

# Potential of Telemedicine in Pediatric Primary Care: The Health-e-Access Demonstration

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The Health-e-Access Connected Care Model is an internet-based, community-wide, network approach to delivering care within the primary care medical home. Its mission is to enable *health care when and where you need it, by providers you know and trust*. Observations and opinions herein reflect research and personal experience with this care model in schools and child-care sites in the Rochester, NY area over a 16-year period and involving over 16,000 telemedicine visits [1]. A shared understanding of the nature of primary care is essential to an exploration of telemedicine's potential in that arena. A definition of primary care offered by Charney and Alpert decades ago remains widely accepted [2]. Essential attributes of primary care include: (1) first contact; (2) longitudinal responsibility over time regardless of presence or absence of disease; and (3) integration and coordination of care encompassing physical, psychological and social issues. These attributes serve the objectives of ready access to a trusted and caring provider for effective and efficient care regardless of the state of well-being and of the nature of any problems. Fidelity to this understanding of primary care has guided design of the Health-e-Access model.

## A TYPICAL VISIT: HEALTH CARE WHEN AND WHERE YOU NEED IT

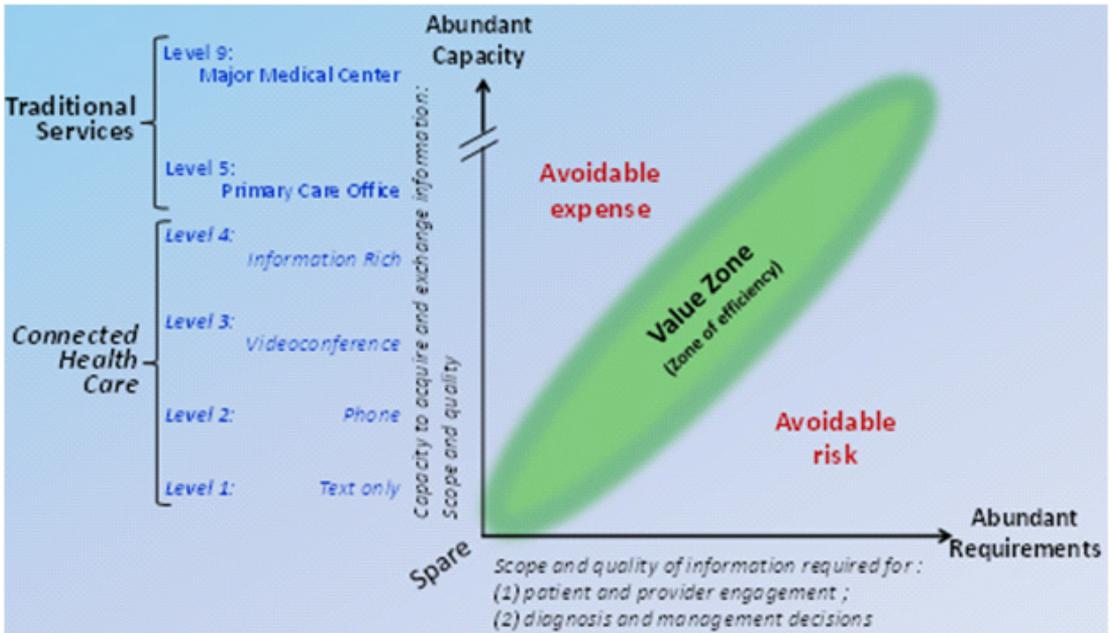
To fully understand the value of this care model, consider the dilemma confronting Elizabeth, a 23-year-old single mother, struggling to make ends meet, when she receives the dreaded call from child care to pick up her 14-month-old son, George. He's been coughing for two weeks now. His child-care teacher has brought the cough to Beth's attention before, but this afternoon he's been fussy too, and his temperature is 100.8°F. She tells Beth she must pick him up, and that he can't return without documentation of a physician's OK. Mom has already missed ten days of work this winter because of George's illnesses. Each hour off the assembly line means an hour's less pay. Even worse, after her last lost workday, Beth's boss told her he couldn't keep her if she missed another, regardless of the reason. The only way to have George seen today is an Emergency Department (**ED**) visit; this requires two buses in both directions and at least six hours altogether. She knows it's not an emergency, that to ED staff she'll just be "the overanxious young mom with the cute baby," and that her other two children need her at home this evening. But the ED is her only choice if she is to keep the job she desperately needs to improve her family's circumstances.

Health-e-Access is designed to enable diagnosis and management of acute and chronic problems among preschool and school-aged children in childcare, schools, and other convenient neighborhood settings, and during workday as well as after-hours periods. A health concern, identified by a parent or by staff in school or childcare, is first brought to the attention of an individual—for example, a telephone triage nurse, who is authorized to request a telemedicine visit by contacting the Health-e-Access coordinator. The coordinator then contacts a telemedicine assistant, who brings portable equipment to the child site. A clinician, generally from the child's own medical home, will perform the visit with the help of the telemedicine assistant. Some large child sites have their own equipment, and a site staff-member has served as the telemedicine assistant.

The telemedicine assistant then elicits history from parents and staff following templates in an electronic medical record and captures clinical observations guided by complaint-specific algorithms. Clinical observations may include images (e.g., tympanic membranes, skin, throat), video clips (e.g., respiratory pattern, infant behavior), lung sounds (via electronic stethoscope) and simple laboratory tests (e.g., rapid Streptococcal antigen). Communication with patient, parents and site staff - essential for evaluation, management and reassurance - occurs by phone or, preferably, by videoconference. The clinician assesses the situation, first determining whether diagnostic and management decisions can be made and implemented based on available information. If so, diagnosis and management is discussed with the family and site staff and medications (which can be delivered to child sites) are prescribed as appropriate. If available information or treatment resources are not sufficient to complete the visit, the clinician facilitates transfer to higher level care, for example, in the ED or the clinician's office.

# DIFFERENTIATING AMONG TELEMEDICINE MODELS

The label, *telemedicine*, is relatively new to many. A broad range of distinctly different care models have been developed and marketed under that label. Accordingly, discussion of telemedicine’s potential requires differentiation among these models. To promote this differentiation, we have preferred the term *connected care*, both because its use begs the issue of what type of connection is under consideration and because “to connect” also connotes interpersonal connectedness, which has long been considered a fundamental attribute of high quality primary care [2].



**Figure 1:** Value and the Continuums of Information Requirements and Capacity.

As illustrated in Figure 1, communication technology offers a broad range of mechanisms for connection across distance [3]. Several distinct connected care models, as well as traditional care models, are listed along the vertical axis. Value in the diagnostic process is achieved when a system provides a sufficiently rich information set without incurring expense beyond that required to optimize diagnostic validity. Value in management is maximized when the system produces optimal outcomes while using only that capacity required to reduce risk to an acceptable level, achieving a balance that limits both avoidable risk and avoidable expense. Richness of the information set is determined by both its scope and quality. In this conceptual model, as the richness of information required (represented by the horizontal axis) for accurate diagnosis and effective management of a health concern increases, the capacity to provide that information (vertical axis) must increase in order to avoid risks associated with incorrect diagnosis and suboptimal treatment. Should insufficient resources be allocated, avoidable risks are incurred

(area below the Value Zone). Should more than the required resources be allocated, however, avoidable expense is incurred (area above the Value Zone).

To elaborate, information requirements represented on the horizontal axis range from spare to abundant. The vertical axis represents the broad range of tools that we might use in obtaining information for making diagnostic and management decisions. These tools range in their capacity to provide key information, also from spare to abundant. Along that range, we might place various connected care and traditional health services. Within the connected care group, models range from text-only and phone-only to video-only and information-rich. Our Health-e-Access model falls in the category of “information-rich”. For the vast majority of acute problems presenting in pediatric primary care, Health-e-Access provides all the tools you need to deliver care that falls in the value zone. With fewer tools - say for an infant with fever - you would incur risk, risk that is avoidable with the proper tools. To see that infant in the emergency department of a major medical center (replete with all sorts of resources that are not relevant to managing this problem) you incur avoidable expense. In essence, the pursuit of value in connected care is fundamentally the same as with in-person care. To deliver high quality service - service that meets the standard of in-person equivalence - you need to match the requirements - for acquisition of clinical information that is important to managing the clinical issue at hand - with connected care tools that can provide that information.

Attaining value in connected care depends on the fit of the model employed with the clinical situation at hand. Processes relevant to use of all clinically relevant information include the expression, perception, recording and presentation of any phenomenon that might enhance the effectiveness of the patient-provider interaction. Useful information surely extends beyond that contributing directly to physical well-being; contributions to reliability, trust, empathy, reassurance, acceptance, confidence, peace of mind, and satisfaction are no less important to effectiveness in serving values of patients and clinicians.

Although the technology required for telemedicine has been available for several decades, its acceptance and dissemination have been slow and controversial. Much of this delay and controversy is likely attributable to the fact that proponents and critics are generally considering distinctly different care models. Providers, legislators, regulators and payers face a complex task in defining standards and enabling appropriate use. Towards mitigating controversy, Figure 1 highlights differences in clinical capacity among these different models. Hopefully, understanding this conceptual model will promote progress on the part of these organizations in meeting their responsibility for enabling the scale-up and spread of well-designed connected care that will benefit the entire community.

## WHY CONSIDER TELEMEDICINE? A PATIENT-ORIENTED PERSPECTIVE

Economists define *efficiency* as “the effects or end results achieved in relation to the effort expended in terms of money, other resources, and time” [4]. In assessing the usefulness of connected care to patients and the potential importance of connected care to a patient-oriented health system, resources falling in each of these categories require consideration. Resources of particular relevance to telemedicine in pediatric primary care include not just payment for care, but also time lost from work and family, peace of mind as impacted by anxiety about the child’s illness and by difficulty in meeting other responsibilities due to time required to access care.

We believe a reasonable objective for the end results (or outcomes) of connected care is to achieve the same results as those of high quality in-person care. For care that meets that standard, we have adopted the label, *in-person equivalence*.

### REVIEW OF THE EVIDENCE

Based on evaluation encompassing over 14 years of experience with over 14,000 telemedicine visits, feasibility, acceptability, effectiveness and efficiency of this model for care of children with acute illness are well established [1,6]. Acceptance of Health-e-Access by parents, providers and insurance organizations is confirmed by high levels of parent satisfaction with telemedicine in school, child care and neighborhood access sites [4,7,8], participation in Health-e-Access telemedicine by over 70 different providers from 10 primary care practices [1], telemedicine access in all Rochester City Schools since September 2010, and reimbursement (at office visit rates) for telemedicine visits by all local payers, including Medicaid Managed Care. For visits by children with a participating primary care practice, continuity of care within the medical home has averaged 83%. Over 97% of telemedicine visits are completed, i.e., less than 3% are referred to a higher level of care for diagnostic procedures or treatment.

Among inner city child care centers with telemedicine, absence due to illness dropped 63% [6,9]. Children with telemedicine access from child care or elementary school make 22% fewer ED visits than closely matched counterparts [7,10]. ED visits avoided, per parent estimates, would have taken 4.5 hours on average [1]. For children with severe disabilities attending a child development center, ED visits dropped 50% with Health-e-Access availability [8,11].

Evidence also suggests that Health-e-Access extends equity in access to impoverished, urban families [9,12]. Prior to Health-e-Access availability in child care or school for an urban intervention group, suburban controls made 80% more acute illness visits overall. With Health-e-Access availability, this difference subsequently disappeared. For an urban control group, however, the urban – suburban disparity in access remained.

Potential for Health-e-Access to replace illness visits at less convenient and more costly access sites is substantial. A study of illness visits in primary care pediatric practice, indicated that 85%

of these could be completed using the Health-e-Access telemedicine model [10,13]. Based on analysis of ED visits in multiple upstate New York counties, almost 40% of children's ED visits appear appropriate for care through Health-e-Access, and payments for Health-e-Access visits (at office visit rates) were one-eighth of payments when these same problems were managed in the ED, reflecting the great potential of this model for cost savings [11,14].

Now consider how the common situation confronting Beth would play out if George's child care were participating in a telemedicine network that enabled him to be evaluated while in child care by his own primary care physician. The telemedicine assistant at child care doesn't hesitate to call Beth about her concerns, knowing the telemedicine link to George's doctor allows both quick access to care for George and peace of mind to Beth and herself. As this family's pediatrician, telemedicine allows you in your office to see George in childcare, as an alert, vigorous toddler, coughing frequently but in no distress, with no evidence of ear infection, asthma or pneumonia. You reassure his caretakers that his low-grade fever is due to a respiratory virus that poses no more threat to child care staff and other children than any cold virus, and that they can check back in with you if his condition changes. Beth (still at work), the telemedicine assistant (at childcare) and you (in your office) are gratified in sharing the happy resolution of this situation via multi-way video-audio connection.



**Figure 2.1:** Here's an important illustration of the high clinical quality of our teled model.

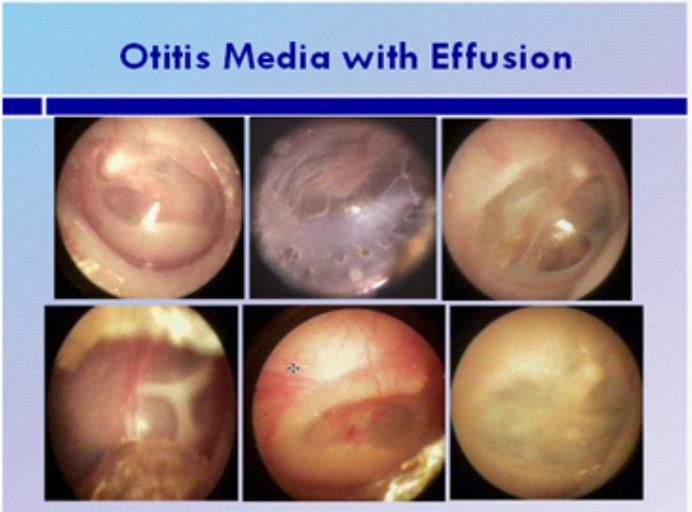
The teled technology we use has the capacity of obtain superb ear drum images. When I review sets of tympanic membrane images with residents and students, they usually ask why we don't use this technology for usual in-person care. To them, the images are obviously much superior for providing diagnostic information than the hand-held otoscope they typically use. They make an important point. We should.

I think these images speak for themselves. Personally, I can assure you that I see clinically-important details here that I have never seen in over 40 years of in using a typical hand-held otoscope.



**Figure 2.2:** And here are some more exquisite images of painful ears in miserable children.

**Note:** The drop of pus emerging from the ventilating tube in the upper-right image.



**Figure 2.3:** I think it is very likely, the ears such as these, which reveal middle ear effusion, NOT acute otitis media are currently being interpreted - frequently - as acute otitis media. That, in turn, leads to unnecessary antibiotic use (which, in the aggregate, clearly is harmful). Diagnosis of acute otitis media is clearly the most common reason antibiotics are prescribed for children, and thus, very likely over-diagnosis of this condition accounts for much of the big problem with antibiotic resistance.

## Normal Tympanic Membrane



**Figure 2.4:** This is here just in case you've forgotten what a normal ear drum looks like (when you can see it well).

Core characteristics of Health-e-Access extend well beyond convenience. Integration within the medical home promotes trust among patients and caretakers and enhances effectiveness and efficiency. Trust is all the more salient when introducing parents to an unfamiliar approach to care of their children. Continuity leverages established relationships with providers and staff, ensures availability of a complete medical record, creates opportunities for using acute visits to deliver health maintenance services, reduces unnecessary testing, promotes efficient follow-up, and increases patient and provider satisfaction.

*Equity in access.* With compelling evidence that access increases with telemedicine, the question arises whether it leads to unnecessary visits and increased costs. Children with care for acute illness available through the Health-e-Access telemedicine model at childcare and schools were previously found to have 22% less emergency department (**ED**) use than counterparts without this service, but they also had 24% greater acute care use overall. We assessed the hypothesis that increased utilization reflected improved rather than unnecessary access among impoverished inner-city children to a level experienced by more affluent suburban children. Utilization among children without and with telemedicine access was compared, beginning in 1993, ending in 2007. Comparison was based on 84,287 child-months of billing claims-based observation.

Health-e-Access Telemedicine was initiated in stepwise manner over 187 study-months among 74 access sites (childcare, schools, community centers), beginning in month 105. Children dwelled in inner city, rest-of-city Rochester, NY or in surrounding suburbs. Rate of total acute care visits (office, ED, telemedicine) was measured as visits per 100 child-years. Observed utilization rates were adjusted in multivariate analysis for age, sex, insurance type, and season of year.

When both suburban and inner-city children lacked telemedicine access, overall acute illness visits were 75% greater among suburban than inner-city children (suburban: inner-city rate ratio 1.75,  $p < 0.0001$ ). After telemedicine became available to inner city children, their overall acute visits approximated those of suburban children (suburban: inner-city rate ratio 0.80,  $p = 0.07$ ), whereas acute visits among suburban children remained at least (worst-case comparison) 56% greater than inner-city children without telemedicine (rate ratio 1.56,  $p < 0.0001$ ). In sum, overall acute illness utilization of suburban children exceeded that of inner-city children at baseline. Overall utilization for inner-city children increased with telemedicine to that of suburban children at baseline. Without telemedicine, however, inner-city use remained substantially less than for suburban counterparts [10].

Observations strongly support the conclusion that Health-e-Access Telemedicine redressed socioeconomic disparities in acute care access in the Rochester area, thus contributing to a more equitable community.

*Extension of the Health-e-Access model to chronic problem management.* Although less experience has been acquired in using this model for chronic problem management, clinical experience suggests that telemedicine holds substantial potential in this arena as well. By way of example, consider asthma and attention deficit hyperactivity disorder (ADHD). These two chronic problems are, by far, the most common chronic problems among children.

To assess whether in-person equivalence can be achieved for such problems with Health-e-Access, consider both the information that needs to be acquired by the provider and the information that needs to be offered to caretakers. For ADHD, information on school performance and behavior at home and school is obtained through standard questionnaires to be completed by teachers and parents. Further insight on ability to focus is sometimes gained through teacher and parent interviews. For asthma, symptom burden is also routinely assessed through standard questionnaires. Obviously, these information-gathering tasks can be accomplished remotely. Electronic completion and scoring of these instruments would, in fact, undoubtedly be more efficient than when hard copy is used, as is now typically the case. As we have demonstrated, requirements for physical examination for asthma, encompassing upper respiratory tract as well as lungs, can be performed using Health-e-Access tools. Experience in school-based telemedicine-enabled chronic care management of children with persistent asthma has been well received by parents, providers and school personnel [14].

*Telemedicine, communication, and the patient-provider relationship.* Video connection has important advantages over models that do not enable real-time, face-to-face interaction and is readily achieved with secure, widely available technology applications that can be used across a broad range of devices (including cell phones). Videoconference enables eye contact, facial expression, and body language and, accordingly, capacity to assess severity of pain, respiratory distress, and responsiveness to social cues. Such judgments may be especially important in evaluating illness severity in the young child [15]. Moreover, face-to-face interaction is important to capacity to express and perceive anxiety, concern, reassurance and empathy [16].

## SUMMARY

In sum, potential of the Health-e-Access telemedicine model is vast, with capacity to offer equal or better quality care for about 90% of acute problem visits seen in pediatric offices as well as a large proportion of chronic problem visits.

This model addresses incentives for all primary stakeholders in the care of children. For children and their families, Health-e-Access equals or exceeds the convenience and quality of urgent care centers or the ED. Health-e-Access enables medical home providers on call to deliver office-equivalent care at any time using low-cost infrastructure while avoiding revenue loss to facilities (e.g., urgent care) outside the medical home. As health care financing shifts to various forms of capitation, providers will be increasingly incentivized to adopt effective, low-cost acute care alternatives such as Health-e-Access. Finally, information-rich connected care serves the values of communities that recognize convenient access to high quality health services as a human right for all members of society.

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