# FACILITATORS AND BARRIERS TO ADOPTION OF A SUCCESSFUL URBAN TELEMEDICINE MODEL


## ABSTRACT

We will evaluate facilitators and barriers to implementation of the Health-e-Access telemedicine network (**HeA**), a health IT application with established feasibility, efficacy, effectiveness and efficiency in management of acute childhood illness. This focus was chosen for developmental stages of this innovative approach to care because the unpredictable occurrence and high incidence of acute childhood illness promotes acceptance of an unfamiliar model of care that is distinguished by its convenience. ***Three service models*** have evolved in use of HeA to enable telemedicine access, (1) child care, (2) school, and (3) after-hours neighborhood models. Each model is highly flexible in meeting patient needs, in part because HeA technology is web-based and includes mobile patient access units The 3 models presently serve families in Rochester, NY, a mid-sized city with marked racial and ethnic disparities in socioeconomic and health status. Models are in various stages of development and deployment. Each has distinct strengths and weaknesses in serving incentives of the primary stakeholders. Incentives vary among the stakeholders, including parent/patient, clinician, patient's telemedicine access site, clinician, provider organization, payers, and the community at large. Children rarely go without care in this community, although care is usually not convenient and often not timely nor efficient.

The fundamental goal of our initiatives is replacement of inconvenient, inefficient and expensive traditional models of care, such as the emergency department (ED), through more convenient, high quality, less expensive models enabled by HeA. ***Specific aims*** are to: (A) achieve substantial deployment and solidify sustainable business models for each of the 3 urban telemedicine service models; (B) identify facilitators and barriers; (C) monitor impact on utilization patterns; and (D) create and disseminate an implementation and sustainability toolkit. A program logic model guides the development and deployment process, the evaluation and analysis in identifying facilitators and barriers, and the development of the implementation and sustainability toolkit. Program logic links the program work plan (activities and outputs in the context of available resources and liabilities) with results (short- and intermediate-term outcomes and long-term impact). Qualitative and quantitative methods will be used to guide program development, identify facilitators and barriers, and assess results. Utilization of all health services for children in the targeted inner-city zipcode areas will be monitored with telephone and telemedicine service logs, ED encounter files, and insurance claims data.

This proposal responds to AHRQ PAR-08-270 for support of health information technology (IT) demonstration projects that evaluate factors associated with successful implementation and utilization of health IT in order to improve the quality, safety, effectiveness and efficiency of health care in ambulatory settings. A particular focus is the AHRQ area of interest of Health IT to support patient-centered care, and the use of electronic exchange of health information to improve quality of care.

## 2. SPECIFIC AIMS

We propose to evaluate facilitators and barriers to implementation of the Health-e-Access telemedicine network (**HeA**), a health IT application with established feasibility, efficacy, effectiveness and efficiency in management of acute childhood illness. This initial focus was chosen because the unpredictable occurrence and high incidence of acute childhood illness promotes acceptance of an unfamiliar model of care that is distinguished by its convenience. We envision a broad range of additional applications across the life span to delivery of preventive services and chronic problem as well as acute problem management, once facilitators and barriers among all key stakeholders are fully explicated and sustainability is established.

This AHRQ Funding Opportunity (PAR-08-270) was designed to promote implementation of health IT innovations that are effective and sustainable in the real world. Research and demonstration projects ongoing since 2001 have addressed many technical, social, organizational and financial challenges to HeA implementation. The logical next challenge is to integrate this network into the healthcare system in a way that optimizes impact (maximizing benefits, minimizing costs) through sustainable service models. The highest level of implementation, we believe, is implementation that is sustained and replicated. Accordingly, we focus on identifying determinants (facilitators, barriers) of sustainability.

***Three service models*** have evolved in use of HeA to enable telemedicine access, (1) child care, (2) school, and (3) after-hours neighborhood models. Each service model has distinct strengths and weaknesses in serving incentives of the primary stakeholders. Incentives vary among the stakeholder groups, including parent/patient, clinician, patient's telemedicine access site, provider organization, payers, and the community at large.

In urban, Rochester, NY where these service models are deployed, families have several options for care of acute illness episodes. We have no evidence that children here go without care, although research on ED use, detailed below, indicates that care is often not timely, convenient, nor efficient. In this environment, families will embrace new service models for care of acute problems only if they recognize clear advantages over the traditional models of office, urgent care facility or ED care. Widespread use of any of the HeA service models will mean distinct reduction in use of traditional service models that are important to the financial interests of organizations that are deeply entrenched in the health care system. Replacement of inconvenient, inefficient and expensive traditional models of care through more convenient, less expensive models enabled by HeA is the fundamental goal of our initiatives.

To be replicated, disseminated and sustained, the new service models must be as good or better than existing models in meeting the incentives of the various stakeholders whose influence determines acceptance and use. The features of these new service models that meet these incentives must be identified and sufficiently well understood so they can be well articulated by individuals and organizations that would promote them.

### *Specific aims:*

**A. Achieve substantial deployment and solidify sustainable business models for of each of the 3 urban telemedicine service models.** Models include ***childcare*** (CC, model 1) access, ***school*** (S, model 2) access and ***after-hours neighborhood*** (AHN, model 3) access. Extensive experience has already been gained with childcare and school models, but additional implementation activities and resources are required to disseminate these models throughout the 4 targeted inner city zipcode areas. AHN telemedicine access has been piloted at 4 inner city neighborhood sites with funding from the NY State Health Department and the NY Health Foundation. Feasibility as well as key community and health system collaborations have been established. To achieve widespread understanding of the usefulness of this service among families and full integration within the health system will require considerable additional effort and time to impart information throughout the general community, to refine protocols and procedures to optimize experience among patient and provider participants, and to execute a broad change management program among provider organizations.

**B. Identify facilitators and barriers to dissemination of the 3 telemedicine service models.** During Project Year 1 and Year 3, we will identify facilitators and barriers for establishing and sustaining the telemedicine models. This will be accomplished through an array of qualitative methods and interviews administered to key informants and representative samples from primary stakeholder groups. Patient (parent) interviews will address satisfaction with the multiple steps in the process of obtaining care via telemedicine and other means of access to care for acute problems.

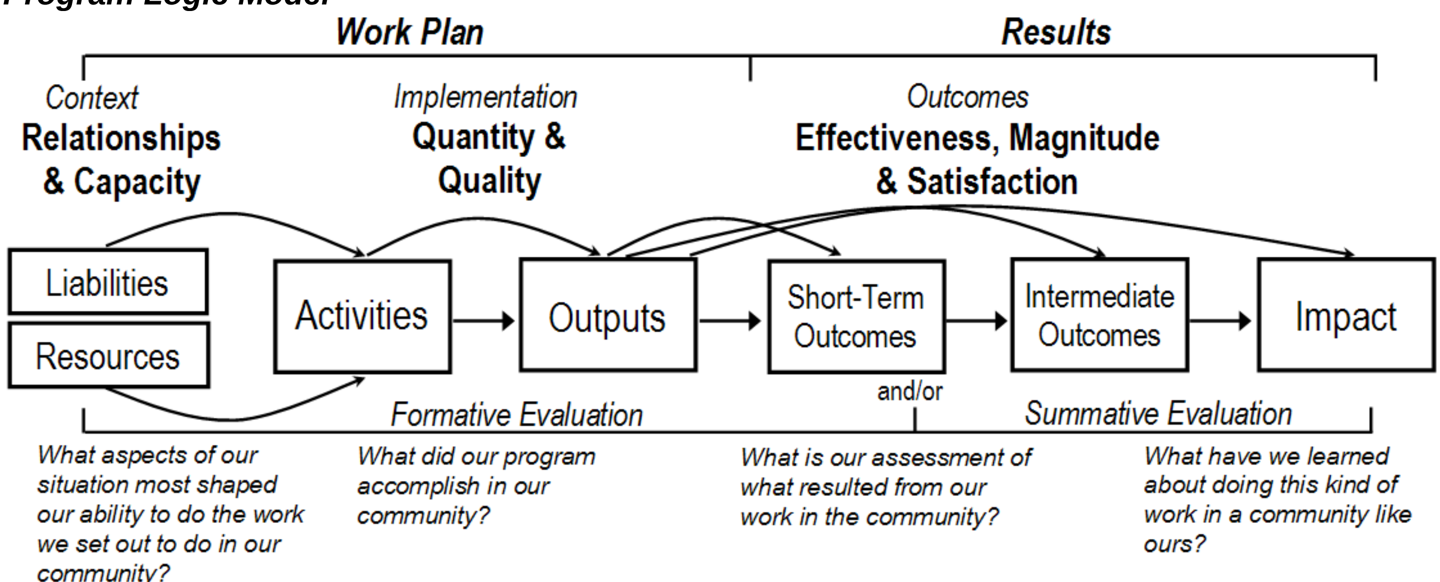
**C. Monitor impact of the HeA models on utilization patterns.** Almost complete utilization data for all children dwelling in targeted zips will be obtained by using three types of data (1) insurance claims, (2) ED encounter/accounting files, and (3) HeA electronic records. We have obtained and analyzed these data in the past. Denominators for calculations of key, zip-specific, utilization rates (ED, HeA service model) will be Year 2000 US Census data. Calculations will be performed for 12-month periods ending early in Year 1 and midway through Year 2. Analysis will be used to: (1) engage collaborating community organizations, clinicians, and provider organizations and their staff in the change process, (2) identify opportunities to improve use of HeA, (3) inform the community at large, and (4) reassure insurance organizations that the impact of HeA is, from their perspective, cost-neutral or better.

**D. Create and disseminate an implementation and sustainability toolkit.** Based on results of qualitative and quantitative analysis of Aim B, best practices for establishing and sustaining HeA to replicate these models will be incorporated into a freely available toolkit.

# 3. BACKGROUND AND SIGNIFICANCE

## OVERVIEW – PROPOSAL AND PROGRAM LOGIC

***Program Logic Model***




We use a ***Program Logic Model*** [1] to structure and integrate both program execution and program evaluation logically, and also to provide an organizational framework for the Implementation and Sustainability Toolkit (Aim D). Program Logic Models include 5 components, resources, activities, outputs, outcomes and impact. The first two – resources and activities – comprise the work plan. The remaining three components – outputs, outcomes and impact – represent results of the plan.

***Work Plan:*** *Resources (or inputs)* include the human, financial, organizational, and community resources a program has available to direct toward doing the work. *Activities* are what the program does with the resources. Program activities are the processes, tools, events, technology, and actions that are an intentional part of the program implementation. These interventions are used to bring about the intended program changes or results.

***Results:*** *Outputs* are the direct products of program activities and may include types, levels and targets of services to be delivered by the program. *Outcomes* are the specific changes in program participants' behavior, knowledge, skills, status and level of functioning. Short-term outcomes should be attainable within 1 to 3 years, while longer-term outcomes should be achievable within a 4 to 6 year timeframe. The logical progression from short-term to long-term outcomes should be reflected in impact occurring within about 7 to 10 years. *Impact* is the fundamental intended or unintended change occurring in organizations, communities or systems resulting from program activities within 7 to 10 years.

Throughout this proposal, sections of our logic model are expanded as appropriate to emphasize: (1) the assumptions and theory underlying our telemedicine service models; (2) causal linkages between program inputs and activities on one hand and program outputs and outcomes on the other; and (3) quantifiable products or events that are most sensitive to progress towards desired outcomes and, thus, are highlighted in measurement and analysis sections of this proposal.

**THE FAMILY'S PROBLEM**

Acute illness in children remains a major morbidity, social and economic burden across the socioeconomic spectrum. In addition to health care costs, acute childhood illness generates costs associated with transportation, parents' time lost from work, school and other responsibilities, and children's time lost from educational programs. A study based on a nationally representative sample of working women found that only 39% had someone they could call on to help with childcare the next time their child is sick.[2] Most women reported either that they would need to miss work (49%) or that they wouldn't know what to do (7%) when this occurs. Another study found that a child's illness accounted for 40% of missed work for parents using childcare.[3] Inner city parents especially jeopardize employment by leaving work to pick up an ill child as often demanded by child care programs or schools. Work absence to care for a sick child means loss of pay (or loss of job) for the many lower SES women working hourly jobs.

**THE HEALTH SYSTEM'S PROBLEM**

Children under 15 years in the United States make an estimated 71 million office visits annually for acute illness.[4] These visits account for 48.8% of all office visits for children and 30.0% of office visits for individuals of any age. In addition, children under 19 years make an estimated 29 million emergency department (ED) visits annually (estimate based on 2002 NHAMCS data),[5] a number that represents 27% of all ED visits. Approximately 20% of children make at least one ED visit yearly, and 7% make two or more. Many costly ED visits occur because of barriers in access to more appropriate settings, as demonstrated in a study of the University of Rochester Medical Center (URMC) ED.[6] Estimates for the proportion of children's ED visits that are non-urgent have ranged between 20% and 70%.[7,8,9,10]

**THE COMMUNITY'S PROBLEM**

Addressing these problems through access in childcare and schools makes sense for many reasons. Constraints of place and time impede access to child health services regardless of geographic area and socioeconomic status. Use of childcare and schools is ubiquitous. Childcare and school represent a home-away-from-home for the majority of US children. Care outside the home is the norm for pre-school children in the United States. Already in 1995, 60% of children from birth to 5 years of age participated in a non-parental childcare or early education program.[11] With continuation of the trend for young mothers to join the work force and the advent of welfare-to-work programs throughout the US, this proportion is undoubtedly larger today. Many pre-school children spend more waking hours in childcare than they do with their parents. Acute illness is a very common and difficult problem for all involved in childcare centers and elementary schools. Higher incidence and greater severity of illness among children in childcare than among children in home care is well documented,[12,13,14,15] as is the substantial economic burden of illness in childcare.[16,17,18]

**RESEARCH QUESTIONS: WHAT MORE DO WE NEED TO KNOW ABOUT HEALTH-E-ACCESS AS A SOLUTION TO THESE PROBLEMS?**

A substantial body of research supports feasibility and efficacy of the HeA model. Evidence also supports effectiveness from patient, provider and payer perspectives. As further detailed in PRELIMINARY STUDIES, evidence based on 7 years of experience with HeA in Rochester indicates that this model holds transformational potential towards optimizing access to care when integrated in the community's health system. Published research over this period – encompassing over 7000 telemedicine visits, children in 23 participating childcare and elementary school sites, 10 participating primary care medical practices with over 50 clinicians doing telemedicine visits – documents that this service enables high quality, cost-effective care that is well accepted by families and clinicians. Especially notable findings include a 63% reduction in absence from childcare due to illness, 87% continuity with the primary care medical home,[21,22] 96% completion of telemedicine visits,[21,22] and health system cost reduction due to 22.2% fewer ED visits for children with telemedicine access.

Much less is known about HeA efficiency, cost-effectiveness and acceptability, especially from the perspective of provider organizations. Provider organizations may have a different perspective from that of individual providers within the organization. Although enhanced continuity of care generally is important to the satisfaction of individual clinicians, the provider organization may believe that upfront costs required for adoption of HeA (e.g., training and other change-management investments in clinicians and staff) are not justified without a guaranteed short-term payoff in increased market share or increased efficiency of operations. Adoption of other innovations (e.g., electronic medical records, establishing evening office hours) may be judged a higher priority. The capacity of organizations to assimilate multiple major operational changes within a period of time is limited. Clearly, methods to minimize the upfront costs, speed the integration in practice routines and promote the assimilation in staff and clinician thought process will facilitate adoption by provider groups. Highlighting the importance of methods to facilitate provider group adoption, a survey of clinicians participating in HeA childcare and school service models, detailed in PRELIMINARY STUDIES indicate that clinicians perceive little or no improvement in efficiency of their operations when they use the HeA system. Accordingly, Aim B (identify facilitators and barriers) will include an emphasis on methods to facilitate adoption and reduce barriers to meeting incentives of provider groups.

Similarly, in order to optimize utilization patterns, knowledge must be gained about facilitators and barriers to changing access-related behaviors of families. These behaviors differ distinctly among the three HeA service models. Almost all parents of children in childcare have major commitments to work or school responsibilities. Many children attend childcare for large periods of each workday, often more than 8 hours, and childcare is essential to the ability of parents to meet this responsibilities. For childcare with telemedicine access, the call to the parent includes options of trying a telemedicine visit or picking up the child immediately. For the usual childcare program, lacking telemedicine access, there is no choice but to pick up the child and miss work. Thus, most childcare parents are eager to try the telemedicine option when they are confronted an untimely interruption at work in the form of a call (often dreaded) from childcare about illness. School-age children also get sick often, although less so than their younger, childcare counterparts. Accordingly, working parents of school-age children often face the same conflict between parental and work responsibilities that confront parents of preschool children.

Both childcare and school telemedicine access is limited to the hours that these facilities operate. Moreover, children who appear ill in the morning generally are not sent off to school or childcare. Accordingly, childcare and school service models are unable to address the problem of access for many childhood illness episodes. After-hours neighborhood telemedicine model is logical model to address these episodes, but there are many important differences in this model, especially in parents' access-related behaviors. Unlike the childcare service model, parents have familiar alternatives for access to care during evenings, weekends and holidays. These alternatives – the ED, walk-in and urgent care clinics, a next-day office visit – are less convenient, outside the medical home, or less timely, but they are much more familiar than telemedicine in a neighborhood site that families associate with social, recreational or religious activities. Much remains to be learned about barriers and the most efficient and effective means to promote use of the after-hours telemedicine service model by families.

## 4. THEORETIC FRAMEWORK AND PRELIMINARY STUDIES

The assumptions about individual and organizational behavior that guide our strategies to achieve substantial deployment of the 3 telemedicine models are based on theories of (1) fundamental human values and incentives and of (2) adoption of innovations in the marketplace. These theories fit the issue we address, which is truly one of transformation. We are promoting a fundamental change in the process through which health care is accessed and delivered. Such change that can be driven only by widespread belief that the alternative process offers clear advantages to most, if not all, stakeholders. When advantages are clear, stakeholders will find a way to overcome minor barriers and participate in a fashion that serves their best interest.

### THREE LEGS OF THE STOOL

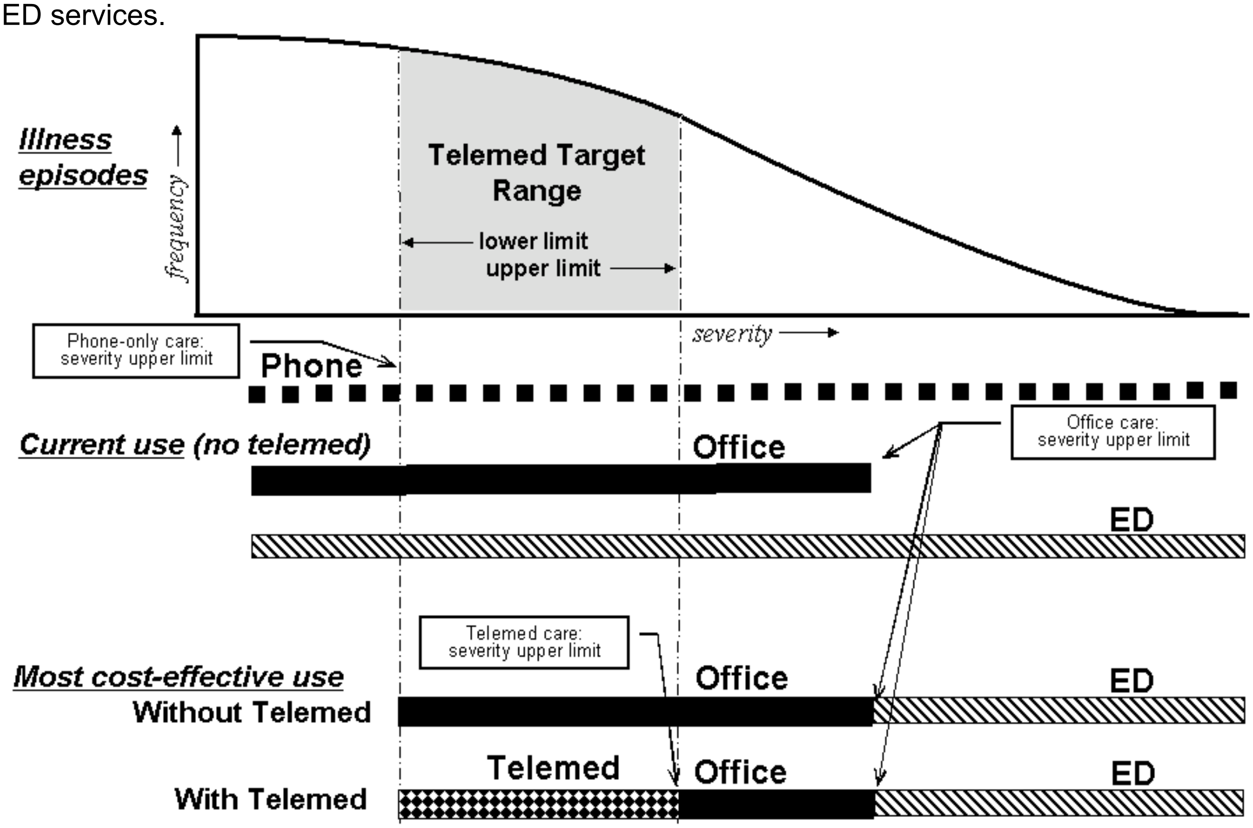
Another conceptual model that guides program development as well as our measurement and analysis in identifying facilitators and barriers has been termed the *three legs of the stool* of organizational architecture.[19] Within this conceptual framework, fostering the adoption, integration, and sustainability of telemedicine in healthcare is like constructing a three-legged stool. Success of any organizational innovation rests on three, solid, balanced legs, incentives, decision rights, and performance evaluation. This research program, including its evaluation metrics, addresses the following questions.

1. **Incentives**: What incentives and values for stakeholders affect the adoption of telemedicine?
2. **Decision rights**: What decisions relating to adoption and use does each stakeholder control?
3. **Performance evaluation**: How will stakeholders know their values are being served, and thus be able to exercise their decision rights in a rational manner?

This model fosters understanding of barriers and facilitators of HeA implementation by drawing attention to those stakeholders with power to influence (decision rights) critical steps in the processes involved in delivering care and to the measures (performance evaluation) required by these stakeholders that will allow them to know whether their values/incentives are being served (incentives). Awareness of decision rights allows identification of *dominant stakeholders*, i.e., those with sufficient influence to "make or break" adoption. Dominant stakeholders, obviously, hold the power to be potent facilitators or barriers to success. Understanding values allows selection of measures (performance evaluation) that are most relevant to the decisions that will determine adoption and sustainability.

### OPTIMIZING THE FIT BETWEEN CARE REQUIRED AND RESOURCES USED

The figure below includes (top portion) a schematic view of the distribution (frequency by severity) of acute illness episodes across the severity spectrum. The severity spectrum begins on the far left with minor illness episodes. Episodes can be managed without direct interaction with healthcare professionals, or by phone consultation, telemedicine visits, office visits, or ED visits. At the severe end of the severity spectrum (far right), telephone and telemedicine offer only triage; here, emergency medical services and EDs constitute key resources. This conceptual model emphasizes the potential to optimize the fit (maximize cost-effectiveness) between care required and resources available. It compares the current use (middle section of the figure) of healthcare resources with the most cost-effective use (bottom section) of office, telemedicine and ED services.




Phone - Telephone triage (including 911 calls) and advice for home management
Telemed - Health-e-Access telemedicine model
Office - Primary care office settings and current alternatives (urgent care center, retail-based clinic)
ED - Emergency Department

Current Use. Both offices and EDs are currently used for minor illness episodes that could be handled by phone alone. This is represented in the current use section of the figure on the far left. For moderately severe illness episodes, there is an overlap between the telemedicine target range (delimited by the two vertical dashed lines) and horizontal bars that depict the current range of office (solid) and ED (back-slash) use. Telemedicine could handle many office and ED visits for these mild to moderately severe illness episodes.

Most Cost-Effective Use. To achieve the most cost-effective fit in a healthcare system *without telemedicine*, only phone management would be used for illness episodes below the lower limit for appropriate office visit use (also the lower limit of the telemedicine target range). Ideally, office visits with the PCP would be used for many illness episodes to the right of this limit, but only for those less severe than the *upper* limit of the office severity threshold; that is, the point on the severity spectrum that requires resources that are available in the ED but not available in the office. Currently, however, many patients in this intermediate range are seen in the ED even though clinician expertise and the technology present in office settings enable clinicians to manage them there effectively. Thus, if patients are adequately covered by health insurance and have adequate transportation, limited office hours and full schedules are the central reasons why patients opt for the ED instead of the office.

To achieve the most cost-effective fit between care required and resources available in the health system *with telemedicine* (bottom bar), most of the illness visits shifted from ED to office to optimize the system *without* telemedicine would, instead, be shifted to telemedicine (checkered bar). Although concern about unnecessary ED use by children has heightened recently, this concern is longstanding. Obviously, attempts to address this issue with the usual system of care have had relatively little success.

***The pivotal influence of telemedicine*.** We believe that shifting visits from the ED to a more effective and efficient system of care will be more successful through the proposed HeA telemedicine model. The reason is, essentially, that **the HeA telemedicine model makes the right thing to do the easy thing to do**. In the health system with telemedicine, the alignment of incentives of key stakeholders makes it easier, for the many illness episodes in the telemed target range, to replace ED visits with telemedicine visits than it is to replace them with office visits. Key actors in determining whether the ED, urgent care facility, medical office, or telemedicine is used for care of a specific illness episode in the telemedicine target range include the provider (or provider's agent such as a phone nurse) and the parent. Their incentives and decision rights determine what facility will be used, and, with telemedicine available, they have strong incentives to do the right thing, in other words, to use the most cost-effective setting (HeA telemedicine) for problems in the telemedicine target range.

Telemedicine-enabled care in childcare or school when a health problem arises demonstrates optimal access attributes of right place and right time. Mechanisms in which telemedicine integrated with telephone management promotes the right care in other community settings, such as the HeA after-hours neighborhood telemedicine access sites, may be less obvious. One important example is that coupling telemedicine access to telephone advice encourages families to contact their primary care provider by phone at any time a concern arises. In the absence of telemedicine, after-hours telephone advice, dispensed both by on-call primary care clinicians and community-wide call-center nurses, frequently directs families to next-day or later in-person office visits. Although medically sound, such guidance may fail the family for psychological, social, or financial reasons. Such guidance may be inadequate to address parental anxiety, may fail to reduce the child's discomfort as soon as possible, and may conflict with personal or work responsibilities the next day. Phone advice that addresses such compelling psychological, social and financial influences by serving as the gateway to a neighborhood telemedicine access point is, however, more likely to be appreciated and therefore more often used.

At the clinician end, HeA telemedicine enables primary care clinicians to provide after-hours care in a fashion that is much more convenient and efficient for them than usual, in-office care. With after-hours telemedicine, they can care for most of the illness episodes presently seen in their office from their own home instead. There is no need to keep their office open. Moreover, it allows them to compete with retail-based clinics and urgent care centers on convenience, while offering the added value of continuity. The proportion of pediatric office visits that can be handled via telemedicine is large. Evidence substantiating this claim is reviewed among Preliminary Studies.

### PRELIMINARY STUDIES

Studies of Health-e-Access (**HeA**) have established the feasibility, efficacy, effectiveness and efficiency of this telemedicine model. Effectiveness and efficiency have multiple dimensions and measures. Relevance of these measures varies among stakeholders. As discussed below, however, evidence indicates that this model holds potential to enhance effectiveness and efficiency from the perspectives of all stakeholders. Preliminary data also supports our rationale for expanding HeA by establishing after-hours neighborhood (AHN) telemedicine access and linking telemedicine access to telephone management.

Prior to providing any health services via telemedicine, we assessed the potential impact of telemedicine for care of illness episodes managed in pediatric office practice. Visits for acute illness in children (<18 yr) presenting in 1999 to the primary care practice based at the University of Rochester Medical Center were studied.[20] Based on presenting chief complaint and final diagnoses, an experienced general pediatrician classified all 12,215 illness visits in 1999 to assess the potential for evaluation and treatment with telemedicine alone. Altogether, 77.9% of visits fell in the *telemedicine likely* group, defined as probably manageable via HeA. Assuming conservatively that at least half of *telemedicine likely* visits could be managed with telemedicine alone, observations suggested that at least 39% of illness office visits could be replaced with telemedicine. HeA technological and organization architecture is described in the section on the *Health IT Intervention* in RESEARCH DESIGN AND METHODS.

***Effectiveness in reducing burdens of childhood illness and enabling completion of visit, continuity of care and patient satisfaction***

Effectiveness. Direct experience with HeA provides the observations that are most relevant to assessing potential. Designed for care of mild and moderately severe acute illness in children, HeA has operated in urban and suburban childcare and elementary schools in Rochester, NY since May 2001, enabling over 7000 telemed visits (thru April 2009) from 22 child sites by 10 participating primary care practices. Especially notable achievements have included a 63% reduction in absence from childcare due to illness following the introduction of telemedicine. In addition, clinicians (N=43) from the 10 different pediatric primary care practices have been able to complete 96.3% of telemed visits attempted.[21,22] (We defined a telemedicine visit as *completed* if (1) the clinician makes diagnosis and management decisions and (2) treatment is instituted based entirely on telemedicine.) Moreover, among visits by children whose primary care practice was participating in HeA, 83% continuity was achieved. We defined *continuity* for telemedicine visits as completion by a clinician from the child's own primary care practice.

Parent perceptions and satisfaction with HeA visits has been high. Among 229 childcare parents interviewed following their child's first telemed visit, 94% said they would have taken their child for an office, urgent care center, or ED visit if the telemedicine visit had not occurred.[23] Parent estimates of the total time saved by the telemedicine visit averaged 4.5 hours. Also, 95% of these parents said the telemedicine visit allowed them to remain at work and 93% said they would choose a childcare program with telemedicine over one without.

A subsequent parent survey also revealed high levels of general satisfaction. This survey also identified specific attributes of telemedicine experience that parents liked and disliked.[24] Among 896 parent questionnaires completed by telephone interview, 578 were completed before and 318 were completed after the first telemedicine visit. 96 parents responded at both times. For those parents interviewed twice, results that follow include only the "after" interview. Demographics of the 800 unique parents responding were as follows. *Race/ethnicity*: black, 44%; Hispanic, 23%; white, 30%; other, 3%. *Education*: < high school, 16%; high school, 60%; college, 25%. *Child care or school location*: city, 77%; suburb, 23%. Several observations on their experience with childhood illness were notable. Almost all (95%) identified a source of well child care. A majority (61%) used one of the primary care practices that participated in Health-e-Access. Most parents (62%) had been required to pick up a child because of illness at child care or school, and 58% admitted that they had, at some time, given antipyretics to avoid being called about illness from child care or school. Mean (SD) estimates for the total parent time required for the usual office visit, including transportation was 2.4 (1.2) hours. On a worry scale of 1 (not at all) to 7 (very), worries about not speaking directly to the doctor about diagnosis and management or management and about the ability of the doctor to examine the child well averaged 2.7. Among 532 responses to open ended probes about likes and dislikes, 85% of responses identified positive attributes. Most of these 85% identified some dimension of convenience (e.g., convenience without further specification, saved time, able to stay at work, prescription delivered to child site or called ahead to pharmacy). Among the 15% of negative comments, the most common issues related to communication with the clinician (3.4%). Good communication, on the other hand, was identified as a positive attribute in 3.8% of comments.

In addition to the dominance of convenience over parent perceptions, another notable finding was lack of concern about continuity of care. As mentioned, 61% among the 800 respondents did not have a participating primary care practice, leaving 39% that did not. Among this 39%, 5% did not have an identified source of primary care (i.e., parent did not identify a source of well child care), leaving 34% who could not have been seen via telemedicine by a clinician from their medical home. Given that 83% of potential continuity visit were seen by a clinician from the child's medical home, at least 40% of visits for the 800 respondents were non-continuity visits. Yet, lack of continuity was not mentioned among the dislikes, not once.

***Clinician acceptance and satisfaction***

Most of the childcare and school telemed visits (70.1%) have been provided by mid-level practitioners (nurse practitioners or physician assistants). Many of these visits were done by a nurse practitioner dedicated to the telemedicine program during an early stage when all visits were done from the HeA central office. More recently, after all 10 of the primary care practices in the current HeA demonstration project began doing telemed visits (April 2006), 59.9% of telemed visits have been done by a mid-level practitioner. One reason that mid-level practitioner involvement has been so successful is that the technology allows highly efficient physician backup consultation. Fixed images, video clips and lung sounds captured in the HeA telemedicine system can be reviewed very quickly by a backup physician from almost any computer with internet access anywhere in the world.

Among the 43 clinicians that had completed at least one telemed visit, 30 (23 pediatricians, 7 mid-level practitioners) responded to a February 2007 questionnaire regarding their experience. Important findings follow. The time clinicians estimated for *decision making* via telemed visits averaged 10.3 min per visit. Also, 82.1% of clinicians estimated the time required for medical decision making via telemed was the same (50.0%) or less (32.1%) than that for similar office visits. Clinicians estimated a mean time for completing the entire visit via telemed (*total time*, i.e., including documentation and any contacts with pharmacy, parents and telehealth assistants) of 19.8 min per visit. Total time required probably has diminished since this survey was conducted because software was upgraded in June 2007 to allow easier documentation and navigation, and to allow prescriptions to be faxed directly from the software application to the pharmacy. Faxing prescriptions eliminates the substantial time that clinicians would otherwise spend phoning in prescriptions to the pharmacy. 48.3% of clinicians estimated that the total time required for completing the visit via telemed was the same (31.0%) or less than (17.2%) that for similar office visits (same as, 31.0%; less than, 17.2%). Among the 6 clinicians who had completed 50 or more telemed visits, mean estimates for time involved in decision making and total time were 7.2 and 15 min per visit, respectively.

Among the 30 clinician respondents, the proportion that felt the information conveyed by tympanic membrane images, other fixed images, or electronic stethoscope sounds was *as good or better* than that obtained in person was 76.7%, 40.0% and 13.3%, respectively. Among the 6 clinicians who had completed 50 or more telemed visits, 100% felt that the information conveyed by tympanic membrane images was *better than* that obtained in person, and the proportions that felt the information conveyed by other fixed images or electronic stethoscope sounds were *as good or better* than that obtained in person were 83.3% and 50%, respectively. 86.7% of clinicians expressed no discomfort working with telehealth assistants. Overall 46.3% of clinicians were at least as confident of diagnoses made via telemed as in person. Among the 6 clinicians who had completed 50 or more telemed visits, 83.3% were at least as confident of diagnoses made via telemed as in person.

In sum, findings indicate the HeA is effective, and that clinicians recognize this. But incentives in efficiency advantages for primary care providers to adopt telemedicine are weak. This mirrors the situation for adoption of electronic medical records (EMR), which only 28% of US physicians had adopted in 2006.[25] As recently observed regarding EMR adoption, "This is really not a technology problem. It's a matter of incentives and market failure."[26] Study findings suggest the HeA telemedicine model, as with EMRs, will attain its full potential only after greater attention is directed to provider incentives.

***Efficiency from the payer's perspective: impact on ED utilization and healthcare costs .***

A major focus in our studies of the HeA demonstration project in childcare and elementary school settings has been its impact on healthcare utilization and costs. This focus responds to reluctance by insurance organizations to reimburse for telemedicine because of their concern that the ready access offered might be associated with an increase in overall utilization. We hypothesized that there would be no change in overall (all sites) illness utilization for children served by HeA, but that there would be significantly fewer ED visits.

To assess this hypothesis we conducted a cohort study comparing utilization, based on secondary data (insurance claims) analysis, for intervention vs. control subjects.[27] For intervention children, telemed was available in school or childcare. All children eligible for inclusion in analysis had at least 6 consecutive months with insurance coverage. Child-months, the unit of analysis, were matched for intervention and control children on age, sex, socioeconomic status and season of the year. Claims data (predominately Medicaid Managed Care) captured all utilization for illness, whether telemed, office, or ED sites were used. A total of 19,652 child months from 1,216 intervention children were matched with 19,652 child months from control children. The study years between May 2001 and July 2007 were each divided into 13 equal 28-day periods in defining child-months. Payments for ED visits potentially replaced with telemed were estimated from ED accounting data for all pediatric ED visits to our medical center for 2006 for diagnoses that have been successfully managed through HeA. Usual payment for office and for telemed visits in this community is $50.

For child-months studied, the mean age was 6.71 years, 60.2% were from children dwelling in inner city zipcodes, and 79% were from children covered by Medicaid Managed Care. Among all child-months studied, higher ED visit rates and higher overall utilization rates both were strongly related ($P < .001$) to younger age, winter months, Medicaid rather than commercial insurance, and inner city residence. Of particular note, the

ED visit rate (visits per 100 child-years) for child-months from inner city children was 60.4 vs. 11.2 for suburban child-months.

As hypothesized, children with telemedicine access had fewer ED visits. In multivariate analysis adjusting for season of the year, health insurance type, child's age and socioeconomic area, ED utilization rate was 22.2% less among the intervention group. Overall illness utilization rates (including office, ED and telemedicine visits) were 23.5% greater for intervention than control children based on multivariate analysis. The higher overall utilization for intervention children is attributable to telemedicine utilization; in bivariate analysis, telemedicine utilization rate was 83.6 per 100 child-years for intervention children, and overall utilization rates were 336.4 and 273.7 visits per 100 child-years, respectively, for intervention and control groups.

Findings indicate the HeA telemedicine model has tremendous potential to reduce health care costs, mostly through replacement of ED visits for non-emergency problems. Even with the novelty of the intervention to both patients and providers and with the limited hours of availability in schools and childcare (i.e., excluding the evenings and weekends when most ED visits occur), health care costs were undoubtedly reduced among children with telemedicine access. Greater overall utilization due to telemedicine visits was a large part of the cost of reducing ED utilization through this telemedicine model. To provide a metric for the tradeoff between reduced ED visits and increased overall visits, we multiplied utilization rates in the control group (i.e., taking control group rates as baseline values) by rate ratios from multivariate analysis, thus calculating the projected increase in annual overall visits per 100 children (64.3) and the projected decrease in ED visits (12.8). Based on these projected changes, the tradeoff was 5.0 more visits overall per ED visit avoided.

This may be considered a cost-effectiveness metric, with overall visits added as the unit of cost and ED visits avoided as the unit of effectiveness. Thus, if the mean payment for the ED visits avoided is at least *5-fold greater* than the mean payment for added visits (i.e., telemedicine visits), then the healthcare system will at least break even on the introduction of telemedicine. Evidence suggests that relative mean payments exceeding this break-even ratio can be expected. In another study, [28] we estimated that mean payment in Rochester for ED visits with potential to be replaced by telemedicine was at least $355, a value that is 7-fold greater than the $51 mean payment for telemedicine visits.

We speculate that most of the observed increase in overall utilization associated with telemedicine reflects the utilization for illness episodes that are sufficiently severe that families with better access generally obtain in-person care for them. A substantial body of evidence indicates that impoverished, urban children endure a substantially greater morbidity burden than their more economically advantaged suburban counterparts.[29] This evidence includes our finding in prior research in this community that the hospitalization rate for asthma was 5-fold greater for inner-city than suburban children, but severity of illness for these hospitalized children did not vary by socioeconomic area.[30] Supporting our speculation, *overall* utilization was statistically no different between inner city (306.5/100 child-years) and suburban children (289.9/100 child-years), suggesting that many inner-city control children, after adjusting for illness severity, would be judged to under-utilize health services for illness when compared to their suburban counterparts.

***Experience with and outreach to racial/ethnic minority group members.***

As indicated in the description of the study population in RESEARCH DESIGN AND METHODS, the families served via HeA have been and will continue to be predominantly members of racial and ethnic minority groups. In addition, leadership of many CCS sites – such as the ABC Head Start, Wilson Commencement Park, Ibero Child Care, Eugenio Maria de Hostas Charter School, and the Rochester City School District – is dominated by members of racial/ethnic minority groups. Finally, the Health-e-Access Community Advisory Board (Appendix C) includes substantial racial/ethnic minority membership.

## 5. RESEARCH DESIGN AND METHODS

### OVERVIEW OF DESIGN AND METHODS

The strength of this evaluation lies not in an experimental design focused on a single or a small number of key findings, but rather in the potential for characterizing an extensive network of relationships among the multiple components of the Program Logic Model (see figure p2). Components include many drivers, activities and outputs of the work plan and the multiple levels of results across multiple stakeholders, i.e., short-term and intermediate outcomes and impact. Validity of the Logic Model is established not by a few key findings but by many observations that support the existence of causal relationships between activities and outputs, then between the multiple outputs and short-term and intermediate outcomes, and finally between outcomes and longer term impact. The elaborate pattern of many logical and interdependent linkages provides the compelling evidence that chance, alone, cannot explain the outcomes observed. Likewise, this logical and interdependent network of activities, outputs and outcomes establishes the existence of best practices, which will constitute the implementation and sustainability toolkit for replicating HeA service models (Specific Aim D).

Proposed studies, focused fundamentally on facilitators and barriers to replication/implementation and sustainability, fit the present stage of HeA development. Given that feasibility, efficacy, effectiveness and efficiency have been established, replication and sustainability are the remaining and most critical issues.

The fully developed Program Logic Model (Appendix B, Measures) guides our measurement strategy. Here in the Research Design and Methods narrative, we highlight several key components of the Logic Model and of proposed measurement and analysis, including technology and organization of the 3 HeA service models, which constitute key resources and activities. We also highlight distinguishing features among the 3 HeA service models and features that differentiate them from traditional models (in-person office, urgent care, retail clinic, and ED visits) and that are critical to meeting incentives of families for convenient yet effective care. Finally, we highlight activities of clinicians and provider groups that would constitute best practices, because providers are a dominant stakeholder, i.e., their full engagement and integration of HeA in patient-centered service routines are critical to optimizing HeA use and to optimizing patient access.

**STUDY POPULATION AND SETTING**

Children (<18 years) dwelling in Rochester's inner city will be the focus of analysis. The inner city includes two contiguous zipcode areas (14608, 14611) on the west side of city (**IC west**) and two contiguous zipcode areas (14605, 14621) on the east side of the city (**IC east**). The Genesee River separates IC west and IC east. Among the City of Rochester's total population (2000 Census) of 219,773, children < 18 years old numbered 61,735. Among these 61,735, 28,690 (46.5%) resided in the 4 zips that comprise the inner city. IC west includes 10,914 children (< 18 yr), and IC east includes 17,776. Any child residing in the City and using participating CCS sites or presenting to AHN access points will be eligible for care via telemedicine.

Rochester's inner city children not only endure a greater burden of morbidity, but their families have less social, material and financial resources to gain access for addressing this burden. Socioeconomic and racial/ethnic disparities between the inner city, the rest of the city and, especially, affluent suburbs are striking. Data from the 2000 census in the above table confirms this and indicates that IC west and IC east are socio-demographically similar, except for the balance between African Americans and Latinos. Disparities are no less present among young families. Based on analysis of over 26,000 Monroe County (Rochester area) birth records for 2006-2008, 31% of inner city mothers over age 18 years (i.e., excluding adolescent mothers) had *not* completed high school at the time they give birth, versus 5% in the suburbs. Among new inner-city mothers, 78% were African-American or Hispanic, compared to 11% of suburban new mothers. Inner city families in Rochester are served largely by health centers and hospital-based primary care practices whose strained resources provide only limited continuity of care and limited evening office hours.

***Comparisons Based on 2000 US Census***

| | **Units** | **IC West** | **IC East** | **City+ of Rochester** | **Suburb*** |
|---|---|---|---|---|---|
| Total population | N | 32,136 | 50,395 | 219,773 | 30,270 |
| Black or African American | % | 70.5 | 50.2 | 38.5 | 2.2 |
| Hispanic or Latino (of any race) | % | 8.8 | 27.9 | 12.8 | 1.3 |
| Median household income | $ | 20,585 | 20,559 | 27,123 | 87,126 |
| Families below federal poverty level | % | 30.6 | 34.0 | 23.4 | 1.0 |
| Families with children < 5y below poverty level | % | 48.8 | 52.8 | 37.5 | 0.9 |
| Families on public assistance | % | 20.5 | 21.0 | 13.6 | 0.5 |
| Educational attainment (among age 25 and over) | | | | | |
| High school graduate or higher | % | 63.1 | 58.8 | 73.0 | 96.0 |
| Bachelor's degree or higher | % | 9.8 | 7.7 | 20.1 | 63.1 |

\+ Includes IC West, IC East and remainder of City

* Monroe County's most affluent suburb, zip = 14534

Six city primary care medical offices have participated in HeA to date, Clinton Family Medicine, Anthony Jordan Health Center, Wilson-Lifetime Pediatrics, Genesee Pediatrics, Rochester General Pediatric Associates, and the Strong Pediatric Practice at the University of Rochester Medical Center (URMC). These practices provide primary care for about 80% of children who have been enrolled in participating CCS sites.

HeA participation was limited to these sites for the prior HeA Demonstration Project. This limitation, as well as the limitation to children using 23 designated child sites, was part of the 2005 agreement with all local insurance organizations to reimburse for HeA telemed visits.

Insurance reimbursement to providers and to HeA. In 2008, these insurance organizations agreed that *any* Rochester area primary care practice may be reimbursed for HeA telemed visits. HeA encourages any pediatric or family medicine practice that wishes to participate in any of the four service models. The only currently non-participating payer covering a substantial proportion of children eligible for telemedicine service is fee-for-service Medicaid. Monroe County (encompassing Rochester) is a mandated Medicaid Managed Care county, so the proportion of Medicaid-eligible children using HeA who are covered by fee-for-service Medicaid (presently 20%) should continue to decrease. All but one of the 6 participating primary care practices accept requested telemedicine visits without regard for presence or type of insurance coverage.

A campaign to promote the general acceptance by both payers and provider organizations of a telemedicine infrastructure fee is a critical program activity towards the development of a sustainable business model for HeA services. Substantial progress has been made towards favorable allocation of an infrastructure fee. A telemedicine infrastructure fee is analogous to the facility fee commonly paid to hospitals as part of the total insurance payment for ED visits or for surgical procedures, with most of the remainder being professional services fees. A telemedicine infrastructure fee is also analogous to practice overhead costs to primary care medical practices. On average, 67% to 75% of practice revenue is required to cover office overhead. Assuming average reimbursement for an illness office visits is $60, then at least $40 of this is “eaten up” by overhead. Based on personnel costs, technology costs and estimates for the capacity at patient access sites of 3 telemedicine visits per unit per hour, we estimate that an infrastructure fee of $20 per visit will sustain HeA, a value that is substantially less than per-visit overhead.

On this basis, the HeA model holds substantial potential to challenge the traditional model of office-based practice. A significant barrier to the rapid provider group adoption of HeA service models, however, is the fact that practice overhead is a relatively “fixed cost”. Current overhead will not drop unless the number of visits shifted from office to telemedicine is sufficiently that office space or office staff can be reduced. Reducing office staff through mechanisms other than retirement is often difficult.

Accordingly, there is little short-term incentive for practices to fully integrate HeA models and maximize telemedicine use, unless there is a large demand for this form of access. For the practice to improve its financial position, this demand should be sufficiently great to lead to increased visits; with increased visits due to telemedicine visits, practices will receive a return on their start-up investment in the form of greater net revenue (i.e., after subtracting overhead) per visit. When telemedicine visits simply replace office visits, there is no such return; an HeA infrastructure fee in fact represents an increase in overhead.

The largest Medicaid Managed Care organization in the Rochester area, Monroe Plan for Medical Care, has agreed to pay for telemedicine visits both a telemedicine infrastructure fee of $20 per visit and a CPT level II (99212) professional services fee. The total Monroe Plan payment, then, is approximately $60, equal to the total payment for a CPT level III (99213) professional services fee. Monroe Plan accounts for about 75% of Medicaid Managed care in Rochester. When seen in the office, almost all of the problems commonly seen via telemedicine generate a CPT of 99213.

The Strong Pediatric Practice of the Department of Pediatrics at URMC, the largest primary care provider for inner city children (identified as the primary care provider for 40% of CCS participants dwelling in the City), has acknowledged that the HeA infrastructure fee of $20 per visit is much less of a burden than the “room tax” charged to the Department for use of office space by URMC. Accordingly, HeA telemedicine figures prominently in Departmental strategies to respond to the surge in demand that will come with the impending novel H1N1 flu epidemic and to grow the practice in general.

Telephone-based service in Rochester. Medical practices providing child health services are mandated (by insurance organizations, as a condition of participation) to offer 24/7 telephone management provided by either a nurse, mid-level practitioner or physician. This service includes assessment, guidance on home management, and guidance on when and how to seek a higher level of care. Although the assessment that can be provided through telephone information exchange is limited because it must be based on history alone, the medical professor’s dictum, that “90% of the diagnosis is in the history”, carries a high level of validity. This is especially the case with acute childhood illness.

The 6 participating city practices all provide telephone-based service during both office and after-hours periods. They each provide after-hours service by using their own providers for some after-hours periods and contracting with Rochester Community Pediatric Telephone Triage (*CPTT*) for others. Some practices cover after-hours phone call until 10:00pm and pass this responsibility to CPTT after that. Other practices pass the responsibility to CPTT only on weekends. Nurses staffing the CPTT system, as well as office nurses managing calls during regular office hours, generally follow standard phone management algorithms in guiding parents.[31] CPTT currently manages about 40,200 (based on 2007 experience) after-hours parent calls from the Rochester area each year. Based on Colorado studies of phone services that use the same algorithms generally used in Rochester,[32] we estimate that the majority of phone contacts leading to the recommendation of an in-person could be managed by HeA. As discussed above (p.2), recommendations for urgent (20%) and next day or later (30%) in-person care emerged from 50% of all calls handled by phone nurses. Based on our experience with HeA, we estimate conservatively that at least 35% all calls are about illness episodes that could be managed effectively by HeA, assuming that almost all "next day or later" calls and a substantial proportion of "urgent" calls could be managed this way. These 35% represent 70% of calls for which phone triage algorithms recommend in-person care (i.e., 35 is 70% of 50).

The proportion of these calls managed for families from the 4 inner city zips is unknown, but a reasonable estimate can be generated based on CPTT records for the numbers of 2007 calls for the 6 city primary care practices that have participated in HeA, and on the proportion of patients from these 4 zips that are registered with the two largest (Rochester General Pediatric Associates, Pediatric Practice at the University of Rochester Medical Center) of the 6 city practices. The 6 city practices account for 14,737 of the 40,205 annual calls. Based on the proportion of patients in the two largest practices that dwell in the inner city (40.3%), we estimate that CPTT manages 5039 calls from inner city parents each year.

## HEALTH IT INTERVENTION: THE TECHNOLOGY ENABLER AND ITS USE

An important reason why this model works is that we have tailored computer hardware, software and connectivity to the types of organizations and individuals, to the unique organizational relationships, and to the clinical problems that must be addressed to make the system successful.

### *Technical Features of the Health-e-Access Model*

- Clinician access anywhere there is broadband internet connection.
- Integration of real-time videoconferencing, digital information capture (images, video clips, stethoscope files), storage, and retrieval/display. Components are fully integrated in software used at both patient and clinician nodes in the system.
- Patient-site software and cameras that have been proven to be readily used by telehealth assistants with a non-health professional background. In a manuscript in the September 2006 online edition of *Pediatrics in Review*,[33] we were able include a number of images, video clips and stethoscope files. This media collection gives one a good idea what non-professionals, who we quickly train as patient-site telehealth assistants, can accomplish with the HeA system. Given that patient-site software and cameras are already successfully designed for use by non-professionals, it is clear that we have already made great strides towards the longer-term objective of developing kiosks for semi-independent patient use.
- Information capture protocols, built into the software, that fit both the vast majority of clinical problems and the workflow at the patient site (telehealth assistant end). Software guides the telehealth assistant through the process of acquiring and recording clinical observations (e.g., images) and clinical history (e.g., obtained through conversations with parents, caretakers, patient-site staff).
- Visit-specific performance evaluation of the clinician by the telehealth assistant.
- Patient records may be opened at multiple clinician sites simultaneously, allowing remote consultation with colleagues and sub-specialists. As with patient-to-clinician connections, clinician-to-clinician connections have the capacity for videoconferencing.
- For the entire network, telemedicine visits—both in-progress and completed—may be accessed through an administrative logon, allowing for centralized triage, support and program management functions.
- Clinician-site software that fits the patient care process, including all of the following within the "visit-in-progress" interface:
  - Succinct presentation of clinical information gathered by the telehealth assistant
  - Logical flow of history and physical examination records
  - Ready access to prior telemedicine visits
  - Simultaneous display of images obtained sequentially over time (e.g., images of rashes, wounds, ear drums captured at prior telemed visits)
  - ICD codes on pull-down menu
  - Patient information handouts chosen from pull-down menu (e.g., "How to manage head lice", "Ear pain and ear infections")

- Prescription fax to pharmacy
- Generation of a zipped file containing the entire clinician's visit record (text, images, video clips, stethoscope sounds). This can be saved to the clinician PC hard drive. It represents the first step towards full integration with any electronic medical record system that the clinician might use.
- Generation of a PDF file, to send or print as needed for parents, containing information on diagnosis and treatment recommendations.
- Visit-specific performance evaluation of telehealth assistant by the clinician

- For a user with administrator privileges (e.g., clinician, program administrator):
  - Ability to add and edit patient information handouts
  - Ability to add ICD codes to the pull-down menu
  - Ability to add and edit pharmacies on the prescription fax list
  - Generation of a billing report in the form of an Excel file
  - Generation of a program management report in the form of an Excel file, including performance evaluations completed by telehealth assistants and performance evaluations completed by clinicians

***General organizational characteristics of the Health-e-Access model***

In order to assess potential impact of expanding HeA, it is also important to understand organizational attributes not yet covered. Many organizational characteristics of the current HeA model will be retained in the expansion, although expansion will involve several changes that will facilitate expansion and sustainability.

<u>Telemedicine access sites and personnel</u>. Based on prior funding from AHRQ, other federal agencies, the Robert Wood Johnson Foundation, the New York State Health Department, state and local foundations and individual donors, a total of 13 CCS telemedicine access sites (6 CC, 7S) have been established since May 2001 in inner city childcare programs and elementary schools. With the advent of widespread wireless broadband connectivity in the City of Rochester and the development of mobile, patient-site, telemedicine units by TeleAtrics, Inc., the telemedicine systems vendor we have used, the original stationary, patient-site units are gradually being replaced with mobile units.

Mobile patient-site units enable more efficient operation for several reasons. Large variability in performance exists among CCS sites. The average, annual telemedicine visit rate among inner-city childcare sites is 134 per 100 children per year, with childcare-specific rates ranging from 72 to 219. The average, annual telemedicine visit rate among inner-city school sites is 37 per 100 children per year, with school-specific rates ranging from 17 to 59. Greater efficiency can be achieved by bringing a mobile unit to a child site as needed, rather than dedicating a unit to a site where it is used infrequently. Moreover, infrequent use by on-site staff is often associated with poor performance by telehealth assistants. Our experience is that roaming telehealth assistants, bringing mobile units to child sites on an as-requested basis, perform better than most child-site staff (generally health aides) who are trained by HeA but are often assigned by their employer primarily to other responsibilities in the childcare or school program. This is not surprising, since roaming telehealth assistants develop greater knowledge and skill because they use the equipment frequently, have fewer competing demands, and are employed and evaluated by HeA leadership. Mobile units, which we began using in the fall of 2008, also allow HeA to serve all CCS sites within a geographic area that can be quickly traversed. All childcare and schools within the 4 targeted zips can be reached within 15 minutes from our downtown office.

Tradeoffs exist, however, to the advantages in efficiency, in flexibility, in performance of telehealth assistants, and in the number of sites that can be served with the mobile telemedicine model. Roaming telehealth assistants are a cost to HeA, while CCS staff performing as telehealth assistants are paid by their childcare program or school district. There may also be a "psychological" cost in that HeA staff coming from outside the organization to help the CCS site address illness may sometimes be resented as "outsiders".

<u>After-Hours Neighborhood (AHN) access</u>. Mobile units, used for the CCS service models during regular hours,, can also be used for the after-hours service model. After-hours sites will expand the HeA care model to enable care for children during evening, weekend and holiday hours. Four AHN sites, one in each of the 4 inner city zipcode areas, were established over a 6-month period, beginning January 2009, with pilot funding from the New York State Health Department and the New York State Healthcare Foundation. The four sites include Wilson Commencement Park (zip 14605), the Ibero-American Action League (14621), Grace United Methodist Church (on the border of 14613 and 14608), and Charles Street Settlement House (14611).

<u>Telephone-based service as the gateway to telemedicine</u>. As discussed, a key element in refining and expanding HeA will be a tight link with systems for telephone management of illness episodes. These systems

include telephone management provided (a) by primary care practices during regular office hours (phone nurses, clinicians) and during after-hours periods (shared by clinicians from an individual medical practice or multiple practices) and (b) by the Community Pediatric Telephone Triage (**CPTT**) service in this community. Most primary care practices in this community that serve children sign over their telephone management responsibilities to CPTT at some time every day. In some cases this occurs when regular office hours end. For other office practices, this occurs after 10:00pm and/or on weekends and holidays. AHN access is available only to children referred directly by their primary care practice or by CPTT. For the occasional family that shows up at an AHN sites without a referral, HeA staff facilitates referral by contacting the telephone management system of the patient's primary care practice.

Algorithms that are followed closely by several primary care practices and by CPTT nurses require minimal modification. These algorithms accurately identify problems requiring urgent and crisis care. Where current algorithms suggest a same-day office visit, a next-day office visit or a later office visit (>24 but within 72hr), telemedicine is offered *as an alternative to an office visit*, unless the problem meets specific exclusion criteria. Exclusion criteria are designed to identify problems where physical examination, lab tests or imaging beyond the scope of HeA are likely to be required. For otherwise-eligible problems "caught" in the "exclusion criteria net", HeA is unlikely to avoid in-person visits.

<u>Telehealth assistants (CTAs)</u>. These individuals enable telemedicine visits at the patient site. We have trained individuals for this now well-established role to collect information (illness history, images, video clips, audio clips), to enable videoconference interactions as required by protocols or by clinician request, and to supplement clinician communication with families. Training requires 1 to 2 weeks of half-day sessions. HeA certifies telehealth assistants based on demonstrated competency and sustained performance during a 2 month "internship". Current HeA staff includes <u>certified telehealth assistants</u> (CTAs) who initially were childcare staff members that we trained and certified to work as CTAs in the childcare programs where they worked. Because of their ability to work well with children, other childcare staff, parents and clinicians, their technical skill and their cultural competency, several CTAs were recruited to work directly with HeA as roaming telehealth assistants. <u>Roaming CTAs</u> travel among neighborhood telemedicine sites as needed by sites that do not have their own CTA or that require technical or clinical troubleshooting for a particular visit.

<u>Telemedicine Coordinator</u>. The Telemedicine Coordinator, a Health-e-Access staff member, ensures that expectations of patients and other individuals at the patient site and at the clinician site are met. The Coordinator monitors system-wide activity (primarily through system tracking displays in the administrative screens of the telemedicine software), allocates resources to meet demands, and performs first-level technical and clinical trouble shooting.

Details of how this responsibility plays out may vary somewhat among the three different service models and from one telemed visit to the next. As an example of the role of the Coordinator, consider a situation in which the clinician managing after-hours phone calls for Primary Care Practice #1 suggests a telemed visit for 9 month-old Keisha. The Coordinator knows that there are 5 parents that are on their way to AHN 14621 (site located in zip 14621) and there are 3 children already at AHN 14621 being seen. Knowing this, the Coordinator can offer telemed access for Keisha not only at AHN 14621 but also at AHN 14605 or AHN 14608, where there are only 2 children and 1 child, respectively, currently being seen, with no child presently in route to either site.

As another example, at 2:30pm, Primary Care Practice #2 requests a telemed visit for 5 year-old Roberto at an elementary school. The Coordinator knows that Roberto's school bus will be taking him home at 3:15pm, but the clinician doing telemed visits for Primary Care Practice #2 won't be able to complete the visit until about 3:30pm, after Roberto is on his way home and after the CTA at his school has left for the day. The Coordinator ensures that the Practice #2 telemed clinician knows how to contact Roberto's parents (generally by phone) to discuss his health problem and it's management. The telemedicine software ensures that a PDF file containing the clinician's diagnosis and management recommendations, tailored for understanding by a non-professional, is generated and available for appropriate staff at Roberto's school and for later printing and distribution to Roberto's family.

The Telemedicine Coordinator serves quality control as well as scheduling functions. For example, before visit data becomes available to the physician (i.e., before it is placed in the virtual waiting room in the clinician-site software), the Coordinator checks the quality and completeness of the visit data. If visit data meets standards, the Coordinator then places the visit in the physician's virtual waiting room and contacts the responsible clinician to confirm that all is ready. If quality is sub-standard, the Coordinator offers suggestions to the CTA and, if necessary dispatches a technician to provider further assistance.

Protocol for enrollment and completion of telemedicine visits. To the extent possible, activities in this protocol are listed sequentially. There are several activities, however, for which the order or occurrence is conditional on prior events.

- Patient/family registers. This registration information remains in the system, accessible only by individuals that have a system log on and that have appropriate permissions (controlled by the system administrator). Children in CCS typically register for telemedicine access at the time they enroll for childcare/school. Registration includes parent consent for telemedicine visits as well as for data sharing by insurance organizations.
- A health problem is identified and brought to the attention of an individual who is authorized to request a telemedicine visit. This is either a phone nurse with CPTT, the primary care physician (PCP), or the phone management system designated to cover for the PCP. The latter may be the CPTT, a clinician from the PCPs office, or a clinician from another PCP office that is affiliated for purposes of phone coverage.
- Telemedicine Coordinator is contacted and the Coordinator confirms eligibility. For patients/family wishing a telemedicine visit who have not yet registered, registration information and consent is obtained by the CTA at the patient site.
- CTA elicits demographic information and prior illness history from family, elicits acute illness history and captures images, video clips and lung sound files, following protocol and records illness history and captured media in the telemed EMR.
- Scheduling is arranged as described in the section above on Telemedicine Coordinator.
- CTA enables videoconferencing component of the visit if clinician requests this feature.
- Clinician records the start of the clinician encounter through a time-stamp that is triggered by a mouse click in the telemed electronic medical record (EMR). (This record is used for both clinical and evaluation purposes.)
- Clinician (1) assesses all available information, (2) determines whether visit can be completed entirely via telemed or if, instead, in-person exam, lab or imaging studies, or hands-on treatment is required, and (3) makes diagnostic and management decisions.
- Clinician communicates with family and enables treatment as appropriate.
- Clinician completes telemed electronic medical record (EMR) with clinical documentation and a brief, performance assessment (part of the EMR) evaluating the performance of both the telemed system and the CTA.
- Clinician records the end of the clinician encounter through a time-stamp that is triggered by a mouse click in the telemed EMR.
- CTA reviews clinician's diagnosis and management recommendations with patient and family, elicits their questions, provides educational material and administers a brief satisfaction questionnaire to family.
- If, after progressing as far as possible with the telemed visit, or after completing it, either the patient wants to be seen in person or the clinician wants the patient seen in person, this is arranged.
- CTA completes a brief, performance assessment (part of the EMR) evaluating the performance of both the telemed system and the clinician).

In sum, the technical and organization features of the Health-e-Access system were designed to fit special tasks involved in unique collaborations, in which clinicians and non-professionals interact via telemedicine to provide health services. The HeA system is tailored to the roles, responsibilities and skill sets of the dissimilar stakeholders from the distinctly different organizations (e.g., community medical practices, childcare programs, primary care practices within large medical centers, elementary schools) that are directly involved with telemed visits.

***Details of workflow in the 3 service models***

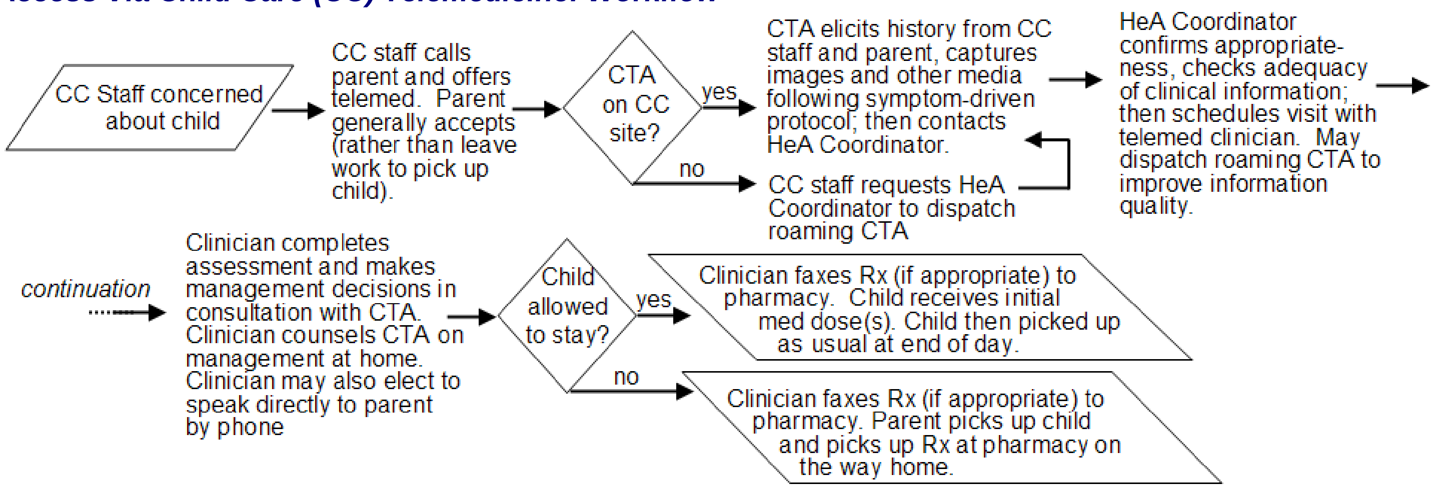
Diagrams below show the sequential flow of work involved in providing care through the 3 telemedicine service models. To emphasize key processes, diagrams are simplified representations. For example, multiple processes controlled by one agent (e.g., CTA, clinician) may be shown as a single step, and alternative pathways of lesser interest (e.g., call 911, emergency visit) may not be shown or elaborated.

Distinguishing features. We believe that many of the most important features distinguishing these service models relate to parent incentives and decision rights involved in their use. Distinguishing features from the parental perspective are highlighted in the *table that follows the workflow diagrams*. Perhaps the most important distinguishing feature from the perspectives of provider organizations and individual clinicians is that AHN access sites allow these stakeholders to expand their operations in both time and place, at relatively little cost, and to compete with walk-in sites (urgent care, retail-based clinics, EDs) to whom they now lose revenue. Cost to the organization is low because telemedicine infrastructure costs are less than office overhead. Cost to the clinician is low because she/he may do HeA visits from home and, if the clinician covering HeA visits is also managing phone calls for the practice, most of the work for the telemedicine visit (i.e., obtaining the history) has already been done by the time the clinician decides (based on the phone call) that a telemedicine visit is warranted.

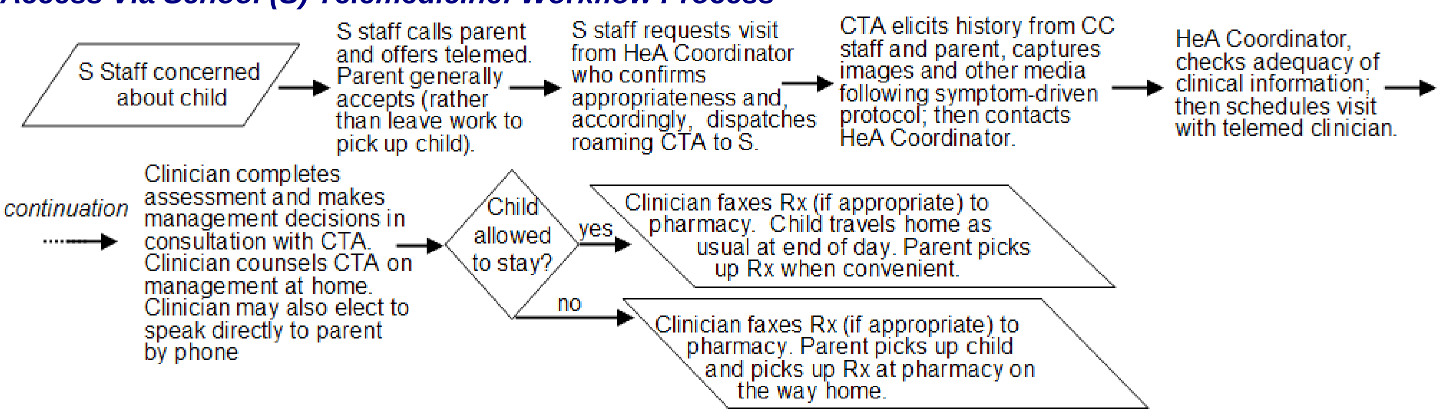
***Abbreviations and Definitions used workflow diagrams***

***AHN*** - After-hours neighborhood telemedicine service model. ***CC*** - Childcare program. ***CCS*** – Childcare program or school. ***CTA*** - Certified (by HeA) Telehealth Assistant. ***HeA*** - Health-e-Access Telemedicine Network (infrastructure). ***HeA Coordinator*** - HeA staff member who fields call from PC Practice phone management and coordinates scheduling (e.g., contacts family and directs them to most accessible AHN site.***PCP*** - Primary care provider (clinician). ***PC*** Practice - Primary care practice. ***S*** – School. ***Unit*** – patient access site telemedicine equipment.

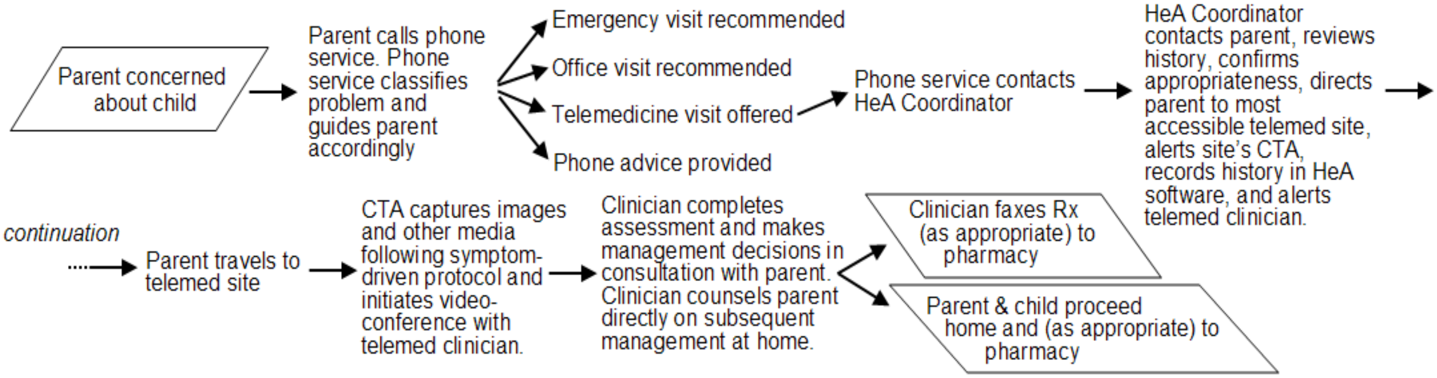
### *Access Via Child Care (CC) Telemedicine: Workflow*




### *Access Via School (S) Telemedicine: Workflow Process*



### *Access Via After-Hours Neighborhood Telemedicine: Workflow Process*




### Distinguishing Features from the Family's Perspective: Incentives and Decision Rights

| *Telemedicine Service Models:* <br> *Determinants (barriers, facilitators):* | **Child Care (CC)** | **School (S)** | **After-hours neighborhood (AHN)** |
|---|---|---|---|
| **Stage of illness** | Child must start the day "well enough" to go to CC | Child must start the day "well enough" to go to school | Parent may intitate access at any stage of illness |
| **Availability of service** | When attending CC (many open as late as 6 pm). Limited to CC hours and circumscribed | When attending school, but limited to school hours and circumscribed by school operations | No inherent constraints, potentially 24/7. Limited only by demand. |
| **Decision rights for telemed access to clinician** | Child site staff, with approval by parent. Parents may send child to CC with a request for a visit. Child site staff may send child home without offering a telemed visit or may | Child site staff, with approval by parent. Child site staff may send child home without offering a telemed visit or may refuse to do visit. | Parent, with professional approval through telephone management. Professional approval could be obtained at AHN site or eliminated entirely. |
| **Decision rights to attend/exclude from CC or S** | Child site staff, often mediated by the clinician. | School health staff. | Generally allowed to attend if given clinician approval, although decision to exclude controlled entirely by child site. |
| **Requirements of parent to access clinician** | Needs to be reachable by phone to give permission. | Needs to be reachable by phone to give permission. | Transportation to AHN site, often walkable, free parking, no wait. |
| **Requirements of parent to obtain prescription** | Pharmacy can usually deliver. Consequently, there often are none -- meds are given to the parent when they pick up child at CC. | Regulations preclude pharmacy delivery to school, so physician faxes to pharmacy of parent's choice and requirements are the same as for AHN Telemed. | Clinician faxes to pharmacy of parent's choice, so prescription should be waiting for the parent at a location easily accessed by the parent. |
| **Motivation to use service** | For working parents, telemed visits are often offered at a time when alternatives present high access costs (e.g., time lost from work, loss of job). Almost 100% of parents using CC are working. | For working parents, telemed visits are often offered at a time when alternatives present high access costs (e.g., time lost from work, loss of job). Substantially less than 100% of parent are working. | Telemed visits are presently offered only at a time (evening) when opportunity cost (financial loss per unit of time spent in obtaining health care) are generally less than during regular working hours. |
| **Parent-clinician communication** | Parent may participate directly via phone or videoconference, but usually communication occurs only through CTA or handout | Parent may participate directly via phone or videoconference, but usually communication occurs only through CTA or handout | Direct via videoconference |

<u>Convenience vs. continuity vs. both</u>. Continuity of care with the medical home is a feature of all 3 HeA service models, distinguishing them from all other "convenience models" (ED, urgent care, retail-based). This feature is important to clinician, provider organization, family and payer incentives in various ways. After-hours neighborhood HeA access may often be no more convenient than urgent care or retail site access, but neither of these models offers the continuity that can be readily provided through HeA. (In Rochester, no retail based clinics yet exist, and only one urgent care center exists in this city.) Thus, HeA offers clinicians and provider groups an opportunity to address the financial challenge posed by other convenience models.

The presence of this distinction raises questions of how important continuity really is to families, and how willing provider groups and clinicians really are to provide continuity that is meaningful to families. When confronted by common illness symptoms in their child and faced with a choice between convenient care *now* versus care by their child's primary care practice *tomorrow*, it is clear that many opt for convenience. Our survey of parents with CCS telemedicine experience confirm the primacy of convenience as a parental value, as discussed among Preliminary Findings. High use of the ED for non-emergency problems also confirms this. To the parent, the benefits of convenience are immediate, whereas continuity pays off only over time and in less concrete terms.

We anticipate that retail-based clinics will continue to grow and compete very successfully with office-based primary care practice, *unless primary care practice adopts a mode of care that is equally convenient*. Although the continued growth of retail-based clinics would continue to serve the immediate family value of convenience, we believe that the values of quality and satisfaction, which serve long-term interests of both family and community would not be well served by this growth. Thus, a mode of care that offers the same level of convenience while preserving potential for continuity warrants careful consideration. Health-e-Access with its mission of <u>*health care when and where you need it, by providers you know and trust*</u>, does precisely that.

### STUDY DESIGN, MEASUREMENT AND ANALYSIS

***Specific Aim A. Achieve substantial deployment and solidify sustainable business models for of each of the 3 urban telemedicine service models.***

The definition of *substantial deployment* is necessarily somewhat arbitrary. The program logic model suggests several operational definitions, such as sufficient deployment to reduce the rate of ED visits by children in targeted zips. Design issues (e.g., identifying appropriate controls when implementing a community wide intervention, separating effects of one service model vs. those of another) render methodologically rigorous evaluation based on measures such as this impractical within budget constraints. Moreover, we have already established the potential for CCS service models to reduce utilization of expensive services (i.e., the ED), and the after-hours service model appears to have even more potential than the CCS model in that regard. In our view, the most meaningful measure of substantial deployment is sufficient volume of service at a sufficient number of sites so that the business models of the 3 service models are financially self-sustainable. Sustainability, which is readily ***assessed by examining HeA accounting records*** requires substantial family acceptance, substantial participation by individual clinicians and provider organizations, substantial collaboration by CCS and after-hours access sites, and substantial commitment by insurance organizations. Our goal is sustainability of all 3 service models by midway through the 3rd project year.

We project that the total number of CCS sites served with mobile units will expand from the 7 school and 6 childcare sites to involve at least 14 (80%) of all 18 city school district elementary schools in the targeted zips and at least 18 (80%) of all 23 licensed childcare sites in the targeted zips. The recently-opened after-hours access sites, one in each of the 4 inner city zip, are expected to remain the same in number (and location), although hours (currently 3.5 hours every evening and 4 hours every Saturday) are likely to expand.

We expect the number of city practices providing HeA visits to increase modestly from the present 6, which provide primary care for 78% of children of the existing CCS sites, to 10. The primary expansion in providers' HeA participation is expected in the number of clinicians who provide HeA visits using any of the service models, and especially in they number of clinicians who provider after-hours HeA visits. The number of clinicians in each practice will be obtained from medical office managers. The clinician who performs each HeA visit is readily extracted from downloads from the HeA software. Measures and criteria for "best practice" levels participation are listed in the table, below (p19) that characterizes performance of a well-functioning provider group.

<u>Expected telemedicine utilization</u>. Best estimates for projected utilization by inner city children are based on observations for children in our 6-year longitudinal cohort study of the impact of HeA on utilization (discussed among PRELIMINARY STUDIES) and on the childhood population for the 4 targeted zipcode areas (28,690 children < age 18y, 2000 US Census). Overall illness utilization rate was 336.4 visits per 100 child-years for children *with* telemedicine access. These children averaged 6.7 years of age. Among all illness visits, 24.9% were done by telemedicine, 62.1% were office visits, and 13.1% were ED visits. With a population of 28,690 children and assuming (1) overall illness utilization rate of 336.4 per 100 child-years for the younger half of the target population and (2) half that rate for the older half of the 28,690 children, then 72,385 annual illness visits are expected. Of these 72,385 visits, if we estimate that the proportion done by telemedicine will eventually rise to the same 24.9% for the proposed, expanded telemedicine service that was observed among children with access in childcare and schools, then eventually 18,024 telemedicine visits are expected annually. We expect that 1/3 (or 6008 visits) of the projected, annual total number of telemedicine visits will occur in the first project year, 2/3 (12,016) in the second year, and the entire total will be achieved in the third year.

***Specific Aim B. Identify facilitators and barriers to dissemination of the 3 telemedicine service models.***

The primary objective of this analysis is to evaluate the HeA program using findings of qualitative and quantitative methods (1) to adjust the existing program to ensure that modifications respond appropriately to stakeholder incentives and concerns (***Years 1 and 2, Formative Analysis***) and 2) to promote the implementation and dissemination of the HeA telemedicine network in communities elsewhere in the nation by identifying barriers and facilitators (***Year 3, Summative Analysis***), including activities that are effective in promoting this process. These evaluations will directly reflect the conceptual model of valuing telemedicine, addressing the incentives and decision rights that are key to the initiation and sustainability of the HeA service models. Qualitative and quantitative evaluations will address the real world factors (facilitators and barriers) associated with successful program implementation and dissemination. Qualitative methods will ascertain adequacy of engagement and training of health care staff, patients, and family in the use of the HeA program; key characteristics of the health care setting; organizational processes and practices; workflow; adequacy of the HeA implementation plan; nature of technical support for HeA; and other factors that emerge from this process.

Assessment will examine key HeA model components including: (1) management of parent calls about illness; (2) integration of HeA into triage/referral protocols and recommendations to use HeA by provider staff/clinicians; (3) utilization and outcome of telemedicine use; and (4) attitudes of stakeholders including provider organization staff/clinicians, parents, HeA and partner site staff and the general community served by HeA sites.

Because activities of provider organizations, their clinicians and their staff are critical to dissemination, we highlight their measurement. Based on experience to date, we believe that a provider group that has matured in its use of HeA to the point that this infrastructure has been integrated in practice routines to a near-optimal level will demonstrate characteristics listed in the following table. Performance evaluation for both formative and summative purposes will include key measurable events, listed below, that reflect these characteristics.

***Performance of a Well-Functioning Provider Group.*** *Definitions for key terms are listed below table*.

| Activities/Best Practices | Ascertainment | Measure/Criterion |
|---|---|---|
| Practice phone nurses offer CCS or AHN telemedicine as an option for illness visits, when appropriate. | Review of phone call logs | Offered, ≥90% |
| Clinicians will routinely offer CCS or AHN telemedicine, when appropriate (defined below), as an option for illness follow-up visits. | Medical record abstraction, visit-specific parent interview | Offered, ≥90% of parents who report f/u visit, ≥90% abstractions with f/u visits in plan |
| The practice will have in place a mechanism (e.g., check box in encounter form) that enables clerical staff to know what problems needing follow-up appointments can be managed via HeA. | Practice performance review. See narrative for description. | Dichotomy, yes |
| Office staff scheduling follow-up appointments for illness will offer CCS or AHN telemedicine visits when appropriate. | Family office visit interviews. See narrative for description | Offered, ≥90% |
| The practice incorporates telemedicine access protocols in their training of new clerical, nursing and clinician (MD, NP, PA) personnel. | Review of protocols | Dichotomy, yes |
| Practice office managers, nurses and clerical staff indicate their acceptance of using both CCS and AHN protocols to enable telemedicine visits. | Completion orientation/training for integration of HeA | Completion, 100% |
| Office personnel follow these protocols. | Interviews with personnel. Medical record reviews. | Interviews: ≥85% claim at least usually. Record reviews: ≥ 75% documented |
| Clinicians indicate their satisfaction with both CCS and AHN telemedicine visits. | Interviews with clinicians, sign-off on protocols. | Generally or always, ≥75% |
| The practice purchases annual software site licenses. | Practice performance review. See narrative for description. | Purchase, yes |
| The practice markets use of CCS and AHN | Presence of brochures or | One or more of |

| | | |
|---|---|---|
| telemedicine to their families. | banners in office waiting rooms, or mention of telemedicine option in recorded phone messages (while "waiting for the next-available staff person") | these techniques will be in use. |
| The practice allocates schedule slots to patients being seen by telemedicine during regular office hours. | Practice performance review. See narrative for description. | Dichotomy, yes |
| The practice allocates schedule slots to patients being seen by telemedicine during evening or weekend office hours. | Practice performance review. See narrative for description. | Dichotomy, yes |
| The practice makes a clinician available to do telemedicine visits during evening or weekend hours that AHN telemedicine access is available . | Review of practice coverage schedules. | Dichotomy, yes |
| At least 80% of clinicians in this practice perform telemedicine visits | HeA electronic records, clinician rosters from each practice | Participation, ≥80% |
| At least 92% of telemedicine visits by clinicians in this practice are completed. See definition below. | HeA electronic records. | Completion, ≥92% |
| Practices support infrastructure fee for HeA | HeA revenue records | Dichotomy, yes |

***Definitions:***

Problems appropriate for telemedicine - Judgment about appropriateness for HeA of illness episodes that generate a phone call will be based primarily on standard phone management algorithms, with specific exceptions. HeA appropriate calls will be those in which the algorithm end point is (1) see within 4 hours (excluding 911 or other emergency calls), (2) see the next morning in the office, or (3) see in office within 24 hours. Exceptions will be age < 3 months with any fever, trauma that may require imaging or suturing, dysuria, adolescent gynecology complaints, and abdominal pain in the absence of diarrhea. Note that for any episodes for which the telemedicine clinician determines the problem is beyond the scope of the HeA model, the telemedicine clinician will facilitate transfer to an appropriate source of care. Family office visit interviews - Interviews with parents/patients visiting the office for illness will be conducted in the waiting room to examine the process followed to access care for children seen in the office rather than a telemedicine site. In content, these will parallel HeA visit-specific interviews. Office visit interviews will include a very brief exit interview to determine whether follow-up is planned and whether telemedicine for conducting that visit. Practice performance review -These reviews are conducted by HeA research staff in Year 1 and Year 3, generally with the office manager of each of the participating practices. When the office manager claims a particular best practice has been adopted, the HeA research assistant will seek or ask for evidence (e.g., see brochures in the waiting room, listen to phone message, see the patient schedule). Completed telemedicine visits - HeA visits with diagnosis and management decisions made, and treatment implemented, based on the HeA telemedicine model alone, i.e., without in-person physical exam, additional laboratory testing, or imaging. Practice supports infrastructure fee for HeA – The practice accepts a reimbursement schedule in which $20 per visit is allocated to support HeA operations.

*Data acquisition – Specific Aim B*

Qualitative (key informant interviews) and quantitative data will be acquired as follows. *Instruments proposed* for acquiring this information are provided in Appendix B.

Phone calls about illness. Management of illness calls from parents or CCS staff will be monitored to determine what recommendations are provided and what parents then actually do. The extent that telemedicine is recommended when appropriate will be determined by examining telephone logs. Assessment will involve evaluation in both Project Years 1 and 3 of 100 randomly selected calls from patients from at least 6 participating practices. For these 100 calls, we will examine phone logs, office medical records, HeA coordinator logs and HeA medical records and billing claims, identifying any events relating to the illness episode that prompted the call. By comparing events captured in any of these data bases, we will determine whether the problem was appropriate for HeA, if HeA was recommended, what the parent did, and how the problem was resolved, including additional follow-up or subsequent visits and whether continuity was maintained.

From all these calls (at least 1200, 200 per practice), for all parents offered HeA who did not select that option (identified by matching phone logs with HeA coordinator logs), contact by phone will determine how they chose to manage the child's illness and why (especially why they opted not to use an HeA service model). Based on the prior work of Dr. McIntosh working with practices to integrate tobacco cessation into their care, we will review we will review  findings with practice clinicians and staff and work with them to identify ways to improve the deployment and use of HeA by their parents.

Utilization of telemedicine and outcomes. For up to 10 HeA visits (different child for each) for each practice each month, we will randomly select visits to examine in detail. We will identify the nature of the problem, where the patient was seen, and timing from initial call to the initial phone management service through use of HeA. This information will be supplemented by the visit-specific, Patient Access and Satisfaction interviews conducted for each after-hours visit (see Appendix B). For these same children, additional review of the office medical record will determine whether additional follow-up calls or subsequent visits were made.

Information will also be obtained monthly about 10 children making illness visits to the office for each practice. These visits will be matched with the 10 HeA visits on diagnosis, age, gender and zipcode of residence. Chart review and visit-specific, Patient Access and Satisfaction interviews conducted with parents by phone will be used to obtain comparable data.

All these, supplemented by the tracking data collected for each HeA visit, will be aggregated monthly by HeA site, by provider practice and by type of illness. As with the above data, each quarter's summary data, including HeA vs. office visit comparisons, will presented to each provider organization. Presentation will include comparison data with other practices. As with the information about phone call management, we will meet quarterly with practice clinicians and staff and work with them to identify ways to improve use of HeA by their parents. Summary data will be discussed monthly within project research team and HeA staff to identify issues and develop strategies to resolve problems.

Attitudes of Stakeholders. Stakeholders to HeA implementation and utilization include provider organizations, provider organization staff and clinicians, parents, HeA and partner site staff, insurance organizations and the general community served by the HeA sites. During Year 1 and again during Year 3, we will conduct key informant interviews with individuals these stakeholder groups. Numbers specified will be achieved in *each* of the Project Years.

- Office managers from all participating provider organizations. There will be at least 6 (current number participating) and probably 10 or more.
- Clinicians, at least 2 from each participating practice (at least 6 practices), and at least one of these a MD and at least one a NP or PA. But for practices with more than 6 clinicians, 2 MDs and 2 NP/PAs. Total of at least 16, for each of Years 1 and 3.
- Participating and potentially participating parents. Among parents with a childcare-aged child, 5 with and 5 without HeA experience. Among parents with a school-aged child, 5 with and 5 without HeA experience. Among parents with after-hours experience, 5 informants will be matched by parents who use the community site for other services and have a child of the same gender and approximate age. Total of 30, for each of Years 1 Year 3.
- Telehealth assistants. 5 who have worked as HeA employees, and 5 who have worked in this capacity as a CC or S employee that was trained and certified by HeA. Total of 10, for each of Years 1 Year 3.
- Telehealth site staff with responsibilities unrelated to healthcare. 5 from childcare, 5 from a school site, 5 from an after-hours neighborhood site. Total of 15, for each of Years 1 Year 3.

General experience with illness access and satisfaction. In addition to interviews mentioned above, we will conduct brief surveys of 300 parents in each of Years 1 and 3 whose family participates in any activities at any of the neighborhood HeA sites (whether they have used HeA or not) to assess their awareness of HeA as an option, what they understand about it, their general attitude about HeA, and, if they have ever been offered the option to use it, whether they accepted or declined and why. For families who have used any of the 3 HeA models queries will address the quality of their experience and whether they would they recommend HeA or use it again themselves.

Analysis - qualitative. Our analytic strategy to identify barriers and facilitators is based primarily on comparison of information obtained through both qualitative and quantitative methods early in Project Year 1 and midway through Project Year 3. The facts that a substantial proportion of key informants and questionnaire respondents will have experience with two or more of the three HeA service models, and that many key informants will be interviewed in both Years, may also enhance the strength of our approach to identifying facilitators and barriers. As described above, qualitative evaluation will be based on interviews of key program stakeholders, termed key informants. Individuals in these groups will be interviewed using a semi-structured interview guide (Appendix B). This guide, developed to reflect our conceptual model (incentives, decision rights, performance evaluation) and, therefore, to identify key facilitators and barriers to the collaborations required for implementation and dissemination, will be refined based on actual telemedicine implementation. The semi-structured guides will provide an interview framework, with additional probing questions where appropriate. Interviewers will take notes during the interviews that will be typed up immediately. Audio recording will not be performed to minimize subject inhibition.

Transcribed data will be broken into discrete statements and coded. The coded data will then be analyzed and reviewed by the core study investigators, including Drs. Dozier and McIntosh, to identify common themes, especially regarding factors that promote or undermine implementation and dissemination. The interviews and data analysis will be overseen by Dr. Dozier, an international leader in use of qualitative methods in program evaluation, with staff assistance from the University of Rochester Clinical and Translational Science Institute Research Services Group, which is the institutional core resource for such activities. Consent will be obtained by the Research Services Group prior to interviewing.

The number of stakeholder interviews was determined by the number of practices, sites and participating staff/providers to capture both the breadth and depth of experiences with or attitudes about acute illness management and HeA. Based on the need to achieve redundancy of responses the number of interviews within any stakeholder group will be adjusted. In many instances, we expect Year 1 and Year 3 respondents to be the same individuals. The minimal numbers for each key informant group will be as follows: 12 office managers, 32 clinicians, 60 parents, 20 telehealth assistants, 30 telehealth site staff. For each group, half the interviews will be in year 1 and half will be in year 3.

Critical to the development of the toolkit (Aim D), findings from the above analyses will be aligned with the provider group performance assessment. This will provide a more complete understanding of how individual attitudes and behaviors match up with organization or system changes.

Analysis - quantitative. Dr. Scott McIntosh, a health services researcher and methodologist with special expertise in changing medical office routines (especially in promoting smoking cessation activities), will lead this analysis. Standard descriptive statistics will be used to characterize (1) management of phone calls about illness, (2) utilization of telemedicine and outcomes of these visits, and (3) general experience with illness access and satisfaction. The total number of records to be analyzed for each of these studies, with half the total acquired in each of Years 1 and 3, are 1200, 1440 and 600, respectively.

A subset of the data of primary interest will be parents, among the 1200 included in the detailed analysis of phone call management, who were offered a telemedicine visit but chose a different option. Acceptance vs. rejection of HeA visits when they are offered by professional managing phone calls is an important index of both parent acceptance and provider organization performance. (The quality of the communication by the professional managing the call is likely to have a significant affect on parent acceptance.) We expect this to be a small proportion, and for the purpose of estimating research assistant effort in developing our budget, we presumed the proportion will be 10%, i.e., about 60 each Year. Phone Interviews with these parents will seek reasons for parent choice of an alternative to HeA.

Sample Size – quantitative studies. Because this event, acceptance of the opportunity to use HeA, is an important index of success in implementation, we use it to demonstrate adequacy of sample sizes. Assumptions: (1) 600 illness episode in both Years for which management is tracked in detail, beginning with phone management. (2) Based on phone documentation, 80% are appropriate for HeA. (3) HeA is offered to 60% of these in Y1 and 85% in Y3, or 288 and 408 in Y1 and Y3, respectively. Then, if we take as clinically important an improvement in parent acceptance of 10% or greater, and a Y1 rate of parent acceptance of 65% (i.e., 187 accept of the 288 offered), the power (with alpha set at .05, two sided test) to detect a 10% improvement (from 65% to 75%) is 81%. Power to detect a 15% improvement is 99%.

We may use the same example to examine provider organization performance. An earlier event in the process that may be used as an index of provider performance is the proportion of HeA-appropriate calls that are offered the HeA option. If we assume 60% are offered HeA in Y1 and that a 10% improvement is clinically important, the power (with alpha set at .05, two sided test) to detect a 10% improvement (from 60% to 70%) is 90%. Power to detect a 15% improvement is >99%.

***Specific Aim C. Monitor impact of the HeA models on utilization patterns.***

For reasons already discussed regarding achievement of Aim A (p18), we do not propose to perform a scientifically rigorous analysis of impact on utilization patterns. Nevertheless, it is critical to monitor utilization patterns, especially for ED use and telemedicine use, for four principle reasons, (1) to engage collaborating community organizations, clinicians, and provider organizations and their staff in the change process, (2) to identify opportunities to improve use of HeA, (3) to inform the community at large, and (4) to reassure insurance organizations that the impact of HeA is, from their perspective, cost-neutral or better. Although we have demonstrated the potential for HeA to reduce payments made by insurers, and it is highly plausible that addition of the after-hours service model will reduce these payments still further, expanded CCS access and the addition of after-hours telemedicine are substantial changes. Especially given their position as a dominant stakeholder, the ability to report regularly to payers on utilization patterns is essential.

Almost complete utilization data for all children dwelling in targeted zips can be obtained by using three types of data, each of which we have analyzed extensively in the past; (1) insurance claims, (2) ED encounter/accounting files, and (3) HeA electronic records. Excellus Blue Cross-Blue Shield, Monroe Plan for Medical Care, and MVP Health Plan (each of which have provided letters of support), account for about 80% of Medicaid, about 95% of Medicaid Managed Care, and about 95% of commercial health insurance in Rochester. We will obtain de-identified billing claims for 12-month periods from these sources for all children dwelling in targeted zips ending early in Year 1 and midway through Year 3, using this data to calculate zip-specific, annual ED use rates and overall (all sites) illness use rates. The Rochester General Hospital (RGH) ED and the UR Medical Center ED account for over 90% of ED visits by children. We will obtain the RGH ED data through HeA participating colleagues, who are also URMC Pediatrics Faculty members. Calculation of zip-specific ED utilization rates based on ED data, again for 12-month periods ending midway through Year 1 and midway through Year 3, will allow cross validation with results from claims data. Denominators for these calculations will be US Census data, broken down by zip. As system administrator for our HeA telemedicine software, we download all data fields we desire for program management purposes into standard data management and statistical analysis software..

***Aim D - Create and disseminate an implementation and sustainability toolkit.***

***The ultimate deliverable of this research program will be a toolkit*** that can be freely used by community and family advocacy organizations, schools, childcare programs, other potential neighborhood telemedicine access sites, clinicians, and provider groups in any community to implement and sustain any of the HeA service models. The **Dissemination Plan** will promote optimal use and widespread replication of this telemedicine model in other communities. Structure and content of the various components of the toolkit will reflect the Program Logic Model (elaborated on the first 2 page of Appendix B). Combined, the various components will address all questions in the right-hand column of this Logic Model document.

The first of two dissemination phases will involve the traditional dissemination of research findings through academic meetings and peer-reviewed manuscripts. The impact of the HeA program on ED use, access to care, parent satisfaction, quality of care, continuity of care with the medical home, clinician satisfaction and clinician productivity will be detailed. We will submit manuscripts to leading pediatric and health care journals. Publications are insufficient for translating discovery into practice, however. The second and most important component of the plan will make use of the successful toolkit and consultation model of dissemination used by AHRQ and other agencies. This toolkit will include: goals of the HeA telemedicine model and how they were achieved; detailed descriptions of each of the 3 service models; background regarding problems addressed; justifications for the HeA service models based on study findings; key features of sustainable business models; other barriers and facilitators to implementation from the perspectives of all stakeholders; and resulting research publications. Practical tools such as job descriptions, training manuals, evaluation metrics, and lessons learned will be included and made available as downloadable PDF files. The toolkit will be packaged for internet availability through AHRQ, University of Rochester and other appropriate websites. Additionally, Drs. McConnochie and colleagues will make themselves available to consult (for cost) with organizations establishing HeA-like programs. Depending on the services required, the consultation will be by phone, webinar, videoconference, or in-person, and it may include a site visit.

**PROJECT ADMINISTRATION AND TIMELINE**

Overall program direction is provided by Dr. McConnochie. Mrs. Wood serves as program manager, providing day-to-day direction of program operations, as she has done since the advent of Health-e-Access. Based on her training in education, she will also provide direction in development and implementation of parent and community education activities related to use of HeA models. Qualitative analysis is directed by Dr. Dozier. Dr. McIntosh will direct quantitative analysis. Also, he will develop and lead the process of interacting with practices in their efforts to improve access and to optimize phone management and use of HeA service models.

***Timeline***

| Project Year 1 | | | | Project Year 2 | | | | Project Year 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Patient Access and Satisfaction Interviews → | | | | | | | | | | | |
| Monitoring of utilization (billing claims, HeA, ED) → | | | | | | | | | | | |
| KI | KI | A | A | | | | | KI | KI | A | A |
| PM | PM | A | A | | | | | PM | PM | A | A |
| IS | | | PD | PD | PD | PD | | IS | | | TK |
| | | | Program modification and expansion → | | | | | | | | |

- KI - Key Informant Interviews
- PM - Phone Management review
- IS - Illness access and satisfaction interviews
- PD - Feedback and development sessions with practices
- TK - Toolkit completion. Development is ongoing to the end of Project Year 3.
- A - Analysis

**PLAN FOR PRIVACY AND SECURITY PROTECTIONS IN THE DEVELOPMENT AND IMPLEMENTATION OF HEALTH IT SYSTEM**

The browser-based, commercially available application, TeleAtrics Connect, will be utilized for this project. Various security mechanisms are built into this system. The entire application runs on the HTTPS protocol so that all data that moves between the client browser and the server application is encrypted. File transfers are also encrypted because they “ride” across the HTTPS protocol. The system utilizes biometric logon with a fingerprint reader to ensure that users do not share passwords and to allow tracking of telehealth assistant activity and interaction with patients to a specific user. This also allows very “strong” Windows account user identifications and passwords to be set up that would be extremely difficult to decrypt. Users are not given these long and cumbersome parameters, and they have no reason to obtain them or write them down. Instead, they only need to swipe their finger on the keyboard. Data protection is also integral to the TeleAtrics application. Once data is transmitted to the hosting facility server located in Allentown, PA, all patient-related data is automatically deleted from local PCs. Data is stored in the TeleAtrics database is closely guarded against unauthorized access. Double badge security physically protects the servers and strict access control ensures that only authorized personnel have access to the production database. Further detail about privacy and security can be found in Appendix A.

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