Patient Evaluation of an Acute Care Pediatric Telemedicine Service in Urban Neighborhoods

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Abstract

Background: Telemedicine has enhanced care for children with illness in Rochester, NY, since May 2001, enabling 13,568 acute illness visits through December 2013. Prior findings included high parent satisfaction with childcare- and school-based telemedicine ("school telemedicine") and potential to replace 85% of office visits for illness. Urban neighborhood telemedicine ("neighborhood telemedicine") was designed to offer convenient care for illness episodes that school telemedicine often cannot serve because illness arises when children are at home or symptoms preclude attendance. This study was designed to characterize health problems prompting neighborhood telemedicine use and to assess parent perceptions of its value. **Materials and Methods:** A parent satisfaction instrument was developed with input from parents and providers. Neighborhood telemedicine was initiated in January 2009 and totaled 1,362 visits through November 2013. During a 29-month survey period through January 2012, 3,871 acute illness telemedicine visits were completed, 908 (23.5%) of them via neighborhood telemedicine. Instruments were completed for 392 (43.2%) of the 908 visits. **Results:** Neighborhood telemedicine comprised 27% of all telemedicine visits during the year of peak neighborhood activity. Almost all survey respondents were satisfied or highly satisfied with neighborhood visits (97.6%) and endorsed greater convenience than alternatives (94.5%). **Conclusions:** Family preferences and the high value placed on neighborhood telemedicine suggest such service is important, especially in health systems driven by patient values. Service provided by neighborhood telemedicine holds potential to meet a large demand for care of acute childhood illness. Financing reform to support patient-centered care (e.g., bundled payments) should encompass sustainable business models for this service.

Key words: pediatrics, telemedicine, e-health, telehealth

Introduction

Since 2001, the Health-e-Access Telemedicine Program (HeA) has offered care models focused on improving access to care for families in low-income, inner-city neighborhoods of Rochester, NY. The HeA model was first implemented in childcare. Following success in that setting,¹ it was expanded to elementary schools. In 2009, HeA was further expanded beyond childcare and school settings ("school telemedicine") to offer urban neighborhood telemedicine ("neighborhood telemedicine") access in four inner-city family service centers.

HeA provides infrastructure designed to enhance primary care in pursuit of its patient-centered mission of "healthcare when and where you need it, by providers you know and trust." This care model enables acquisition and exchange across distance of a relatively broad scope of clinical information that is used to inform medical decisions and engage patients in implementing recommendations. Visits are conducted at the patient end by either a "roaming" telemedicine assistant (technician) or by access-site staff who are trained to function as telemedicine assistants. Telemedicine units are portable, allowing visits to be conducted anywhere with a broadband Internet connection. Units include peripheral devices, connected to a laptop computer, that enable acquisition of high-resolution images of tympanic membranes, eyes, throat, or skin as well as audio files of lung sounds. Simple laboratory testing includes rapid streptococcal antigen tests and fungal and bacterial cultures of skin and scalp. Both real-time interactive (videoconference) visits and store-and-forward (asynchronous) visits are conducted. When a parent is present, videoconferencing is usually involved. Diagnostic information is generally exchanged asynchronously; it is first stored on a central server and uploaded by the clinician when conducting the visits. When parents are not on-site, communication with parents usually occurs by phone before and after the child is seen. For neighborhood visits, a parent is present with the child. Further details of HeA operations are specified elsewhere.²

Patient satisfaction was a dominant objective and an anticipated outcome of improved access. Patients naturally compare their experience with HeA to experience with alternatives that are also designed to address illness symptoms that arise unexpectedly. Alternatives include visits to a primary care physician (PCP) office, emergency department (ED), urgent care center, or retail-based clinic. Among these, only the PCP office is likely to offer care with a familiar, trusted provider.

A high level of family satisfaction in school settings has previously been reported.^{1,3} Even though over half of ED visits in the community occur during evenings, weekends, and holidays (periods when school

facilities are closed), school telemedicine was associated with 22% less ED use.⁴ HeA in school settings has inherent limitations, however. Illness often arises when children are at home. Illness manifestations often preclude childcare or school attendance. Consequently, it seemed unlikely that HeA would approach its potential for enabling more convenient and valuable care for families if available only in school settings. We estimate this potential at 85% of pediatric primary care office visits for illness.^{5,6} In view of inherent limitations and large unmet potential, implementing neighborhood telemedicine was a logical, patient-centered initiative, particularly for after-hours periods.

Materials and Methods

Analysis of HeA utilization was based on electronic encounter records that were generated in the process of completing telemedicine visits. A survey instrument was developed to assess motivations for use, satisfaction, and acceptance of the HeA model as an acute care option. Content was developed from parent focus groups, from key informant interviews with parents, healthcare providers, and staff, and from an instrument previously used with school telemedicine service. From these sources, a working group with content experts resulted in a final instrument to assess overall patient satisfaction. After piloting at one neighborhood visit, the instrument was reviewed by two volunteers from a local neighborhood association for understandability and ease of use. Feedback indicated that the survey was easy to understand and imposed minimal burdens on respondents.

Survey administration took approximately 2.5 min for Part I (administered prior to the visit and focused on decisions leading to it) and another 2.5 min for Part II (administered following visit completion and focused on satisfaction). The survey was administered by a receptionist who had no role in the visit itself, but who greeted families arriving at access sites. This strategy was taken to mitigate positive response bias. Respondents were assured of confidentiality. No information allowing linkage of survey responses to encounter records was collected.

Between September 15, 2009 and February 1, 2012, 392 surveys were conducted. For 366 (93.4%) of the surveys, Part II was completed immediately after the visit. Nine Part II surveys lacked administration date. For the remaining 17, Part II was completed by phone between 1 and 60 days after the visit. Phone interviews were necessary when the parent preferred to leave as soon as possible following acquisition of clinical information by the telemedicine assistant. In most instances, this occurred when the provider was not yet available to communicate with the family about diagnosis and management recommendations. In such cases, the communication between parent and provider required to complete the visit occurred by phone.

Each of the four community sites, one in each of Rochester's inner city zip code areas, was offered by a family service agency. Based on the year 2000 U.S. Census, 51.2% of families in this area with children under 5 years of age fell below the federal poverty level, the median household income was \$20,559, and 78.6% of the population was African American (58.1%) or Hispanic (20.5%). By comparison, in a representative Rochester area suburb, 1.0% of families with children under 5 years of age fell below the federal poverty level, 96% of

adults had at least a high school education, and 3.5% were African American or Hispanic.

This study was approved by the Research Subjects Review Board at the University of Rochester Medical Center.

Results

From initiation in May 2001 through December 2013, 13,568 acute care telemedicine visits were completed. Over the 28.6 months (September 15, 2009–January 31, 2012) the survey was conducted, in total, 3,871 acute care telemedicine visits were completed, 908 of which were at neighborhood sites. These 3,871 visits were distributed as follows: neighborhood, 23.5%; childcare, 36.4%; and schools (including a child development center), 40.1%. Medicaid or Medicaid managed care covered a large majority of both neighborhood (77.0%) and all other (70.9%) telemedicine visits. During the peak year for neighborhood activity (2010), 438 of these visits were conducted, comprising 27.5% of all telemedicine service. The 392 neighborhood visits with completed instruments represented 43.2% of the 908 neighborhood acute visits during the 28.6-month observation period that interviews were conducted.

PROBLEMS ADDRESSED

Parent concerns were recorded for 288 of the surveyed visits. Some parents expressed multiple concerns, bringing the total number of concerns addressed to 329. Concerns among these 329 fell in the categories of skin (27.7%), ear (20.4%), eye (16.7), mouth and throat (16.4%), cold/upper respiratory (10.9%), and other (7.9%).

Table 1. Distribution of Diagnoses at Neighborhood Versus School Telemedicine Sites

	NEIGHBORHOOD	SCHOOL
Acute otitis media	16.2%	15.6%
Conjunctivitis	14.9%	10.2%
Upper respiratory tract illness	10.7%	11.0%
Streptococcal pharyngitis	6.3%	8.8%
Viral pharyngitis	5.7%	11.2%
Otitis media with effusion	5.1%	9.9%
Atopic dermatitis	4.6%	2.0%
Other skin	4.4%	3.8%
Tinea capitis	4.2%	1.1%
Nonspecific viral illness	3.9%	5.3%
All others ^a	24.0%	21.1%
Total	100.0%	100.0%

Data are distributions among all 3,871 telemedicine visits for acute problems during the survey period, of which 908 occurred at neighborhood and 2,963 occurred at school sites.

^aSeventeen additional diagnoses.

Table 2. What Would You Have Done Otherwise?

RESPONSE OPTIONS	NUMBER	%
Wait until the first available appointment at your child's doctor	155	40.2
Go to the emergency department	114	29.5
Go to an urgent care center or walk-in clinic	66	17.1
Wait to see if the problem gets better	51	13.2
Total	386	100.0

The actual query was "If this telemedicine visit was not available, what would you have done?" Six parents did not respond to this item. Nonrespondents included two parents referred to a higher level of care by the telemedicine provider.

All 3,871 acute telemedicine visits during the survey period were classified on the basis of ICD diagnosis codes assigned by the provider who completed the visit. Less common diagnoses were grouped, whereas common diagnoses were assigned their own category. Thus, diaper dermatitis made up a unique category, whereas less common skin conditions were counted as "other skin." Based on this diagnosis classification, the top 10 problems addressed at neighborhood and school visits are as listed in *Table 1*. The largest differences in proportions between neighborhood and school sites were for viral pharyngitis (neighborhood, 5.7%; school, 11.2%) and otitis media with effusion (neighborhood, 5.1%; school, 9.9%).

ACCESS DECISIONS

Most parents became aware of the neighborhood telemedicine option in a phone interaction with PCP office staff (73.6%), generally a

phone nurse. Other sources included school or childcare staff (12.3%), a brochure or poster at the PCP office or elsewhere (4.1%), other unspecified source (2.6%), word of mouth from a friend or relative (1.8%), and staff at the neighborhood site (1.3%). The remaining 4.4% had previously used the neighborhood service. As indicated in *Table 2*, almost all parents (86.8%) indicated that they would have obtained care elsewhere. In part, this may reflect the fact that most had been guided to do so in speaking by phone with an office nurse.

In traditional health services, transportation consumes patient resources of both time and money. For 83.8% of neighborhood telemedicine visits, travel required less than 15 min. It required 15–30 min for 12.8% and greater than 30 min for 3.3%. Walking was the second most common means of access to neighborhood sites, used by 14.0%. Means of transportation also included family car (76.2%), a friend's car (8.2%), and bus or taxi (1.7%).

Part I of the survey addressed the importance of convenience in *deciding* to use neighborhood telemedicine. As indicated in *Table 3*, 85.3% indicated it was very important, and only 0.8% indicated it was unimportant.

SATISFACTION

Following the visit, parents were asked to rate their level of satisfaction. Response options ranged from highly unsatisfied (scored as 1) to highly satisfied (scored as 5). As in *Table 3*, the mean score was 4.81, with 84.1% of parents indicating that they were highly satisfied. Parents further confirmed their appreciation in expressing interest in using telemedicine for routine visits. With response options ranging from not at all interested (scored as 1) to very interested (scored as 5), mean scores were 4.4 and 4.2 regarding routine visits for the child and themselves, respectively. The value of convenience was underscored by responses to a post-visit query asking whether the

Table 3. Satisfaction with the Telemedicine Visit

SURVEY ITEM	RANGE OF RESPONSES ^a	NUMBER OF RESPONSES	SCORE (%) ^a					MEDIAN	MEAN
			1	2	3	4	5		
Pre-visit									
How important was convenience to you in deciding to use telemedicine today?	Not at all to very important	381	0.3	0.5	3.2	10.2	85.3	5	4.81
Post-visit									
How satisfied are you with the care your child received here?	Highly unsatisfied to highly satisfied	377	0.0	0.8	1.6	13.5	84.1	5	4.81
Would you be interested in using telemedicine for routine healthcare visits for...									
Your child?	Not at all to very interested	375	4.8	1.9	10.4	13.9	69.1	5	4.41
Yourself?	Not at all to very interested	372	8.9	1.9	10.5	17.7	61.2	5	4.20
Do you feel this visit was more convenient than [specified alternative]?	Not at all to very much more	373	1.1	0.3	4.0	13.1	81.5	5	4.74

^aFrom 1 = worst to 5 = best.

neighborhood visit seemed more convenient than alternatives they had considered. As in *Table 3*, 82.5% indicated that the neighborhood visit was much more convenient, and an additional 13.1% indicated it was more convenient. One might interpret this to mean that the neighborhood visit met parent expectations, as expressed in Part I regarding the importance of convenience in *deciding* to use neighborhood telemedicine.

ADVANTAGES AND DISADVANTAGES

Finally, parents were asked what was better and what was worse about this neighborhood visit compared with alternatives (*Table 4*). Most parents identified at least one advantage (355 [90.6%]). Many volunteered multiple advantages so that the mean number of ad-

vantages endorsed by these 355 parents was 1.2. Three primary response categories were identified among advantages: convenience, location, and service. Representative examples of specific responses in these categories are listed in *Table 4*.

In total, 53 disadvantages were offered by 52 parents. All except four of the 52 parents with a negative observation also recognized an advantage. Three negative response categories were identified: service, location, and equipment. *Table 4* also lists representative examples for these categories.

Discussion

Most parents had learned about neighborhood telemedicine from PCP office staff. This highlights the importance to dissemination and implementation of integrating neighborhood telemedicine within primary care telephone coverage systems. Parents using neighborhood telemedicine were highly satisfied, and convenience predominated among advantages expressed. This supports the view, endorsed by others,⁷ that in primary care convenience is a major determinant of quality from the patient's perspective. Additional observations deepen understanding of what families value in the health system response to children's acute illness episodes and how health systems can respond.

ADVANTAGES TO PATIENTS AND FAMILIES

Findings regarding alternative sites considered by parents indicate that 13.2% would have waited to see if the problem got better. Some of these children would have recovered rapidly and uneventfully, but for others, treatment to shorten the course of illness and/or reduce symptoms would have been delayed. Also, 40.2% would have waited until the first available PCP appointment. Effective treatment for many of these children might also have been delayed. Almost 30% would have visited the ED, events that parents have estimated to require 4.5 h.³ Finally, 17.1% would have made an urgent care visit. Like ED visits, these lack continuity of care within the medical home.

After-hours alternatives for care are limited in most communities to some combination of ED, urgent care centers, retail-based clinics, evening office hours, and telephone-based guidance. Each has significant drawbacks when compared with the neighborhood model, especially from family and community perspectives. For families with health insurance and low copayments, disadvantages principally include inconvenience (long wait times, travel time), travel expenses, and lack of continuity with the primary care medical home, as well as clinicians unknown by the family and sometimes relatively inexperienced with pediatric acute care.⁸

PROVIDER ORGANIZATION INCENTIVES

Financing mechanisms that are designed to account for process and outcome that patients prefer (e.g., convenience), such as bundled payment financing within accountable care organizations,^{9,10} appear more likely than fee-for-service financing to foster the widespread dissemination and implementation of patient-centered models. Bundled payments might be allocated for all service within the cycle of care for a large group of acute illness episodes that present with a

Table 4. What Was Better or Worse About This Telemedicine Visit?

RESPONSE CATEGORIES	AMONG ALL RESPONSES		AMONG ALL RESPONDENTS (%) ^a
	NUMBER	%	
Positives			
Convenience	297	65.7	75.8
Service	95	21.0	24.2
Location	60	13.3	15.3
Total	452	100.0	
Negatives			
Service	38	73.1	9.7
Location	9	17.3	2.3
Equipment	5	9.6	1.3
Total	52	100.0	

Respondents were asked to compare their experience with this telemedicine visit to what they would expect from the care option they would have chosen had telemedicine not been available. The distribution of these alternative care options is presented in *Table 1*.

^aThe total number of survey respondents was 392. For positive respondents, the sum of percentages exceeds 100 because many parents offered positive observations in more than one category. Relatively few respondents offered negative observations. For advantages, there were, in total, 452 positive comparisons. Among the 392 parents responding to the survey, 355 (90.6%) of them offered at least one type of positive observation. Representative examples among positive responses included more convenient (quicker, seen right away, didn't have to miss work), better service (not crowded, relaxed atmosphere, friendly and caring staff, you can see what the doctor sees, gave me a lot of information, amazing technology, better communication with doctor), and better location (close to home, parking free, parking convenient). For disadvantages, there were, in total, 53 negative comparisons or suggestions for improvement from 52 parents. All except 4 of the 52 parents with a negative observation also offered a positive observation. Representative examples among negative responses included worse service (doctor did not examine the child in person, took a long time for the doctor to call, needed to go elsewhere for the prescription), worse location (no toys were in the waiting area, no vending machine, need better signage), and equipment problem (parent noted that such a problem occurred).

set of common symptoms. In such an environment, information flow and workflow that serves patient values while limiting cost of delivering care are likely to evolve.

HEALTH SYSTEM ADVANTAGES

For the many families for which the neighborhood telemedicine visit replaced an ED visit, current fee-for-service payments were substantially smaller.^{11,12} Other families would have made an urgent care visit. Such visits are reimbursed at a modest premium above office and telemedicine visits, but, because they occur outside the medical home, they are also likely (along with ED visits) to be associated with more testing than those within the medical home.

An impending crisis in the shortage of primary care providers in the United States will become more apparent as healthcare financing reform eliminates financial barriers only to reveal insufficient numbers of providers to meet demands from the previously uninsured or poorly insured. The Association of American Medical Colleges has projected that the United States will be confronted by a shortage of 91,500 physicians by 2020.¹³ If the equity in access promised by healthcare reform is to be achieved, removal of financial barriers must not simply reveal insufficient personnel as the limiting factor.¹⁴ Attributes of the telemedicine model described and evaluated herein include several that might alleviate provider shortage. Much of the work involved in collection of information required for diagnostic and treatment decision-making, including physical examination, is performed by technicians. If well integrated with nurse-managed telephone triage, much of the history-gathering and guidance on home care involved in this model might be performed by phone management nurses rather than physicians or nurse practitioners. Finally, the ability of providers to work from virtually anywhere, including home, might well increase their availability for service.

LIMITATIONS

The self-reported data of survey-based evaluation have inherent sources of bias such as selective memory, embellishment of events, and exaggeration. Because patient identifiers were not included in the survey data, these data could not be linked to specific telemedicine encounters. Survey data were obtained on 43.2% (392) of the neighborhood visits during the survey period, a substantial sample of these visits. Age and sex distributions and problems addressed at these 392 visits were similar to those for all neighborhood visits during the survey period. Nevertheless, this was a convenience sample so representativeness cannot be assured.

Conclusions

Neighborhood telemedicine represents a unique care model with potential to meet a large demand for care of acute childhood illness. Much of this demand is currently met by services that command high payments and/or occur outside the medical home. Moreover, neighborhood telemedicine also holds potential to replace a large proportion of acute visits to traditional sites that *cannot* be replaced by school telemedicine because of limitations inherent to school access sites. Neighborhood telemedicine was implemented to the

extent that its use approached that of school telemedicine models. Acute problems addressed were similar to those addressed in office settings and through school telemedicine. The model was valued highly by families, especially for its convenience.

Professionals managing parent calls about illness function as gatekeepers for access to after-hours care. Generally, this is an office phone nurse, or, for the many pediatric calls during after-hours periods, it is a physician, nurse practitioner, or a call center nurse. Nurses addressing parent concerns about illness generally follow guidelines embodied in phone management protocols.^{15,16} If the HeA care model—both effective and efficient from the health system perspective and highly valued by families—is to achieve its potential to replace the vast majority of office visits for illness as well as a large proportion of ED and urgent care visits, (1) patient values must become a primary driver of phone nurse and provider recommendations among care options, and (2) the telemedicine option must be integrated in phone management protocols.

Acknowledgments

The authors are grateful for participation and collaboration in this initiative by parents, personnel at neighborhood access sites (Charles Settlement House, Grace United Methodist Church, Wilson Commencement Park, and Ibero American Action League), medical and graduate student assistants, and telephone nurses of the Strong Pediatric Practice at the University of Rochester Medical Center. Funding was provided by the Agency for Healthcare Research and Quality (grant R18 HS018912; K.M.M., Principal Investigator), the New York State Healthcare Foundation, and the New York State Health Department Health Care Efficiency and Affordability Law (HEAL) NY Phase 6.

Disclosure Statement

K.M.M. and N.W. had a financial interest in TeleAtrics, a product of Trifecta Technologies, a vendor of telemedicine systems and support. No funding for this research was provided by Trifecta. S.M., D.C., A.M.D., and C.A. declare no competing financial interests exist.

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Received: February 11, 2014
Revised: March 6, 2014
Accepted: March 7, 2014