evaluation, clinician-to-clinician consultation). A substantial amount of literature included videoconferencing techniques. Those studies that included videoconferencing techniques <u>and</u> used asynchronous use of telemonitoring were included in this analysis. Videoconferencing and "store and forward" are considered common techniques used in telemedicine to transfer data (e.g., x-ray, digital images) to the physician for both real-time and retrospective review. This is especially a useful technique when working with the pediatric population with mental health conditions.

The literature search strategy included searches containing terms that would capture articles related to the effectiveness and cost effectiveness of telemonitoring for the top conditions of the Wellness Program population: asthma, developmental disabilities, ADD/ADHD, depression, and bipolar disorder. (For more information about the literature search strategy, please refer to the Appendix). The search results were additionally culled to determine which studies were most applicable to children, since more than 90 percent of the Wellness Program's enrollees are children. As mentioned previously, the current analysis focuses on asthma and autism, since a

[4] Wootton R. Twenty Years of Telemedicine in Chronic Disease Management –An Evidence Synthesis. Journal of Telemedicine and Telecare. 2012; 18: 211–220.
[5] Bergmo, T. Can Economic Evaluation in Telemedicine be Trusted? A Systematic Review of the Literature. Cost Effectiveness and Resource Allocation. 2009; 7: 18.
[6] Leach et al. If you Bill it, They will Come: A Literature Review of Clinical Outcomes, Cost-effectiveness and Reimbursement for Telemedicine. California Telemedicine and eHealth Center; 2009.

large portion of the literature and evidence base pertains primarily to these conditions—with asthma having the most relevant search results followed by autism. While depression was a common condition and yielded several studies, the initial analysis revealed that the majority of literature could not be generalized to children. The use of telemonitoring for depression was either targeted at the elderly population living in nursing home facilities, at cancer patients suffering from depression, or people suffering from anxiety or eating disorders. Speech and language development disorders (as subsets of developmental disabilities) both appeared in substantial supporting literature during preliminary literature searches. However, detailed analysis of the literature revealed that these studies primarily focused on synchronous forms of telehealth that did not include an asynchronous use of telemonitoring as a major program component were not included in this analysis. Telehealth activities included speech-language pathology assessment and treatment telerehabilitation, both of which were excluded from this evaluation. Similarly, literature on other mental health and behavioral conditions such as ADD/ADHD and bipolar disorder were concentrated on telephone-based treatments to children in rural areas or low-income housing communities, and are also outside the scope of this evaluation.

Effectiveness of Telemonitoring for Children with Autism

Autism is a neurological disorder that affects three areas of development—social interaction, communication, and creative/imaginative play. The disorder begins in childhood and persists through life.[7] In general, there are inconsistencies in the terminology and definitions associated with autism, which required clarification: The terms Autism, Autistic Disorder, or Autism Spectrum Disorders (ASD) are commonly used terms. Related disorders (Asperger's Disorder and PDD-NOS [pervasive developmental disorder-not otherwise specified]) and/or the two less common disorders (Rett's Disorder and Childhood Disintegrative Disorder) that are technically considered pervasive developmental disorder/autism. PDD is frequently used interchangeably with ASD.[8] The literature search strategy included a comprehensive search of all terms, but for the purposes of this report, the term "autism" is used synonymously with all of these conditions.

Research has shown that while there is no cure for autism, there is evidence suggesting that behavioral intervention treatments may improve the behavior, cognitive function, language, and social skills of children with autism.[9,10] Children with autism, and their families, face challenges starting from the initial diagnosis (e.g., scheduling appointment at the clinic) throughout the long-term treatment. There are communication barriers between the physician and the family due to the unique nature of autism. Often, it is difficult to accurately and effectively communicate the therapeutic and behavioral responses of autism to the physician in real-time. In addition, specialists who can effectively assess and treat children with autism are few in number, especially in underserved and rural areas.[11] Telemonitoring and related technologies provide an opportunity to address some of these challenges.

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[7] Oberleitner R. et al. Merging Video Technology with Personal Health Records to Facilitate Diagnosis and Treatment of Autism. Proceedings of the 1st Distributed Diagnosis and Home Healthcare (D2H2) Conference, Arlington, Virginia, USA; April 2-4, 2006.
[8] The American Psychiatric Association's Diagnostic and Statistical Manual-IV, Text Revision (DSM-IV-TR).
[9] Myers SM, Johnson CP; American Academy of Pediatrics Council on Children With Disabilities Pediatrics. 2007 Nov; 120(5):1162-82.
[10] California Health Benefits Review Program. Analysis of Senate Bill TBD 1: Health Care Coverage: Autism. A Report to the 2011-2012 California Legislature; 2011.
[11] Soares N and Langkamp D. Telehealth in Developmental-Behavioral Pediatrics. Journal of Developmental & Behavioral Pediatrics. Telehealth in Developmental-Behavioral Pediatrics. Accepted for publication, forthcoming Fall 2012.

Findings from Literature

Currently, the data in literature related to autism and telemonitoring are limited to summary articles describing telemonitoring interventions, and are observational in nature. The evidence presented in literature emphasizes the unique needs of the autism community and suggests that telemonitoring and health technologies can positively impact children with autism and their families.

Abowd et al. describe systems that support "capture and access" technologies to enable monitoring and interventions for children with behavioral and learning disabilities, including autism. These technologies can be used not only in the home but in school-based environments, and can help to provide a more "complete picture" of the child's behavioral, social, and communication needs.[12] Oberleitner et al. find that similar capture and access technologies can be used to accurately diagnose and monitor a child's symptoms and spontaneous behavior, as well as assess a child's reactions to a specific therapeutic intervention. Tele-behavioral health platforms that utilize a custom video clip capture in conjunction with a personal health record platform technology can provide significant benefits to the child with autism as well as their community of caregivers.[13] These technologies include unobtrusive digital cameras to capture both video and audio content of the child in their natural setting. The digital video clips can then be stored and managed on a medical record database which stores all information in one secure, central location and can be securely transmitted to the physician over the internet or other secure online server. While the information can be presented to the physician for immediate attention and treatment advice, it can also be captured, measured, mined, and analyzed over time. This type of telemonitoring can be used for continuous monitoring systems where captured data can be tracked and analyzed in the future to develop more effective and tailored treatment plans.[14]

Child and Adolescent TeleMental Health (CATMH) programs, another form of telehealth that includes asynchronous use of telemonitoring, is described by the American Telehealth Associations' Evidence-Based Practice for Telemental Health.[15] This report describes how CATMH programs have been successfully implemented for children, including preschoolers as young as 2.5 to 3 years old, with mental health disorders in pediatric clinics and community mental health centers. These programs integrate the use of video teleconference (VTC) as a method for therapists and practitioners to observe children's motor skills and other behaviors while they move around and play in a safe and comfortable environment. Studies show that parents and children were satisfied with services provided by these CATMH programs.[20]

CATMH programs implement innovative ways for teletherapists to successfully work with children with cognitive limitations, such as autism. One of the common challenges faced is building a relationship between the therapist and the child, and being able to engage children that have not yet developed interpersonal skills and relatedness. To overcome this challenge, teletherapists strategically manipulate the picture-in-picture box in the corner of the monitor used for the VTC to have a close-up view of the child and his/her parents. They also utilize creative

[12] Abowd et al. Challenges and Opportunities for Collaboration Technologies for Chronic Care Management. The Human-Computer Interaction Consortium (HCIC 2006).

[13] Oberleitner et al. Merging Video Technology with Personal Health Records to Facilitate Diagnosis and Treatment of Autism. Proceedings of the 1st Distributed Diagnosis and Home Healthcare (D2H2) Conference, Arlington, Virginia, USA; April 2-4, 2006.

[14] Oberleitner et al. The Potential of a Store and Forward Tele-Behavioral Platform for Effective Treatment and Research of Autism. Proceedings of the 26th Annual International Conference of the IEEE EMBS, San Francisco, CA, USA; September 1-5, 2004.

[15] American Telehealth Association. Evidence-Based Practice for Telemental Health;2009.

ways to stimulate a traditional play session with children over the telemonitor. CATMH found that children often enjoyed drawing pictures, and the pictures were able to reveal behavioral and physiological patterns in the child. While the parents provide history to the teletherapist, the children would draw pictures which would be sent electronically to the therapist for review and analysis. Additionally, teletherapists used story-telling and puppets to facilitate play with the child over the telemonitor. According to the ATA report, while these early stage studies did not draw conclusions about the overall clinical effectiveness of these telehealth programs, they did provide a positive outlook for the role of telemonitoring in managing the mental health disorders of children.

In summary, research suggests that children with autism and their parents are satisfied and open to using telemonitoring as a form of health intervention. Additionally, effectiveness results to date show improvement in behavior.[20] No information or conclusions on cost effectiveness have been made thus far. While the evidence base is still evolving, experts and researchers have found that telemonitoring and the introduction of innovative health technologies have the potential to provide positive benefits to children and their families.

Potential impact of pilot program for children with Autism

Telemonitoring for observation, ongoing diagnosis and evaluation, and treatment of autism is primarily focused on the time shifting of data analysis, resource access (i.e., access to specialists without the need for travel), and augmented data collection (i.e., behavior capture of patients in real-world conditions and non-clinical setting). While these methods can be used both synchronously and asynchronously, they have to date primarily been used to expand and augment traditional autism standard of care. For example, telemonitoring is used to alleviate the shortage of pediatric subspecialists focusing on developmental disabilities, reducing the wait times for specialist access that have averaged 13 weeks.[16] Access limitations are further exacerbated in underserved (rural and urban) areas. The largest benefit of a telemonitoring pilot program for autism patients by HHSC will be the increased availability of specialist resources. This increase in resource availability has the potential to increase patient compliance with treatment regimens, increased access to specialists aligned to a patient's specific need, and increased flexibility in patient evaluation.

Due to limited information detailing measured effectiveness improvements in autism as well as ambiguity around the demographics and exact number of patients currently enrolled in the Wellness Program, cost-effectiveness was not able to be determined at this time. Based upon existing literature, however, it is most likely that implementation of telemonitoring to support patients with autism will result in an expansion of care availability with an increased cost related directly to the costs of telemonitoring. No reductions in care cost itself would be expected as the standard of care would remain the same, albeit provided via remote resources.

[16] American Board of Pediatrics 2010-2011 Workforce Data Available at http://www.abp.org/ Accessed August 1, 2012.

Effectiveness of Telemonitoring for Children with Asthma

Asthma is a chronic inflammatory respiratory disease and is the most common chronic disease of childhood.[17] This chronic disease brings significant burden to sufferers and requires proper treatment and careful attention from clinicians and caregivers. In the cases of both pediatric and adult asthma, there is a significant cost burden when the asthma is not properly managed; from indirect costs associated with school and work absences to costly trips to the emergency room or physician's office.[18] Telemonitoring can potentially play a role in addressing some of the cost burdens faced by asthma patients by enabling remote delivery of patient-centered care, thereby facilitating expert feedback, and promoting self-monitoring and management compliance.

To examine the effectiveness of telemonitoring interventions for children with asthma, the analytic strategy emphasized the most authoritative literature—meta-analysis of RCTs, followed by systematic reviews. The evidence base was further examined to determine whether the study populations included children. The results were not always conclusive as it was difficult to accurately measure health outcomes and generalize results across individual indications (e.g., for patients with mild to severe asthma) and assess the full range of telemonitoring applications. However, the overall analysis of the evidence suggests that telemonitoring is a potentially effective method to monitor and treat asthma patients. Potential health benefits include improved quality of life (for both patient and caregiver), reduced exacerbations, improved PEF, and treatment maintenance. There is some evidence that hospitalization may be reduced, depending on the severity of asthmatic condition and design of the telemonitoring system, although the data pointing to this are inconclusive. Table 1 contains a summary of the analyzed literature by clinical outcome and cost effectiveness.

Findings from the Literature

Systematic literature reviews that analyzed effectiveness studies of telemonitoring in patients with asthma were used as the primary source of data for this evaluation. Four recently published systematic literature reviews met the criteria for inclusion and were found to be the most comprehensive review of empirical studies.[19,20,21,22] One of these in particular, the Cochran Collaboration Review, was heavily weighted since it was a meta-analysis of RCTs.[23] In addition, the literature search strategy included studies that were either excluded from the systematic reviews or conducted after their publication dates, and specifically focused on children with asthma.

The Cochran Collaboration Review. The Cochran Collaboration conducted a meta-analysis of RCTs that studied the effectiveness of "telehealthcare" for asthma.[24] Reviewers defined

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[17] Masoli et al. Global Burden of Asthma. The Global Initiative for Asthma 2003.

[18] Punekar et al. Establishing the Incidence and Prevalence of Clinician-Diagnosed Allergic Conditions in Children and Adolescents Using Routinely Collected Data from General Practices. Clinical and Experimental Allergy 2009; 39: 1209-16.

[19] McLean et al. Telehealthcare for Asthma (Review). The Cochrane Library; 2010: 10.

[20] Jaana et al. Home Telemonitoring for Respiratory Conditions: A Systematic Review. The American Journal of Managed Care. 2009;15:13-320

[21] Paré et al. Clinical Effects of Home Telemonitoring in the Context of Diabetes, Asthma, Heart Failure and Hypertension: A Systematic Review. J Med Internet Res. 2010;12:2.

[22] Smith et al. Technology and its Role in Respiratory Care. Primary Care Respiratory Journal. 2009;18:159-164.

[23] A meta-analysis refers to a method of pooling results from different studies (in this case, RCTs) to understand the combined impact of telehealthcare interventions on a particular health outcome. Individual RCTs are weighted (e.g., by the size of the study population, study design, etc.) Meta-analysis allow for researchers to make more powerful estimates than those estimates derived from a single study.

[24] McLean et al. Telehealthcare for asthma (Review). The Cochrane Library; 2010: 10.

telehealthcare services as the use of the telephone, videoconferencing, text-message (also known as Short Message Service – SMS), instant messaging, email and the Internet to facilitate remote patient monitoring and decisions on care by healthcare professionals. The Cochran review included studies that included adults and/or children. The review included 21 RCTs (completed and/or in progress) conducted on patients with asthma. Reviewers found telehealth interventions did not result in improvements in quality of life that were clinically meaningful. Reviewers also examined whether telehealthcare services affected the likelihood that a patient would visit the emergency department (ED) and found no statistically significant effects on ED visits. They did find a significant reduction in hospitalizations over a 12-month period, especially for those with severe asthma. In general, they found that telehealthcare interventions are "unlikely to result in clinically relevant improvements in health outcomes in those with relatively mild asthma, but they may have a role in those with more severe disease who are at a high risk of hospital admission." The review concludes that more rigorous research must be done to establish the effectiveness and cost-effectiveness of these telehealthcare interventions.

Two studies that were included in the Cochran review included children. Chan et al. focused primarily on the effects of telemonitoring on asthma management in children, while the study by Willems et al. examined the cost-effectiveness of a nurse-led telemonitoring program on both children and adults.

Chan et al. compared the effects of internet-based home monitoring with office-based care on children with asthma. [25] A total of 120 children with asthma between the ages of 6-17 years old were randomized into either the intervention group or the office-based group. The telemonitoring intervention was an internet-based asthma website that allowed patients to interact directly with trained asthma care mangers. Store-and-forward technology was used to collect and submit the children's daily asthma diary, inhaler technique video and Peak Expiratory Flow (PEF) meter recordings directly to trained asthma care managers for review and feedback. The office-based group received standard in-person asthma care with a nurse case manager. The disease control outcome measures included quality of life for both the caregivers and the patients, utilization of services (e.g., hospitalizations, unscheduled asthma-related clinical visits) and symptom control (e.g., therapeutic adherence, symptom diary adherence). Researchers found that children who received the home asthma telemonitoring had greater adherence to their daily symptom dairy submission and better metered-dose inhaler scores. However, there were no other differences in the therapeutic or disease control outcome measures between the two groups. Chan et al. concluded that while the home asthma telemonitoring technology may be comparable to office-based care, the data did not show any significant improvements in the health outcomes of children with asthma.

Willems et al. evaluated the cost-effectiveness of a nurse-led telemonitoring intervention that measured peak expiratory flow in mild to moderate patients with asthma. 109 outpatients, 56 children (7-18 years) and 53 adults (18 years and older) were randomized into either an intervention group or control group.[26] The telemonitoring intervention was a home monitoring device with a matching modem that allowed the patients to record and review their spirometry

[25] Chan et al. Internet based Home Monitoring and Education of Children with Asthma is Comparable to Ideal Office-based Care: Results of a 1-year Asthma In-home Monitoring Trial. Pediatrics 2007; 119: 569-78.

[26] Willems et al. The Effectiveness of Nurse-led Telemonitoring of Asthma Results of a Randomized Controlled Trial. Journal of Evaluation in Clinical Practice. 2008;14: 600-9.

test results and transfer the data directly to a trained nurse by connecting their monitor to a phone. The control group received standard outpatient care. As a result, the data showed no significant differences in the quality of life between the two groups. The mean healthcare costs per patients, calculated in 2002, were higher in the intervention group (€2,228 for adults, €1,193 for children) than in the control group (€1,720 for adults, €588 for children). While the medication costs and costs of professional home care accounted for the overall higher healthcare costs, the cost difference between the groups was largely due to the costs of the intervention. Willems et al. concluded that the intervention was not cost saving and had limited cost effectiveness, especially among children (€31,035 ($37,948)/QALY gained among adults and €59,071 ($72,229)/QALY gained among children).[27] They did suggest, however, that a price decrease for the monitoring device would increase the probability of intervention being cost-effective over time.[28]

Reviews conducted by Jaana and colleagues and Pare and colleagues. Jaana et al.[29] discussed the effects of home telemonitoring for patients with respiratory conditions, while Paré et al.[30] evaluated telemonitoring in the context of four chronic diseases: diabetes, asthma, heart failure and hypertension. Both of these reviews were published in 2010, synthesized the same studies, and drew similar conclusions: that there are mixed results but the evidence trends towards improved quality of life, reduced exacerbations, improved PEF, and treatment maintenance.

- Both reviews analyzed a total of six RCTs on patients with asthma and indicated that five studies revealed a significant improvement in Peak Expiratory Flow (PEF), a significant reduction in the symptoms associated with asthma, and a large improvement in perceived quality of life when using telemonitoring. One of the five RCTs that demonstrated positive health benefits was conducted by Rasmussen et al on a sample of 300 Danish adults randomized to three groups: (1) home telemonitoring by Internet (the intervention group);(2) monitoring by a specialist; and (3) monitoring by a general practitioner. The trial yielded positive results in all health outcomes when comparing asthma patients in the intervention group to the patients in the two non-intervention groups with statistical significance: fewer asthma symptoms, better quality of life, and better pulmonary function. The statistically significant results suggested that a patient's asthma was better controlled when physicians and patients used an interactive tool to monitor asthma over the Internet. Likewise, similar results were confirmed by the other four small RCTs that indicated positive health outcomes.
- Jan et al. conducted and RCT assessing the effectiveness of an Internet-based interactive asthma educational and monitoring program for improving childhood asthma outcomes. Children using the intervention (n=88) in comparison to the conventional asthma management (n = 76) reported fewer symptoms, improved peak expiratory flow (PEF), and improved quality of life. [31]

[27] QALY: Quality adjusted life years. In the cost effectiveness analyses the mean incremental health care costs were weighted against the mean incremental effect in terms of quality adjusted life years.
[28] Willems et al. Cost-effectiveness of Self-Management in Asthma: A Systematic Review of Peak Flow Monitoring Interventions. Int J Technol Assess Health Care 2006; 22:436-442.
[29] Jaana et al. Home Telemonitoring for Respiratory Conditions: A Systematic Review. The American Journal of Managed Care. 2009;15:13-320.
[30] Paré G. et al. Clinical Effects of Home Telemonitoring in the Context of Diabetes, Asthma, Heart Failure and Hypertension: A Systematic Review. J Med Internet Res. 2010;12:2.
[31] Jan et al. An Internet-based Interactive Telemonitoring System for Improving Children Asthma Outcomes in Taiwan. Telemedicine and e-Health. 2007; 13: 257-268.

- Guendelman et al. conducted an RCT focusing on limitation in the activity of children (aged 8-16) and found that the intervention groups had significantly less likelihood to experience PEF readings indicating severe asthma exacerbation, insufficient control requiring medical condition, and urgent call to the hospital.[32]
- William et al. (cited by both systematic reviews) showed no significant difference in clinical outcomes (e.g., asthma symptoms and quality of life) between telemonitoring and standard care. The study design may have been limited given the small sample size, infrequency of data transmission (once a month vs. daily) or severity level of patient's asthma.

Review conducted by Smith and colleagues. Smith et al. used inclusion criteria that were less rigorous (i.e., included other studies that were not limited to RCTs) and found less promising outcomes for telemonitoring and improvements in health outcomes. Smith et al. explored the effects of technology and respiratory care, specifically with long term conditions such as asthma and chronic obstructive pulmonary disease. The review states that studies revealed patient's overall satisfaction and compliance with a wide variety of technology, but studies lacked clarity and empirical evidence to support service, care and financial benefit to patients and health outcomes. Smith et al recommended that more robust studies be conducted to address the concrete benefits of telemonitoring on specific patient populations with chronic illnesses, and asked whether the use of technology actually promotes the resolution of symptoms or encourages patients to better self-manage their respiratory condition.[33]

Additional studies which were not included in the systematic reviews. Bergman et al. conducted a prospective study on 96 children with asthma between the ages of 5 and 12 to evaluate the feasibility of a school-based telemonitoring program to facilitate asthma care and improve asthma outcomes. [34] The telemonitoring intervention involved a telemedicine link, which included real-time video and audio conferencing, to provide access and communication between an asthma specialist and the child while at school. Through this telemedicine link, the asthma specialist was able to interview the child, observe asthma-relevant examination by the on-site nurse and review spirometry data directly uploaded to their laptop computer. The asthma specialist could then provide an asthma action plan and treatment recommendations for each child. After the 32-week period, subjects demonstrated a significant improvement in the functional health outcomes, which included both physical and social health of the child and their parents, and asthma knowledge of both the child and parents. Results also showed a trend towards improvement (i.e., reduction) in the number of asthma attacks per patient. There were, however, no significant changes in spirometry, hospitalization, ED visits or unscheduled visits to the primary care physician. As a result, the study successfully demonstrated the feasibility, efficiency and acceptance of using a telemedicine link to facilitate expert asthma care to children in school. While results suggest positive effects of a school-based telemonitoring program, Bergman et al. recommend researchers conducted an RCT to fully assess the impacts of telemonitoring on health outcomes.

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[32] Guendelman et al. Improving Asthma Outcomes and Self-management Behaviors of Inner-city Children: A Randomized Trial of the Health Buddy Interactive Device and an Asthma Diary. Archives of Pediatrics & Adolescent Medicine. 2002; 156: 114-120.
[33] Smith et al. Technology and its Role in Respiratory Care. Primary Care Respiratory Journal. 2009;18:159-164.
[34] Bergman et al. The Use of Telemedicine Access to Schools to Facilitate Expert Assessment of Children with Asthma. International Journal of Telemedicine and Applications; 2008.

Deschildre et al. examined the effects of daily home spirometry with teletransmission on children (n=50) with severe asthma.[35] The data were examined once a day by a well-trained physician who then contacted the parents of the child with asthma if clinically indicated. Researchers found no significant differences in exacerbations, inhaled corticosteroid maintenance treatment, lung function, or quality of life for the children, but parents showed significant and positive satisfaction rates. Researchers stated that their findings suggest ongoing medical feedback is necessary to realize the benefits of remote telemonitoring.

Potential impact of pilot program for children with Asthma
According to the Texas Asthma Control Program, asthma is one of the most prevalent chronic diseases in Texas, affecting an estimated 921,000 (14.3 percent) children (0-17 years of age) with self-reported lifetime asthma diagnosis. In addition, the hospitalization rate for children Texas in 2007 was approximately:

- 27.7 hospitalizations per 10,000 Texas residents for children aged 0-4;
- 18. 3 hospitalizations per 10,000 for children aged 5-9;
- 8.1 hospitalizations per 10,000 for children aged 10-14; and
- 3.2 hospitalizations for young adults aged 15-34.

While it is not possible to quantify certain benefits, children with asthma enrolled in the Wellness Program may realize benefits via improved quality of life, reduced exacerbations, improved PEF, and treatment maintenance with appropriate telemonitoring interventions. Appropriate telemonitoring interventions could include a range of interventions such as PEF monitoring and spirometry paired with remote health education and management.

Feasibility and other Considerations for Pilot Programs

Clinical and cost effectiveness are important considerations when assessing the feasibility of expanding or implementing a telemonitoring program. But there are several other factors that should be taken into consideration, including: telemonitoring applications and technologies that are appropriate to the population; system reliability and maintenance, patient, caregiver, and clinician acceptance and participation; availability and method of reimbursement; privacy of data transfer; methods for determining access to the telemonitoring services especially for underserved (rural or urban) areas, and the potential for cost reductions or cost-shifts from other settings of care. This section highlights a few of these considerations drawing from the grey literature and expert input.

Applications of telemonitoring can be considered in two ways: either for novel therapeutic uses (i.e., collection of novel/augmented clinical information, development of not otherwise possible treatment programs and interventions) or for time/geography shifting of traditional therapy modalities.

The first application (i.e., novel therapeutic uses) has the most potential for increasing clinical effectiveness, reducing cost, and improving cost effectiveness since it alters the previous

[35] Deschildre et al. Home Telemonitoring (force expiratory volume in 1 S) in Children with Severe Asthma Does not Reduce Exacerbations. European Respiratory Journal. 2012: 39: 290-296.

standard of care in some way by including additional interventions into a therapeutic program. The primary issue to consider, however, is whether these new improvements supersede the additional costs associated with the new telehealth interventions (e.g., upfront system costs, maintenance). Additionally, it is feasible that certain indication areas have a treatment 'ceiling' where additional intervention, therapy, etc., will result in no additional gains (e.g., once asthma is effectively managed, additional interventions will not result in significant reductions in cost or effectiveness). Together, these costs and potential limitation of therapeutic benefits of novel/additive interventions must be carefully considered when determining how and when to implement telemonitoring programs.

Geographic and/or time shifting of care availability and therapy, however, can be evaluated in a more straightforward manner. In this situation, therapeutic benefits of certain interventions are known and telehealth technologies are being used to expand availability of specialists (e.g., reduce long distance trips to specialists, allow providers to review data at a time other than data collection) to the patient population.[36] This expansion of availability and easier accessibility has the potential to increase adherence to standard treatment regiments, thereby improving overall effectiveness. As with novel uses of telehealth, the costs of implementing and maintaining systems required will be one of the biggest factors in evaluating potential overall cost savings. Interestingly enough, the *method* of determining geographic distance and travel time may impact feasibility calculations. For example, if the method to determine geographic distance was direct distance (e.g., "as the crow flies") the "distance" may be 25 miles. But actual distance calculated by using mileage and travel time could be double that number. These factors must be appropriately calculated when weighing benefits and travel time offsets.[37]

As noted above, the telemonitoring system cost (both upfront and over time) is a variable that must be considered in determining if and how to implement a telehealth program. Depending upon the complexity of systems implemented, specialist staff may be required to utilize the systems, maintenance may overcome potential cost savings, and system reliability may be an issue if systems are not fully established prior to implementation.
Another consideration is patient and caregiver acceptance and participation. Anecdotal evidence from home telemonitoring programs suggest that patients and caregivers may be more open to home monitoring than expected because it provides data that can support the caregiver or the patient's own self-care and maintenance, as well as providing a feeling of security.[38] In addition, as telemonitoring utilize platforms such as mobile devices, more consumers will be willing to test and use the associated telemonitoring applications.[39]

Reimbursement strategy and methods are also a key consideration. Reimbursement may only cover the portion of a telemonitoring event involving the clinician-patient visit (i.e., data collection and patient feedback), while excluding the transmission and review of patient data. Review of patient data in the case of children with developmental disabilities or autism is

[36] The Children's Partnership, School-Based Telehealth: An Innovative Approach to Meet the Health Care Needs of California's Children Digital Opportunity for Youth Issue Brief, Number 6: October, 2009.
[37] Soares N and Langkamp D. Telehealth in Developmental-Behavioral Pediatrics. Journal of Developmental & Behavioral Pediatrics. Telehealth in Developmental-Behavioral Pediatrics. Accepted for publication, forthcoming Fall 2012.
[38] Konschak C and Flareau B. New Frontiers in Home Telemonitoring: It's Already Here. Where are you? JHIM. 22:3. 2008.
[39] PricewaterhouseCoopers. Healthcare Unwired: New Business Models Delivering Care Anywhere. September 2012.

resource intensive.[40] For example, reviewing a 30-minute videotape of child's play behavior may be more time and effort intensive than reading an x-ray or blood sugar levels, but may be reimbursed at the same level as those activities (e.g., patient data review). Thus, potential payment levels provided by payers for services rendered through telehealth/telemonitoring, particularly for asynchronous telemonitoring, must be considered through all stages of program design and implementation.

Summary of the telemonitoring activities used by STAR and STAR+PLUS MCOs

In June 2012, HHSC sent a survey to the STAR and STAR+PLUS managed care organizations (MCOs) via e-mail, requesting a summary of telemonitoring activities and the cost effectiveness of those telemonitoring efforts. Of the 20 STAR and STAR+PLUS MCOs surveyed, 13 MCOs responded that they had not implemented or participated in any telemonitoring efforts to date, and four of the MCOs surveyed did not provide responses.

One MCO described their participation in a telemonitoring project for children with diabetes, where blood sugar results were monitored through a device. The project was ultimately not successful, and the MCO ended their participation in the telemonitoring project. The MCO has not participated in any other telemonitoring activities since that time.

Another MCO currently uses a vendor to provide telemonitoring services for their members with gestational diabetes. The vendor performs a home assessment with the member and training. The vendor then follows up with the member via telephone to record daily blood sugar results and insulin administration. The vendor is paid on a per diem basis. The MCO believes that this telemonitoring effort has proven cost-effective by helping to educate the member as well as provide an appropriate intervention, which ultimately keeps the member from seeking emergency services.

This same MCO also uses a different vendor to provide telemonitoring services to its members with asthma. An initial telephonic assessment with the member is completed, followed by a home visit where a trigger analysis is performed, if needed. The vendor then monitors the client via telephone and records their compliance with the prescribed treatment plan. The MCO also believes that this telemonitoring effort has proven cost-effective, by helping to educate the member as well as provide an appropriate intervention, which ultimately keeps the member from seeking emergency services.

The remaining MCO recently began using telemonitoring services in a limited capacity for certain behavioral health services. Their current use of telemonitoring is only for case management services and is used to capture case management sessions. The case managers that use telemonitoring provide services such as care coordination and member status checks (through which the case manager provides referrals for community resources, for example). The telemonitoring records are then used to develop treatment plans, and ensure quality case management visits. The implementation of this telemonitoring effort, however, is very recent, so cost-effectiveness is not yet assessed.

[40] Interview with Neelkamal Soares, MD, Physician of Developmental-Behavioral Pediatrics, University of Kentucky and University of California, Los Angeles, August 1, 2012.

Conclusion

The use of telemonitoring is limited in the Texas Medicaid program, which leads to a lack of empirical data to support the expansion of telemonitoring with this population. The Diabetes Home Monitoring Pilot Program encountered many obstacles with enrolling and retaining participants, and no significant positive clinical and cost outcomes were achieved. An analysis on feasibility of adding telemonitoring pilot programs for other diagnosed conditions showed that while there are some reports of positive clinical outcomes from telemonitoring activities with children who have diagnoses of asthma and autism, there is a lack of data to support the cost-effectiveness of these interventions. Also, a survey of Medicaid MCOs showed that the use of telemonitoring is extremely limited within this sector of the Medicaid population, and there is minimal evidence of cost-effectiveness. While HHSC's overall analysis suggests that telemonitoring activities are not likely to yield net cost savings to the State, the lack of data on this subject makes it difficult to draw any valid conclusions and additional assessments may be needed to fully assess the cost effectiveness and feasibility of expanding telemonitoring activities in Texas.

Appendix

Table 1: Levels of Client Participation

Level of Participation		Treatment	Control
1	Randomized into two groups	476	510
	Crossed over to other group	1	32
2	New totals after cross over	507	479
3	Verbal agreement only	267	238
4	Returned a signed Informed Consent	107	57
5	Returned a baseline blood sample	98	50
6	Blood sample of sufficient quality	90	48
7	Submitted at least two blood samples	66	37
8*	Submitted valid blood sample at entry and exit	51	32

*The Diabetech analysis is based on this level of client participation

Table 2: Mean Change in A1c – Control vs. Treatment

	Control Group	Treatment Group	*p* Value
n	32	51	
Baseline A1c	7.37 ± 2.27	7.64 ± 1.96	0.57
6 month A1c	7.00 ± 1.64	6.83 ± 1.39	0.09
Change A1c	**0.37 ± 1.90**	**-0.81 ± 1.14**	**0.16**

[1] Values are mean ± SD

Table 3: Cost analysis comparing original "intent to treat" control and intervention groups.

From Level of Participation (# 1 from Table 1) – Randomized Groups

	Intervention Period (Nov2009-Jul2010)			
Item	**Control Group**	**Treatment Group**	**P- Value**	**Difference**
Member Diagnostics				
Members	510	476		
Member Months	3682	3428		
Avg. Member Months	7.22	7.20		
PMPM:				
ED	$41.37	$39.08	0.800	-$2.30
IP	$228.28	$202.85	0.894	-$25.43
MD	$344.24	$334.94	0.533	-$9.30
Professional	$40.85	$38.33	0.773	-$2.51
Rx	$472.95	$459.29	0.821	-$13.66
Other	$6.14	$3.40	0.359	-$2.74
Total	**$1,133.83**	**$1,077.89**	**0.640**	**-$55.94**
Utilization (Rate per 1000MM)				
ED	111.90	115.52	0.892	3.62
IP	31.50	30.05	0.756	-1.46
MD	2358.50	2229.29	0.184	-129.21
Rx	2966.59	2829.05	0.128	-137.54

- There were 476 people in the treatment group.
- No metrics were statistically significant indicating that there was no detectable difference between the intervention group and the control group including the $56 PMPM drop in total costs which had a non statistically significant p-value of 0.64

Table 4: Cost analysis comparing original "intent to treat" control and intervention groups after migrating cross-over members.

From Level of Participation (# 2 from Table 1) – Randomized Groups with Cross-Over

	Intervention Period (Nov2009-Jul2010)			
Item	**Control Group**	**Treatment Group**	**P- Value**	**Difference**
Member Diagnostics				
Members	479	507		
Member Months	3440	3670		
Avg. Member Months	7.18	7.24		
PMPM:				
ED	$33.43	$46.67	0.494	$13.24
IP	$232.69	$200.38	0.744	-$32.31
MD	$343.84	$335.94	0.462	-$7.90
Professional	$40.25	$39.06	0.681	-$1.19
Rx	$465.66	$467.03	0.881	$1.36
Other	$6.53	$3.22	0.314	-$3.31
Total	**$1,122.39**	**$1,092.30**	**0.631**	**-$30.10**
Utilization (Rate per 1000MM)				
ED	97.97	128.34	0.151	30.37
IP	31.40	30.25	0.843	-1.15
MD	2332.27	2262.40	0.564	-69.87
Rx	2957.56	2846.59	0.331	-110.96

- There were 507 people in the treatment group.
- No metrics were statistically significant indicating that there was no detectable difference between the treatment group and the control group including the $30 PMPM drop in total costs which had a non statistically significant p-value of 0.63

Table 5: Cost analysis comparing original control and intervention groups with verbal agreement to participate.

From Level of Participation (# 3 from Table 1) – Verbal Agreement to Participate

		Intervention Period (Nov2009-Jul2010)		
Item	**Control Group**	**Treatment Group**	**P- Value**	**Difference**
Member Diagnostics				
Members	238	267		
Member Months	1790	1832		
Avg. Member Months	7.52	7.60		
PMPM:				
ED	$34.43	$45.33	0.528	$10.90
IP	$289.26	$122.58	0.117	-$166.68
MD	$312.75	$335.66	0.788	$22.91
Professional	$31.68	$33.78	0.679	$2.10
Rx	$507.21	$425.33	0.054	-$81.87
Other	$2.99	$4.01	0.400	$1.03
Total	**$1,178.31**	**$966.70**	**0.106**	**-$211.61**
Utilization (Rate per 1000MM)				
ED	94.97	124.45	0.398	29.48
IP	23.46	21.29	0.709	-2.18
MD	2308.94	2231.44	0.646	-77.50
Rx	2789.94	2728.17	0.544	-61.78

- There were 267 people in the treatment group.
- No metrics were statistically significant at the 5 percent level indicating that there was no detectable difference between the treatment group and the control group
- Total costs dropped by $212 PMPM which had a non-statistically significant p-value of 0.106.
- Rx costs did drop by $82 and almost achieved statistical significance at the 5 percent level.

Table 6: Cost analysis comparing original control and intervention groups with signed informed consent to participate.

From Level of Participation (# 4 from Table 1) – Signed Informed Consent

	Intervention Period (Nov2009-Jul2010)			
Item	**Control Group**	**Treatment Group**	**P- Value**	**Difference**
Member Diagnostics				
Members	57	107		
Member Months	232	682		
Avg. Member Months	7.73	7.58		
PMPM:				
ED	$46.19	$82.44	0.508	$36.25
IP	$146.50	$87.67	0.726	-$58.83
MD	$282.30	$360.48	0.312	$78.18
Professional	$36.79	$43.57	0.620	$6.78
Rx	$550.41	$486.73	0.554	-$63.69
Other	$8.84	$1.50	0.414	-$7.34
Total	**$1,071.04**	**$1,062.38**	**0.968**	**-$8.65**
Utilization (Rate per 1000MM)				
ED	150.86	180.35	0.786	29.49
IP	12.93	19.06	0.523	6.13
MD	2409.48	2504.40	0.895	94.92
Rx	3025.86	2870.97	0.161	-154.89

- There were 107 people in the treatment group.
- No metrics were statistically significant indicating that there was no detectable difference between the intervention group and the control group including the $9 PMPM drop in total costs which had a non statistically significant p-value of 0.968.