A Prescription for Internet: Feasibility of a Tablet Loaner Program to Address Digital Health Inequities

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Abstract

Objective The coronavirus disease 2019 pandemic accelerated the adoption of telehealth technologies. Persistent disparities in telecommunication devices, internet connectivity, and digital literacy, however, undermine the potential for telemedicine to reduce barriers to health care access. Health systems may have a role in addressing these structural inequities. We describe the operationalization and feasibility of an internet-enabled tablet loaner program at a freestanding children's hospital.

Methods Between October 2020 and October 2021, pediatricians enrolled families through ambulatory clinics at an academic urban freestanding children's hospital. Eligibility criteria included difficulty accessing virtual care due to lack of stable internet or device. Tablets featured an unlimited data package, access to the patient portal, and virtual visit platform. A private technology company managed device configuration and distribution. To characterize program impact, we compared the proportion of completed clinical encounters during the intervention compared with a preintervention period (March 2020–October 2020) and conducted a qualitative survey with program participants. Participant and visit characteristics were obtained from the electronic medical record and summarized with descriptive statistics.

Results A total of 111 families participated in the tablet loaner program, the majority of whom were Hispanic (51.4%) and black, non-Hispanic (26.1%), and publicly insured (64.9%). Between the preintervention and intervention periods, there was a significant increase in completed video- and phone-based virtual visits (75.3 vs. 79.1%, $p = 0.038$). The proportion of video-based only visits increased from 82.9 to 88.9%. $p < 0.001$. Families reported that the tablet improved the patient's ability to receive medical care (93.7%) and was easy to use (93.9%).

Conclusion The tablet loaner initiative was associated with an improvement in markers of virtual visit engagement and health care experience. Efforts to expand telemedicine equity must consider technological access and digital literacy as well as broad coalitions across industry, government, and community organizations.

Background and Significance

The coronavirus disease 2019 (COVID-19) pandemic spurred a transformation in health care delivery, including the rapid uptake of telemedicine.[1] This shift was enabled by changes in public and private reimbursement models and waivers for Health Insurance Portability and Accountability Act violations for clinicians who use everyday communication technologies. As a result, telemedicine services have been adopted across clinical applications and domains, becoming a core piece of many health systems' digital health offerings.

While telemedicine holds the promise to expand access to health care, it also has the potential to worsen existing structural inequities.[2] Among the major barriers is a lack of high-speed internet or modern telecommunications devices—otherwise known as the "digital divide."[3] Urban and rural low-income and racial and ethnic minoritized communities face significant disparities in technology access and literacy.[4] The COVID-19 pandemic has widened gaps in telehealth utilization, patient portal adoption, and use of other digital health platforms, such as online appointment schedulers.[5,6] Populations already at risk for health care disparities have been found to be more prone to missed care opportunities with a greater reliance on audio-only telephone-based visits.[7–9] Phone encounters may be more feasible in some settings, but lack the same level of provider–patient engagement and monitoring afforded by video modalities.[10] Altogether, internet connectivity has become increasingly recognized as a social determinant of health.

Objectives

To date, few evidence-based strategies to address structural inequities have been reported.[11,12] Health systems have a unique opportunity to mitigate health disparities by advancing internet and technological access. Toward this end, between October 2020 and October 2021, our free-standing children's hospital led an internet-enabled tablet loaner pilot program for select pediatric patients and their families. In this case study, we describe the operationalization of the program, including participant recruitment, device distribution, and technical support. We also evaluate the effect of internet and tablet use on virtual missed care opportunities, virtual visit modality, and perceived care experience.

Methods

Participant Enrollment
Boston Children's Hospital (Boston, Massachusetts, United States) is a large urban academic medical center with 415 licensed inpatient beds. The tablet loaner program operated out of nine departments: primary care, adolescent medicine, psychiatry, complex medical care service, asthma, gastroenterology, neurology, and endocrinology. Patients and their families were invited to participate if they were primary Boston Children's Hospital patients, reported difficulty accessing virtual care due to lack of stable internet connectivity or device, and were anticipated to have a high volume of virtual visits based on historical patterns. There were no exclusion criteria. Physicians screened and recruited eligible families at their discretion during routine clinical visits. A "prescription" with relevant contact information and digital needs was then sent to the project coordinators to manage tablet distribution. This study was determined to be exempt from Institutional Review Board approval.

Tablet Configuration, Distribution, and Use
We partnered with a private mobile device deployment service (ConnectUs Corps, King of Prussia, Pennsylvania, United States) for tablet computer supply, configuration, and distribution. The LG (Seoul, South Korea) G Pad X 8.3 VK815 was used for the pilot program and preloaded with access to the BCH patient portal (MyChildren's) and virtual visit platforms as well as Zoom Meetings, a videotelephony software program. Additionally, each device was equipped with an unlimited Verizon (New York, New York, United States) data package, proprietary mobile device management, unified endpoint management, and security features. To our knowledge, there was complete 4G and 5G LTE coverage within the Boston and Greater Boston area.[13] Families were given unrestricted access to internet content. Language interpretation services were available to all families and connected via a third-party application during virtual encounters. Prior to each virtual visit, families received two email and two text notifications and reminders.

Tablets were either delivered directly to the patient's residence or distributed in the clinic. If desired or no longer needed, the device could be returned via in-person drop-off or prepaid shipping. The initiative was supported by a 2020 Federal Communications Commission COVID-19 Telehealth Grant. A breakdown of costs associated with the initiative is provided in the Supplemental Materials (►Supplemental Table S1, available in the online version)

Training and Education
Multiple tiers of education and technical support were available throughout the program. ConnectUs communicated directly with participants for hardware and connectivity issues. Support staff from the project team addressed concerns related to Boston Children's Hospital (BCH) digital applications (e.g., My Children's Patient Portal) and virtual visits. Participating families also received a technical reference guide (translated into English and Spanish) to assist with device set-up, maintenance, and basic troubleshooting.

Data Sources and Definitions
Participant sociodemographic information, including race and ethnicity, primary language, interpreter need, and insurance status were abstracted from the electronic medical record. Race and ethnicity were self-reported and corresponded with the patient's identity, not necessarily that of their caregivers or household. The electronic medical record was also used to ascertain ambulatory clinical encounter type (e.g., in-person versus virtual), specialty, and completion status (completed, no show, left without being seen). We defined telehealth visits as virtual encounters conducted by

video or phone. We estimated home broadband access by linking participant addresses with census tract-level data on computer and internet usage from the 2021 American Community Survey (U.S. Census Bureau). After the tablet loaner program had concluded, enrolled families were contacted by the study team via phone to complete a brief survey on their experiences. Survey participation was voluntary and without remuneration. Outreach was standardized and consisted of two separate phone calls followed by two text messages for nonresponders.

Statistical Analysis

The intervention period spanned October 10, 2020, to October 10, 2021. To control for the abrupt and rapid changes in health care delivery with the onset of the COVID-19 pandemic, we used March 10, 2020, to October 9, 2020 as the preintervention period. We summarized participant and visit characteristics as well as survey responses with descriptive statistics. Changes in the proportion of completed visits (completed visits divided by the total number of scheduled appointments) between the pre- and postintervention periods were compared with the two-proportions z-test. Only ambulatory encounters with a physician or advanced practice provider (psychologist, nurse practitioner, and physician's assistant) were considered for analysis.

Statistical analysis was performed in R, version 4.1.3, with a significance threshold of $p = 0.05$.

Results

Participant Characteristics

Between October 2020 and October 2021, a total of 111 families were enrolled in the tablet loaner program (►Table 1). Most patients were Hispanic (51.4%), followed by Black, non-Hispanic (26.1%). English (55%) and Spanish (38.7%) were the most commonly preferred languages, with 39.6% of families requiring language interpretation services. A majority of participants were publicly insured (64.9%) and resided in census tracts with <90% broadband coverage (67.6%). Four families (3.6%) opted to return their devices prior to the completion of the pilot. Reasons for device return were not specified.

Table 1 Characteristics of study population

Characteristics	Overall
	$n = 111$
Race/ethnicity[a]	
Black, non-Hispanic	29 (26.1%)
Hispanic	57 (51.4%)
Other[b]	13 (11.7%)
White, non-Hispanic	12 (10.8%)
Preferred language	
English	61 (55.0%)
Other	7 (6.3%)
Spanish	43 (38.7%)
Broadband access, by census tract	
50–70%	6 (5.4%)
70–90%	69 (62.2%)
>90%	24 (21.6%)
Missing	12 (10.8%)
Insurance type	
Private	3 (2.7%)
Private/Public	36 (32.4%)
Public	72 (64.9%)
Needs interpreter	
Yes	44 (39.6%)
No	64 (57.7%)
Missing	3 (2.7%)

[a]Race and ethnicity information was obtained from patient and family reported data at the time of registration documented in the electronic medical record.
[b]"Other" includes Asian, American Indian, and multiracial children as well as those whose racial or ethnic identity was not recorded.

Virtual Visits

There were 2,081 clinical encounters over the course of the tablet loaner program, 50.7% of which were virtual visits (►Table 2). Patients completed virtual visits with a variety of specialties, most frequently psychiatry (47.6%), followed by

Table 2 Change in completed clinical visits, by encounter type

	Preintervention		Intervention		p-Value[a]
	Visits completed, n (% of scheduled)	Visits scheduled	Visits completed, n (% of scheduled)	Visits scheduled	
Overall	1,161 (79.2)	1,465	2,081 (82.7)	2,516	**0.007**
In-Person	469 (85.9)	546	1,025 (86.5)	1,185	0.793
Virtual	692 (75.3)	919	1,056 (79.1)	1,335	**0.038**
Telephone	118 (85.6)	138	118 (80.8)	146	0.371
Video	574 (73.5)	781	938 (78.9)	1,189	**0.006**

Note: Bolded text indicates statistical significance ($p < 0.05$).
[a]Two-proportions z-test of difference in proportion of completed visits between the preintervention and intervention periods.

Table 3 Postintervention participant survey responses

Question	Yes, n (%)
Has your tablet from Boston Children's improved your child's ability to receive medical care?	46 (93.9)
Has your tablet been easy to use?	46 (93.9)
Did you require technical support to use the tablet?	14 (28)

primary care (12.3%), adolescent medicine (6.8%), and gastroenterology (5.3%; ►Supplemental Table S2, available in the online version)

There was a greater proportion of completed virtual visits during the intervention compared with the preintervention period (79.1 vs. 75.3%, $p = 0.038$), whereas the proportion of completed in-person encounters remained unchanged (86.5 vs. 85.9%, $p = 0.793$). Among virtual visits, an increase in completed video-based, but not phone-based, encounters was observed (video: 78.9 vs. 73.5%, $p = 0.006$, phone: 80.8 vs. 85.6%, $p = 0.371$). Between the preintervention and intervention periods, the proportion of video-based visits relative to total telemedicine visits significantly increased (88.9 vs. 82.9%, $p < 0.001$).

Participant Survey

A postintervention survey was completed by 64.9% ($n = 72$) of participants (►Table 3). Most families reported that the tablet improved the patient's ability to receive medical care (93.7%) and was easy to use (93.9%). Among the 28% who required technical support, the most common issues concerned device set-up, troubleshooting internet connectivity, or need for replacement parts due to physical damage or lost components.

Discussion

In this analysis, we assessed the feasibility and impact of an internet-enabled tablet loaner pilot program at a large, urban freestanding children's hospital. We observed a decrease in the proportion of missed care opportunities and greater utilization of video-based virtual encounters associated with the pilot program. Participants reported a high degree of satisfaction, citing improvements in care and ease of use. Our results suggest that the program was effective in mitigating inequities in telemedicine and health care delivery in the era of COVID-19.

We focused our intervention on device and broadband access. The changes in visit completion rates and modality illustrate how technology provision can independently advance virtual engagement. Racial, geographic, and socioeconomic disparities in internet coverage and telecommunication are key mediators of the "digital divide."[14] These in large part result from discriminatory practices by internet service providers in maintaining and upgrading broadband infrastructure. Structural solutions, while necessary, are not sufficient to achieve telehealth equity. Low-income, limited English proficiency, and racial and ethnic minoritized communities have been found to have lower levels of digital literacy, an important prerequisite to using and navigating digital platforms.[15,16] Indeed, many of our families reported technical issues despite offering robust support services.

Health systems have increasingly recognized the need for comprehensive, equity-driven approaches to telemedicine adoption.[11,12,17] Strategies have focused on addressing digital literacy through community-based partnerships and educational resources. Changes in scheduling and logistic workflows—including screening for technology needs, guaranteeing interpreter services, and waving requirements for portal enrollment to secure a virtual visit—have also been incorporated. Efforts to expand hardware and internet access have not been as widely deployed and to our knowledge, this is the first description of such an initiative to be established at a freestanding children's hospital. The Department of Veterans' Affairs (VA) developed perhaps the most ambitious tablet distribution program to date, reaching almost 7,000 patients across the United States in collaboration with a private technology company.[18] In both the VA and our examples, telemedicine capabilities were augmented with meaningful relationships across sectors. Medical centers often have unique capture of at-risk populations not otherwise afforded to the industry but have limited resources and technical expertise to implement solutions at scale. The alignment of complementary strengths between our institution and technology partner proved crucial to the success of the tablet program. In the same spirit, health systems should have a role in local, state, and national policy actions. The recent $65 billion Internet for All initiative and FCC Affordability Connectivity Program provides subsidies for internet service and telecommunications devices.[19] Although not all internet service providers participate in the program and the benefit is limited (up to $30/month), hospitals could connect eligible families to these resources as a supplement to sustained internal efforts aimed at expanding broadband coverage and digital literacy.

Importantly, the operationalization of our program relied on active clinician participation. We provided loose eligibility criteria but largely deferred to provider discretion to identify and recruit potential families. This approach yielded a cohort that reflected the demographics most affected by the "digital divide"—a substantial proportion was from a racial and ethnic minoritized group, non-English-speaking, and/or publicly insured. Furthermore, the majority lived in communities with low penetration (<90%) of household broadband. A decentralized enrollment strategy may thus be viable for future iterations of the program, paired with central logistics for device deployment and technical support. Evaluating for hardware and/or internet connectivity challenges could ultimately be integrated in social determinants of health screening, which are now routinely used in primary care practices.[20] Our hospital system is actively collecting information on digital access among our patient families to improve future outreach.

There are limitations to this analysis. First, the evaluation of the tablet loaner program was retrospective and pragmatic in design. Our survey was not based on a validated instrument (e.g., Health Information Technology Usability Evaluation Scale) and the intervention coincided with the expansion of telehealth services over the course of the COVID-19 pandemic. It is therefore difficult to isolate the effects of our intervention, define a true control period, and address potential recruitment biases. Second, we validated the program with a small cohort at a single academic medical center, limiting its generalizability. The 1-year intervention period makes it challenging to extrapolate our funding and implementation model to longer-term, core digital health offerings. That said, we believe these experiences provide a valuable framework for technology distribution programs in other settings.[21] If our outcomes are reproducible, an investment in larger initiatives could be offset by the improvements in missed care opportunities and unnecessary lower-value acute care utilization (e.g., preventing emergency department visits). Lastly, we were unable to ascertain the usage patterns of the devices outside of direct clinical encounters. How the tablets and internet impacted portal engagement, patient–provider communication, and nonclinical applications, such as education, warrant investigation in future prospective studies. Of note, only one device exceeded 20 GB of monthly data usage, suggesting that video streaming and gaming were uncommon. A more comprehensive evaluation of screen time as an unintended consequence of device ownership would be an another important area of exploration.

Conclusion

The COVID-19 pandemic has magnified structural barriers to remote models of health care delivery. Efforts to advance the promises of telemedicine will fall short unless disparate access to telecommunication devices, internet connectivity, and digital literacy are addressed. In this study of a freestanding children's hospital, we found that an internet-enabled tablet loaner program was feasible and associated with improved markers of virtual visit engagement. Our results highlight the importance of equity-driven program design and implementation, including provider recruitment and multisector partnerships. As technological innovation increasingly shapes the health care ecosystem, so too must the medical community ensure these solutions are placed explicitly in the service of the most marginalized communities.

Clinical Relevance Statement

During the COVID-19 pandemic, telehealth has emerged as an increasingly prevalent mode of health care delivery but may be inaccessible due to disparities in internet coverage, telecommunication devices, and digital literacy. We find that an internet-enabled tablet program implemented at a freestanding children's hospital improved virtual visit engagement and positively impacted their care experience. This model may provide a framework for health systems to address the "digital divide" and advance telehealth equity.

Multiple-Choice Questions

1. The configuration and distribution of the tablets were coordinated by which of the following entities
   a. Local government agency
   b. Hospital
   c. Private technology company
   d. Library

   Correct Answer: The correct answer is option c. We partnered with a private technology company with expertise in mobile device management. Each tablet was preconfigured with an unlimited data plan, access to the hospital's patient portal, and virtual visit platform. The company oversaw logistics, including shipping, and returns, and provided direct technical support. This collaboration highlights the importance of complementary, cross-sector relationships to overcome the "digital divide." Our institution provided a direct conduit to patients and their families but benefitted from industry-level technical expertise and resources to operationalize the program.

2. Which of the following factors is not associated with the "digital divide?"
   3. Device access
   4. Residence in high-income neighborhood
   5. Internet connection
   6. Digital literacy

   Correct Answer: The correct answer is option b. The digital divide refers to differential access to modern digital technologies as a result of disparities in internet coverage, telecommunication devices, and digital literacy, among other causes. Racial and ethnic minoritized, low socioeconomic status, non-English speaking, and rural—and increasingly urban—underserved populations are disproportionately affected. Addressing the "digital divide" is prerequisite to realizing telehealth equity.

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