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Tech + touch: A pilot study to facilitate access to health information technology for Spanish-speaking parents

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ABSTRACT

Objectives: As Spanish-speaking parents face many barriers to care, we sought to: (1) understand HIT experiences and preferences; (2) pilot test a tablet/navigator intervention; (3) understand HIT uses and barriers.
Methods: Prospective, uncontrolled, non-randomized, pilot intervention examining facilitated access to a patient portal for Spanish-speaking parents. Parents were recruited from pediatric specialty clinics in an academic center. Parents received an electronic tablet pre-populated with health resources, plus 2 telephone calls from a navigator. Surveys assessed HIT perceptions/use; portal activation was assessed through electronic records.
Results: Twenty-five Spanish-speaking parents were enrolled. All parents wished they knew more about their child's health and that doctors knew them better. Most parents endorsed interest in HIT, however only 12% activated portals. Post-intervention, there were non-significant increases in using portals to make appointments, receive reminders, send/receive messages, and view labs/instructions. Uses of study tablets included video visits (56%), health/COVID information (16%), and schoolwork (16%).
Innovation: Spanish-speaking parents express high interest in HIT. Provision of tablets may augment electronic capacity and facilitate video visits. Greater Spanish-language support is needed for Spanish-speaking parents to meaningfully use portals.

1. Introduction

Approximately 13% of the United States (U.S.) population speaks Spanish as their primary or secondary language [1]. Spanish-speaking families experience communication barriers [2] that contribute to disparities in healthcare access, quality, and health outcomes [3-8]. National health objectives aim to improve communication for individuals using a language other than English (LOE) who experience health disparities [9]. Health information technology (HIT), namely electronic health record (EHR) patient portals, has the potential to serve as a tool to address these disparities by improving access to care, encouraging patient-provider communication, and improving quality of healthcare. HIT may provide an additional method for accessing healthcare, and could reduce barriers such as transportation, which can contribute to health disparities [10]. EHR patient portals have become the primary digital touchpoint utilized by healthcare systems to facilitate online communication between patients and their healthcare teams [11].

Despite widespread adoption of portals, prior studies demonstrate lower rates of patient portal interaction among patients using a LOE [12,13]. Spanish-speaking parents endorse interest in HIT, including patient portals, to communicate about their children's health; however, Spanish-speaking parents' HIT preferences and experiences are not well understood [4]. Additionally, relatively little is known about how access to portals can be facilitated for patients who face language barriers to health care. Currently, one of the most obvious barriers to portal use is a lack of widespread availability of Spanish-language patient portals by health systems. Additionally, barriers to HIT use may include limited accessibility to household devices [4], low digital literacy, and lack of linguistically and culturally appropriate HIT resources [14]. We hypothesized that providing an electronic tablet customized with Spanish-

Abbreviations: HIT, health information technology; IRB, institutional review board; EHR, electronic health record; VBN, volunteer bilingual navigator; LEP, limited English proficiency.

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language resources, and paired with individual assistance in Spanish would: 1) increase parent use of an electronic patient portal, and 2) result in more positive parent perceptions of HIT and patient portals. Thus, we conducted a prospective, uncontrolled, non-randomized pilot intervention of facilitated access to an EHR patient portal for Spanish-speaking parents to (1) understand Spanish-speaking parents' HIT preferences and experiences, (2) pilot test a tablet/navigator intervention to address potential barriers and increase HIT access/use and (3) understand HIT uses and barriers to successful HIT use among Spanish-speaking parents.

2. Materials and methods

2.1. Study population

Parents were recruited from pediatric specialty clinics in a single academic center from August 2020 to January 2021. Spanish-speaking research assistants identified potentially eligible patients by reviewing clinic schedules. Phone contact was attempted for all potentially eligible patients. Parents were eligible if (1) their preferred language was Spanish; (2) they had never activated the institutional patient portal; (3) they had internet service in their home or the ability to easily access internet service; (4) their child was under the age of 13 years (given proxy portal access needed for youth age 13 and older); (5) they anticipated that their child would need at least 1 follow-up appointment within 1 year. Parents were excluded if they did not meet any of the defined inclusion criteria.

Parents' consent to participate was documented using a verbal consent form; additionally, for children ages 7 to 12 years, assent to participate was documented using a verbal assent form. This study was approved by the Institutional Review Board (IRB) at the University of North Carolina at Chapel Hill.

2.2. Intervention

In the institution studied, we previously described low patient portal use by Spanish-speaking parents, and limited household technology devices [4]; we had also implemented navigators to improve patient experience [15]. We theorized that several elements may be needed to address barriers to HIT and portal use, including: 1) availability of appropriate electronic devices (hardware); 2) electronic health information and resources in Spanish; 3) language-concordant support and assistance with use of technology and devices. Thus, we designed an intervention, Estudio Triple T (Tableta, Tecnología, y Toque) that combined these 3 elements: an electronic tablet, information technology in Spanish, and a human touch. The intervention consisted of receiving an electronic tablet by mail which was pre-populated with Spanish language health resources (Appendix 1), plus two follow-up phone or video calls per parent preference from a culturally and linguistically appropriate navigator. Our team also created a printed user's guide that provided step by step instructions in Spanish to using the tablet and the pre-populated Spanish-language health information resources and included instructions to activating the patient portal using the pre-installed application on the tablet; the printed guide was mailed to parents with the tablet. The patient portal application was available at our institution only in English; therefore, navigators provided Spanish-language instructions in using it to perform simple tasks such as viewing future appointments and requesting medication refills. The original study design planned recruitment and intervention delivery in person at clinic visits; due to the COVID-19 pandemic, the protocol was modified to recruit and deliver the intervention virtually.

Volunteer bilingual navigators (VBNs) are certified in English and Spanish and were implemented in the study setting previously to support families with wayfinding and nonmedical communication [15]. Three VBNs received an additional 30-min standard training specific to this intervention in how to assist families in accessing electronic resources through the study tablet and activate the patient portal. Approximately one week after parents received the tablet, the VBN called parents to assist with orientation to the tablet, provide information about health information resources available through the pre-programmed tablet, provide virtual assistance with activating their patient portal, and describe the process for patient video visits. Two weeks later the navigator attempted a 2nd phone call to answer any questions about the tablet use or functioning. The tablet also served as an incentive for study participants.

2.3. Pre-intervention measures

Baseline measures were obtained at enrollment by a bilingual research assistant in Spanish via telephone interviews, which included demographics, and baseline HIT access, use, and interest. Demographics included caregiver sex (female, male), caregiver age (continuous), country of origin (U.S., Mexico, Honduras, El Salvador, Guatemala, Columbia, Ecuador, other), number of years in the U.S. (continuous), education level (elementary/primary school, middle school, high school, trade/vocational school, and college, dichotomized as middle school or less, high school or more), employment status (full time, part time, homemaker, not working), annual household income (<$10,000, $10,000–$19,000, $20,000–$39,000, $40,000–$59,000), and household size (continuous). HIT questions were adapted from the Consumers and Health Information Technology National Survey [16], and translated into Spanish by bilingual research assistants. HIT baseline questions addressed the following domains: 1) *general information technology use* (5 items); 2) *previous HIT use* (3 items); 3) *familiarity with HIT* (3 items); 4) *interest in HIT* (2 items); 5) *communication needs* (7 items); 6) *communication preferences* (3 items); 7) *perceptions of HIT* (3 items); 8) *perceptions of patient portals* (3 items).

2.4. Post-intervention measures

A post-intervention questionnaire was conducted by telephone by bilingual research assistants 1 month after parents received the tablet and assistance from navigators and included the same items used in the baseline questionnaire to reevaluate parents' *communication preferences, perceptions of HIT,* and *perceptions of patient portals.* Overall scores for parent perceptions of HIT and parent perceptions of patient portals were calculated by summing the Likert responses for the three items in each of these domains (score range 3–12). Study tablet use by household members, study tablet use by activity on a Likert scale (dichotomized as never/very little vs. moderately/very often/almost always), and an open-ended question about barriers to portal use were also evaluated. Since virtual visit availability expanded greatly during the study period due to the COVID-19 pandemic, we also inquired about electronic devices used for video visits. Activation of the patient portal was assessed through the electronic medical record review of portal activity at 6 months.

2.5. Statistical analysis

Demographic characteristics were summarized using medians and interquartile range for continuous variables and proportions for categorical variables. Descriptive baseline statistics for individual items within each HIT domain were examined using proportions. Pre-intervention vs post-intervention HIT perceptions and uses were compared for each individual item using the Wilcoxon test (for medians) and the McNemar test (for proportions) as appropriate; median pre- and post-intervention scores for parent perception of HIT and parent perception of patient portals were also compared using the Wilcoxon test. Wilcoxon signed-rank test was used for comparing the score ranks of pre- and post-HIT perception and usage, given that the scores were ordinal and we could not assume normal distributions.

3. Results

Of caregivers who were screened ($N = 314$), 79 were potentially eligible and phone contact was attempted; 25 caregivers, all of whom were parents, consented and were enrolled. All parents participated in at least 1 navigator call; 76% participated in 2 calls. Parents were mostly mothers (96%) from Mexico (64%) with a household income <$40,000 (76%) (Table 1). Before receiving the study tablet, 84% of participants reported having an electronic device; smart phones were the most frequently reported device in the home (Fig. 1). At baseline, all parents reported wishing they knew more about their child's health care and that their doctor knew more about them/their child's health, and most (90%) agreed that keeping track of all their child's health information was difficult (Table 1).

Regarding HIT use at baseline, most parents reported having used an electronic device for health-related reasons (64%) such as searching a website for nutrition, weight, and exercise information (60%), while fewer reported searching online for information about a disease or medical problem (24%) (Table 2). Few reported being very familiar with HIT such as mobile applications (16%), websites for personal health information (12%), or use of electronic medical files by doctors and health care systems (16%). Most reported being very interested in using HIT via a smartphone or tablet (84%) and a patient portal (78%).

Twenty parents completed the post-intervention questionnaire. There was no difference observed in parents' communication preferences, perceptions of HIT, or perceptions of patient portals before and after the intervention (Table 3). After the intervention, there were increases in the proportion of parents who reported using the patient portal to make appointments, receive reminders, send/receive messages from doctors/nurses, view labs, and view instructions; these increases were not statistically significant. On examination of free-text responses to an open-ended question about barriers to patient portal use, the most frequently endorsed reasons for lack of portal use were lack of awareness/ understanding of the portal, lack of access to internet, no perceived need for the portal, and preference for in-person communication. Based on electronic health record review, 12% of parents activated the patient portal.

Table 1
Baseline characteristics of parents ($N = 25$).

Characteristics	*N* (%)/ Median (IQR)
Sex	
Female	24 (96%)
Age (years)	38 (32–40)
Number of people in household	3 (3–4)
Country of origin	
Mexico	16 (64%)
Honduras	*6 (24%)*
Guatemala	3 (12%)
Education level	
Middle school or less	9 (36%)
High school or less	16 (64%)
Employment status	
Working full time	6 (24%)
Working part time	4 (16%)
Not working	5 (20%)
Homemaker	10 (40%)
Annual household income	
<$10,000	6 (29%)
$10,000–19,999	6 (29%)
$20,000–39,999	7 (33%)
$40,000–59,999	2 (9.5%)
Health communication preferences[a]	
Keeping track of child's health information is difficult	18 (90%)
I wish the doctor knew me and my child's health better	25 (100%)
I wish I knew more about my child's health care	25 (100%)
Health communication needs in past year[b]	
Schedule an appointment	23 (92%)
Receive a reminder when child needs an exam	22 (88%)
Keep up to date with child's health records	22 (88%)
See the doctor's instructions for taking care of child's health	20 (80%)
Send/receive an email from a doctor or nurse	17 (68%)
Refill a prescription	16 (64%)
View the results of labs or other tests	15 (60%)

[a] % agree shown (strongly agree/agree); response options were 4-point Likert scale from 1 (strongly agree) to 4 (strongly disagree).
[b] % of parents responding "yes" to having need within past year.

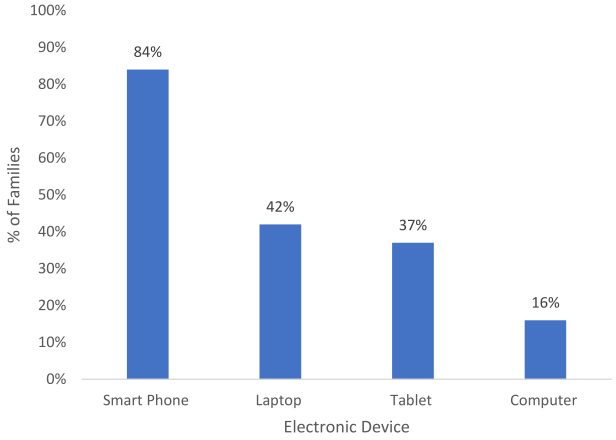

Fig. 1. Percent of parents with electronic devices in home at baseline.

Parents reported that study tablets were mostly used for video visits, entertainment, news, health/COVID information, and children's schoolwork (Fig. 2). The study tablet was equally and most often used by a parent or child (75%). Fifty-six percent of families reported having a video visit; 50% of them reported using the study tablet for the video visit. Of those who did not use the study tablet for the video visit, 38% reported using a phone and 12% reported using another device.

4. Discussion and conclusion

4.1. Discussion

In this HIT pilot intervention providing Spanish-speaking parents with customized tablets and language-concordant assistance from patient navigators, we sought to understand Spanish-speaking parents' HIT preferences and experiences and increase patient use of a patient portal that was accessible in English only. This intervention did not lead to changes in perceptions of HIT, and only 12% of parents activated the patient portal despite the linguistically tailored resources and support that were provided. While activation of the patient portal was modest following this intervention, we learned about the ways in which language-specific support combined with technology provision may benefit Spanish-speaking families, and gained insight into remaining challenges to having more Spanish-speaking parents meaningfully engage in patient portal use.

While the overall proportion of parents who activated the patient portal for their children was low, more parents reported using the patient portal for specific health communication needs following the intervention. This is notable because patient portal activation is an initial step that is necessary but not sufficient to enable parents to benefit from the functionalities of patient portals, and parent report of using specific functionalities indicates active engagement beyond basic activation. Specifically, more parents reported use of the patient portal to make an appointment, receive reminders about exams, vaccines, and radiology studies, send/receive messages, view laboratory or other results, and view physicians' instructions. Parent-reported uses in this study provide insight into the patient portal functions that may be most accessible and initially beneficial and could be emphasized when parents are introduced to portals. In contrast, we observed no change in

Table 2
Baseline parent health information technology use and interest ($N = 25$).

Technology use and interest	*N* (%)
Parent current technology use	
Check bank account online or pay bill online	
Almost never	21 (84%)
Often	4 (16%)
Use social media apps or websites, such as Facebook, Instagram, or LinkedIn	
Almost never	5 (20%)
Often	20 (80%)
Read the news online	
Almost never	8 (32%)
Often	17 (68%)
Watch the videos online, like on YouTube	
Almost never	6 (24%)
Often	19 (76%)
Shop online	
Almost never	24 (96%)
Often	1 (4%)
Parent health information technology use (ever)	
Searched online for information about a disease or medical problem	6 (24%)
Typed information on a website about eating, exercise, or weight	15 (60%)
Used an application on a cell phone or tablet for any health-related reasons	16 (64%)
Parent familiarity with health information technology	
Familiar with mobile applications to save/keep up-to-date with health information	
Not at all	7 (28%)
A little	14 (56%)
Very	4 (16%)
Familiar with websites where you can get, save, or update your health information	
Not at all	13 (52%)
A little	9 (36%)
Very	3 (12%)
Familiar with doctors and health care systems using electronic medical files	
Not at all	15 (60%)
A little	6 (24%)
Very	4 (16%)
Parent interest in health information technology	
Level of interest in health programs on a smartphone or tablet	
Not at all interested	0 (0%)
A little interested	4 (16%)
Very interested	21 (84%)
Level of interest in using a patient portal	
Not at all interested	1 (4%)
A little interested	4 (17%)
Very interested	18 (78%)

Table 3
Parents' interest in and use of health information technology (HIT) before and after tablet and navigator intervention ($N = 20$).[a]

	Pre-intervention[b]	Post-intervention[b]	*P* value
Parent communication preferences[c]			
Keeping track of all their health information is difficult	*2*	1.5	0.38
I wish the doctor knew me and my child's health better	1	1	0.78
I wish I knew more about my child's health care	1	1	0.97
Perceptions of health information technology[c]			
Overall score[d]	7	6	0.45
Things like electronic health records – even sending emails back and forth – can improve your relationship with your doctor.	2	1	0.15
Technology can make it easier for you to schedule a doctor visit, look at results, renew your medicine, and talk with your doctor.	2.5	3	0.64
With more technology and information, you could feel more in control of your health and the type of health care you receive.	2	2	0.69
Perceptions about patient portal use[c]			
Overall score[e]	3	3	0.85
I don't need this to handle my health needs	1	1	0.71
I don't like using computers or the Internet	1	1	0.86
It would take too much time	1	1	0.93
Reported uses of patient portal[f]			
Make an appointment	0	0.05	1
Renew medications	0	0	–
Stay up to date with your child's health records, like vaccines dates	0	0	–
Receive a reminder when your child needs an exam/vaccine/xray	0.05	0.1	1
Send or receive a message from the doctor or nurse	0	0.15	0.25
View lab or other results	0.05	0.2	0.25
View instructions from your doctor about your child's health	0	0.1	0.48

[a] Pre and post-intervention responses provided for N = 20 participants who completed both surveys.
[b] Medians displayed and paired Wilcoxon tests used to compare pre- and post-intervention values for all items except "Reported Uses of Patient Portal" for which proportions are displayed and McNemar test was used for comparison.
[c] Response options: 4-point Likert scale from 1 (strongly agree) to 4 (strongly disagree).
[d] Score calculated from sum of Likert responses from 3 items shown. Lower scores indicate more positive perceptions.
[e] Score calculated from sum of Likert responses from 3 items shown. Higher scores indicate more positive perception.
[f] Response options: Yes/No. Proportion responding "Yes" is displayed.

parent report of use of the patient portal for other functions, such as renewing medications, and staying up to date with a child's health and vaccines. It is possible that functions such as renewing medications through the patient portal are less readily accessible, and therefore require some additional orientation in Spanish to increase engagement. Similarly, staying up to date with a child's health may be challenging when the health record is primarily in English. Having accessible, visible, brief health summary information in Spanish via patient portals is one strategy that could support parents in making fuller use of portals for staying up to date with their child's health, and meeting the need that parents expressed in this study to know more about their child's health.

We found that all Spanish-speaking parents in our study desired more communication than they currently receive about their children's care. This is consistent with previously described differences in communication patterns by language [2] and previous findings that medical teams displayed less respect and partnership with Spanish-speaking Latino caregivers [17]. Prior studies of families using a LOE have also been found to receive less information and support during inpatient family conferences [18]. In addition to language, Spanish-speaking caregivers may also face access barriers that prevent them from receiving optimal information about their children's care [3,4].

Patient portals are one potential avenue to improve access and

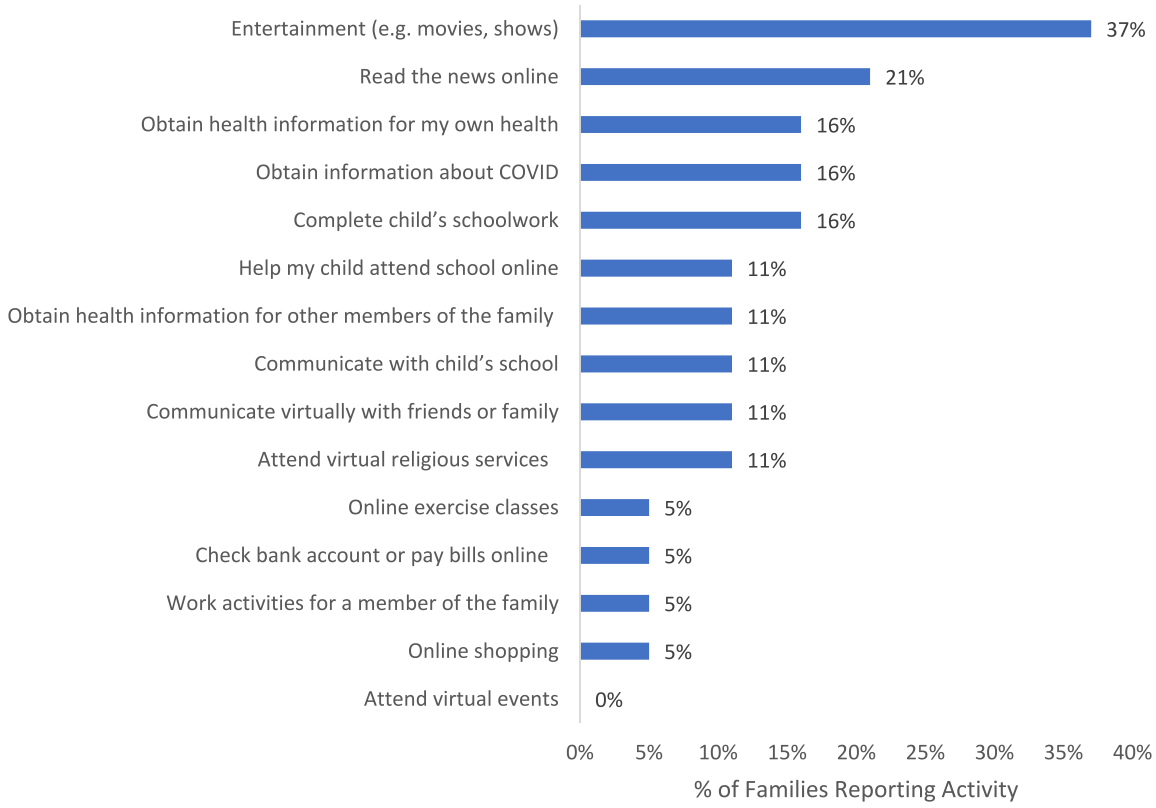

Fig. 2. Uses of study-provided electronic tablet ($n = 19$).

communication with Spanish-speaking families. We found that Spanish-speaking patients may have the necessary means (access via smartphones), background (high use of phone apps, tablet use for video visits and health information), and interest in HIT and patient portals. However, we did not observe an increase in HIT preferences or interest in and use of patient portals. This may be due to several challenges Spanish-speaking parents faced to successful patient portal use. Like many health systems, the portal in our study was only available in English for parents to access independently or with the assistance of VBNs via phone, presenting a barrier to set-up and navigation. Spanish-language patient portals are available, (e.g., Epic's MyChart) however, are not yet universally used by health care systems [19]. HIT preferences may shaped by larger systemic and societal factors, may be difficult to impact, and may require a longer intervention period to change. Low digital literacy, concerns regarding privacy and confidentiality of HIT, concerns related to reliability of web-based information, and a preference for in-person interaction may also explain why we did not observe a change in HIT preferences [14].

In addition to patient-facing barriers, healthcare providers have expressed concerns related to time and reimbursement for care provided through patient portals [20]. Adoption of Spanish-language portals will likely need policy makers, product makers, healthcare organizations, and providers to work together to expand federal policies and funding for language accessibility to include digital communication, continue development of language accessible portals, integrate language services into portal messaging workflows, and engage patients and caregivers in portal use and awareness as part of standard of care. Currently, the literature on non-English language patient portals is sparse. To ensure HIT is accessible to populations using a LOE, it is vital that healthcare organizations and investigators continue to measure and evaluate portal use, quality, cost, and outcomes for patients using a LOE and caregivers [19]. Additionally, parents lacked familiarity with patient portals and other HIT for personal health information, and that may also contribute to concerns about confidentiality and reliability [4,21]. Efforts to improve digital literacy among patients using a LOE, including familiarity and safety of patient portals, through collaborations with community organizations (e.g., libraries) and linguistically tailored support from community health workers may improve familiarity with and use of patient portals and HIT [19].

Furthermore, due to restrictions related to the COVID-19 pandemic, we modified the original intervention to enable it to be conducted remotely. Testing the use of remote technologies was especially salient during the pandemic when many families did not have sufficient electronic devices to meet new technology needs such as online school and video visits. This enabled us to learn how families used the study-provided tablet. Our findings that more than half of families used the tablet for video visits, and that 16% used it for children's education, though that was not the intended purpose, suggests unmet technology needs that can be addressed through the provision of electronic resources. However, due to pandemic restrictions, navigators had to use the very technologies that families may have found challenging, such as video calls, to assist families with use of the tablet and patient portal. Providing assistance regarding HIT while relying on information technology to communicate was a significant challenge; and could partially explain our low portal activation rate. A preference for in-person interactions [14] may also explain our low activation rates and it is possible that in-person assistance, as was originally planned for this study, would be more effective in enabling families to activate the patient portal. Additionally, families expressed uncertainty about the added value of the portal; Spanish-language materials to highlight its benefits could address this. Concerns regarding privacy and confidentiality related to HIT may also present a barrier to activation and use of patient portals [14], and efforts to improve digital literacy and confidence should be addressed as previously discussed. Finally, since patient portal activation required navigating a multi-step process in English, we anticipate that this may have deterred caregivers from activating the portal, even with assistance. The challenges we encountered in remote delivery of a HIT intervention are not surprising as other studies have

found that Spanish-speaking patients experienced difficulties with telehealth visits and HIT, and many expressed a preference for in-person visits [10,22]. Future interventions might address these barriers through greater in-person assistance, making all aspects of the patient portal available in Spanish, and providing clear, low-literacy, Spanish-language information about confidentiality.

This was a small pilot study, which may have limited the ability to detect a true difference before and after the study intervention. Our sample ($N = 20$) had only 29% power to detect a 1-point change in the Perceptions of Health Technology score, and 55% power to detect a 1-point change in the Perceptions about Patient Portal Use score; a larger sample size ($N = 98$) would be needed to detect these changes with 80% power. While the small sample size limited power, it was necessary at this stage to refine intervention delivery, given the innovative, multi-component nature of the intervention, and conduct preliminary testing to inform larger studies. Our study also used self-report measures that are subject to recall bias. Our study population consisted of parents at specialty clinics potentially limiting generalizability to those presenting to a primary care setting. Despite these limitations, literature examining HIT interventions is limited, and our study provides valuable insight into characteristics of HIT interventions that may be needed to increase access and use of HIT and patient portals among Spanish-speaking patients, and may be used to inform a larger study with more power.

4.2. Innovation

This pilot study introduces a novel approach to engaging primarily Spanish-speaking caregivers with HIT by providing multiple supports aimed at reducing reported barriers to patient portal use, namely appropriate access to electronic devices, access to electronic HIT and resources in Spanish, and personal support from a language-concordant navigator. Of interventions to increase electronic patient portal use, ours is one of the few developed specifically to address the gap in electronic patient portal use by Spanish-speaking caregivers and was uniquely designed to holistically address both linguistic and cultural barriers. While our pilot intervention did not lead to an increase in patient portal use or activation, our findings highlight the need for the translation of HIT resources into Spanish, increased support with portal activation and navigation to facilitate caregiver engagement with these tools, and the potential role for in-person support.

4.3. Conclusion

Spanish-speaking caregivers express high interest in HIT and patient portals. While provision of electronic tablets may augment electronic capacity and facilitate connecting to video visits, Spanish-speaking caregivers also reported barriers with portal set-up and navigation. These findings highlight the need for greater Spanish-language information, support, and resources to facilitate portal use, and the need for studies to determine what types of assistance are most effective in engaging Spanish-speaking parents in setting up and using patient portals meaningfully. Since patient portals have become a major method of health communication, institutions should make efforts to ensure that this technology is accessible to populations using a LOE, including those who speak Spanish. To facilitate equitable access, healthcare institutions should provide plain language, low literacy-adapted information about patient portals, simplify and clarify activation steps to make them maximally accessible in all languages, and consider providing in-person assistance to assist patients in activating and using HIT, including patient portals. Healthcare organizations may also need clear, effective, multilingual communication about the value and benefit of activating and using patient portals. More broadly, community-level investments in internet access are needed to address the barrier of limited internet access that was identified by parents in this study.

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Clinical Trial Registration

This study is registered as NCT04410380. Data Sharing: Research data may be shared in a de-identified data set to protect subject privacy; please contact the investigators with an analytic proposal and request.

CRediT authorship contribution statement

Jennifer C. Gutierrez-Wu: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Jennifer Pilotos McBride:** Writing – review & editing, Formal analysis. **Allison Pittman:** Writing – review & editing, Formal analysis, Data curation. **Yumei Yang:** Writing – review & editing, Formal analysis, Data curation. **Feng-Chang Lin:** Writing – review & editing, Supervision, Methodology, Formal analysis. **Kori B. Flower:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pecinn.2024.100358.

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