Adapting a Pregnancy App to Address Disparities in Healthcare Access Among an Emerging Latino Community: Qualitative Study using Implementation Science Frameworks

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Abstract

Background: Digital mobile health (mHealth) applications are a popular form of prenatal education and care delivery in the U.S.; yet there are few Spanish language options for native speakers. Furthermore, existing applications do not consider cultural differences and disparities in healthcare access, including those specific to Emerging Latino Communities.

Objective: This research uses iterative qualitative methods based on the Transcreation and Health Equity Implementation Framework to assess the needs of Latino pregnant individuals for the design of a mHealth pregnancy application. We then adapt an existing application, initially developed for native English speakers, to meet those needs.

Methods: We use a three-step culturally-sensitive process to translate a mHealth app to meet the needs of pregnant Latino immigrants living in the United States. Interviews with stakeholders (n = 12) who advocate for the needs of pregnant individuals in an emerging Latino community were used as inputs to identify domains of possible disparities in access to prenatal care. We then conducted semi-structured interviews with peripartum Latino users (n = 14) to understand their perspectives within those domains. We identified a list of topics to create educational material for the modified App and implemented a systematic translation approach to ensure that the new version was acceptable for immigrants from different countries in Latin America.

Results: The interviews with stakeholders revealed seven critical domains that need to be addressed in an adapted prenatal app: language barriers, financial barriers, social support, immigration status, cultural differences, healthcare accessibility, and connection to population-specific language-appropriate local resources. The interviews with peripartum women informed how the existing content in the App could be adjusted or built upon to address these issues, including providing information on accessing language-appropriate care and community support. Finally, we used a systematic approach to translate the existing application and create new content. This work illustrates an approach for culturally-sensitive language translation of digital tools focusing on addressing existing health disparities.

Background

Of annual U.S. births, 23% are to immigrants.(1) As a result, access, and delivery of high-quality healthcare for immigrant maternal populations, particularly non-English speakers, is an essential public health issue.(2) Specifically, the American College of Physicians calls for measures, such as supporting safety-net health care facilities and eliminating restrictions based on immigration status, to address potential disparities in care for immigrant populations proactively. This call necessitates that healthcare delivery through technology, including mobile health (mHealth) tools, also addresses the needs of diverse people(3) by considering the existing disparities associated with migration status and financial instability.

The prenatal period is particularly vulnerable for non-English speaking immigrants due to disparities in care and experience, ranging from stressors related to immigration (including lack of stable immigrant status), low English proficiency, distance to care, systemic marginalization, and stigma.(4,5) This is even more pronounced in immigrant communities that are rapidly growing in destinations with proportionally smaller Latino populations, often referred to as Emerging Latino Communities.(6) Immigrants in Emerging Latino Communities face further challenges due to a lack of local linguistically appropriate services and social support.(7) Latino immigrants settling in nontraditional destinations usually do not have the strong social support networks that other large, well-established Latino communities offer.(8)

Half of the total births to immigrants are of Hispanic or Latino origin. However, pregnant Latino individuals are often at a disadvantage when using mHealth tools due to the lack of culturally sensitive and language-specific design.(9–12) In general, even with the widespread use of smartphones, research shows that mHealth usage patterns vary widely by race, ethnicity, and English proficiency.(13,14) Pregnancy mHealth applications (apps) have the potential to offer personalized communication directly to pregnant individuals and identify pregnancy-related health issues earlier than may be possible with routine prenatal care.(15,16) Nevertheless, the benefit of existing prenatal apps may be limited for immigrant populations if they fail to address users' needs in the context of existing health and cultural disparities.(17) A one-size-fits-all approach to app design may benefit the health outcomes of majority populations while sustaining, or perhaps even creating, new health disparities among non-white individuals, particularly those from Black and Hispanic communities.(18) Previous studies that focus on mHealth pregnancy interventions usually exclude non-English speakers, as very few pregnancy apps are multilingual,(11) and usability and feasibility studies of mHealth interventions during pregnancy have generally excluded the perspective of Spanish-speaking Latino pregnant individuals in the U.S.(19)

The MyHealthyPregnancy (MHP) App was developed to aid risk communication to pregnant individuals and their providers. The design of this integrated mobile health platform (patient-facing App and EHR-embedded provider-facing information portal) incorporates a user-centered approach to serve the needs of individuals with high-risk pregnancies living in communities that have been systematically denied access to economic and social resources.(20) In this proof-of-concept study, Krishnamurti *et al*. found high app engagement levels among recruited patients, with the most consistent use among individuals from historically under-resourced communities and those with pregnancy risk factors. This tool has subsequently been shown to be effective at identifying those at risk of both psychosocial and clinical risks associated with maternal mortality.(16,21) Here, we apply an approach, grounded in implementation science frameworks, to translate the MyHealthyPregnancy app to address Latino pregnant individuals' cultural context and linguistic needs.

Methods

To adequately modify our existing tool to address domains of disparity common to Latino pregnant people in a specific community, we drew from the Transcreation approach developed by Nápoles *et al*. (22) Transcreation outlines the steps for a community-engaged process of planning, delivering, and

evaluating interventions to reduce health disparities in specific underserved communities. The focus is on community fit and interventions that fit the targeted community and also improve outcomes.

There are seven steps described by the Transcreation Framework(22): 1) identify community infrastructure and engage partners, 2) specify theory, 3) identify multiple inputs for the new program, 4) design intervention prototype, 5) design study, methods, and measures for community setting, 6) build community capacity for delivery, and 7) deliver the intervention. In this paper, we focus on the first four steps to identify design components for the new Spanish version of the MyHealthyPregnancy app.

Identify community infrastructure and engage partners

Our initial step was to identify current infrastructure and partners with relevant experience to understand the context in which the App would be delivered. For this purpose, we engaged several stakeholders who treat, teach, and support Latino women. We began with community outreach and word-of-mouth to identify stakeholders w in Pittsburgh, PA, which is currently considered a U.S. Emerging Latino Community.(23) Our focus was on healthcare and community organizations working with Latinos and educators who serve Latino patients. These stakeholders then recommended contacts they believed could offer additional insight (e.g., local Spanish-speaking doulas). Included in these informational interviews were three healthcare providers, three prenatal educators, two doulas, two leaders from community organizations, one academic researcher, and one social worker.

1. Specify a Theory

In this step, we reviewed published literature to determine areas to address in order to understand health disparities and the specific context of this population. The Health Equity Implementation Framework by Woodward *et al.*(24) was used to organize literature around the different components believed to predict a successful and equitable implementation (Figure 1). This framework was designed to assess both implementation and health equity determinants at the same time. Along with the contextual factors primarily considered in implementation frameworks, Woodward et al. place a focus on the clinical encounter. This inclusion reflects how the unique patient-provider relationship can affect health disparities for vulnerable populations. Finally, they recognize how societal influence, including economies, physical structures and sociopolitical forces affect a patient's ability to access and experience healthcare services.

Review of the literature in these areas identified eight primary sources of disparity for the pregnant Latino population: language (low English proficiency), access to health insurance, immigration status, cultural factors, location of services and transportation, healthcare accessibility, and health literacy.(23,25–32) These domains reveal how societal influence and context can conflict with communication goals, interpersonal objectives and exacerbate potential discrimination, eventually lowering participation and engagement with healthcare interventions, including mHealth apps.

3. Identify and Use Multiple Inputs

In transcreation, the purpose of the third step is to identify evidence-based interventions and evidence-based guidelines to guide the design of the intervention. MyHealthyPregnancy draws from behavioral decision research methods to offer a personalized medical communication smartphone app. The objective of this tool is to assess and communicate pregnancy risks related to preterm birth. This study focuses on refining and tailoring the MyHealthyPregnancy app for a new population. For this purpose, we conducted interviews with Latino peripartum individuals.

Patient Interviews

We conducted qualitative semi-structured interviews with Latino peripartum individuals to characterize their experience of the domains identified in the literature and clarified by the stakeholder interviews. The semi-structured interview instrument included open-ended questions about the themes identified (e.g., Are you worried about your ability to depend on a support system?), along with additional open-ended questions about the participant's pregnancy experience to identify any other domains or themes (e.g., What are some things that are done differently around pregnancy here in the U.S. in contrast to where you or your family came from?).

Participants

We recruited 15 peripartum individuals for the semi-structured interviews, with 14 completing the entire process (one participant withdrew after enrolling due to a scheduling conflict). All interviewees were recruited using community recruitment strategies that included posting flyers in Federally Qualified Health Centers visited by Latino populations, Facebook groups, and snowball sampling from recruited participants. To participate, individuals had to 1) be 18 years or older, 2) speak Spanish as their primary language, and 3) be pregnant or have given birth within six months of the interview. Interviews were conducted in person or by telephone between June and August 2019. For their participation, interviewees were compensated USD 50 for approximately 1 hour of their time. All participants had access to a smartphone.

Interview procedures

The semi-structured interviews started with open-ended questions formulated to suggest potentially relevant topics but not desired answers. As the interview progressed, questions became increasingly focused on the areas identified by our literature and stakeholder interviews. If necessary, responses were followed up with prompts for clarity (e.g., "How does that work?" "Can you explain what you mean a little more?"), as well as prompts that facilitated discussion of the issues. All the interviews were conducted in Spanish.

Coding

After an initial round of open coding to identify themes by the primary author, complete thematic analysis coding was conducted by a second Spanish-speaking coder. The second coder conducted a deductive analysis, identifying several subcodes within each domain.

4. Design intervention prototype

After analyzing the interviews, a series of app updates were outlined to address the interviewees' healthcare barriers, concerns, and inequities and used it to design a prototype of the Spanish language MyHealthyPregnancy app that addressed the specific concerns for Latino pregnant people in this community.

Results

Stakeholder and User Input

Table 1 outlines exemplar quotes on six of the determinants identified considered more relevant to this particular community and a seventh, social support, considered especially relevant in the case of an Emerging Latino Community. They also offered recommendations on how a mHealth implementation may offer support to minimize existing disparities.

Table 1

Domains and intervention approaches from Stakeholder Feedback

Domains Discussed	Exemplar Quotes	mHealth Implementation
Language	*"[Patients] want to speak Spanish when they feel vulnerable."*	Language appropriate applications
	"Find ways to reduce small language barriers, such as hospital menus, [pregnant individuals] have no information on when to order food, etc. - small barriers that exist because of lack of information, caused by lack of language."	Access to and information on translation services
		Share information in the appropriate language on what is going to happen during care and delivery
Access to health insurance	*"It is common for [pregnant individuals] to have to deal with payment problems because most do not have insurance. [We] have to teach them to understand their body signals so that they go to the emergency room when they are about to give birth. At that time, they could apply for emergency insurance."*	Provide information on navigating health-related financial considerations in the U.S.
	"The issue of payment creates stress, that they need to communicate [in English] with the hospital social worker."	Provide access to information on Federally Qualified Health Centers
		Offer postpartum services that are accessible without cost
Social Support	*"Women with low education and socioeconomic status. Commonly, they do not have anyone who supports them. For example, their mothers had no resources or could not come due to immigration permits."*	Community support through forums connecting Spanish-speaking pregnant individuals
	"They have to limit themselves to a very small circle; they do not have the aunt, the grandmother, the neighbor, in general, the extended network that generally supports Latino women during pregnancy – [they feel that] nothing is not going to happen to me because there are individuals who will take care of me."	Support programs for language-appropriate doula services
Immigration Status	*"Migration problems - they are scared of even leaving the house."*	Access to information on how immigration status will influence (or not influence) their access to care.
	"[Pregnant individuals] are worried about telling [healthcare facilities] information and that they may	

	contact their place of employment which could jeopardize their jobs."	
Cultural Differences	*"Pregnancy is traditionally more social and managed among the family."*	Acknowledge the importance of family as a source of support and provide ways to enhance links to a community of other Latino individuals
	"Less-educated women may be focused on using [traditional tea] and other things, natural care, generally this is not communicated to the providers."	Provide information on traditional medicine and how to discuss this topic with providers
		Offer nutritional advice based on staples of Hispanic diets
Healthcare Accessibility	*"In Latin America, healthcare is not a product - it is a public service, and the relationship is totally different. They don't see themselves as customers in the healthcare system."*	Educate providers in the different doctor-patient relationships in Latino cultures
	"Mothers must be helped to have the confidence to communicate their problems with nurses, doctors, police (in cases of domestic abuse) - Give them the confidence to communicate with resources themselves."	Educate users about their ability to ask questions and participate in their own healthcare decisions
Location of Services	*"Women will travel if you offer a valuable service… you need to gain trust, once trust is gained you need to give them the tools to overcome a barrier (for example transportation) and then they are highly motivated to go to prenatal classes where they get support."*	Offer spaces for community organizations to offer classes, collaborate, and form a network to support Latino pregnant individuals
	"There is a limited number of organizations offering classes and information, especially in Spanish and in a culturally sensitive way, but the main problem is insurance."	

Patient interviews were then used as additional input. The self-reported demographics of our sample of 14 Latino peripartum women are outlined in Table 2.

Table 2

Self-reported demographics (n = 14)

	n (%)
Country of Origin	
Mexico	5 (36%)
Colombia	3 (21%)
Argentina	2 (14%)
Ecuador	1 (7%)
El Salvador	1 (7%)
Peru	1 (7%)
Honduras	1 (7%)
Education Level	
Less than High School	2 (14%)
High School	3 (21%)
Some College	2 (14%)
College	5 (36%)
Postgraduate	2 (14%)
First Pregnancy	
Yes	8 (57%)
No	6 (43%)
Have used other pregnancy apps during their current pregnancy	
Yes	8 (57%)
No	6 (43%)

Within the domains identified, interviewees detailed nuances based on their personal experiences. In the **Language** domain, some emphasized language appropriateness as a limitation to effective

communication with providers during prenatal care visits. Some interviewees felt they could not ask follow-up questions for topics they did not understand. This feeling limited their ability to clarify any concerns or issues with the provider's instructions, leading to difficulty following through with provider recommendations.

When discussing **Access to Health Insurance**, the possible *cost of services* was reported as a significant source of stress during pregnancy and after the baby was born. All interviewees talked about financial worries. Three mentioned that they were unsure about the payment process for delivery services and what steps to take at the time of childbirth.

In the **Social Support** domain, the emotional toll of not having extended family members available, often a great source of support in their native countries, was reported as a primary cause of stress. 11 out of 14 interviewees later brought up the *importance of family support* when they expressed their concerns about whom they could reach out to in an emergency or even at the time of delivery.

Interviewees expressed uncertainty in the **Immigration** domain, saying that they were unsure of how it would affect their pregnancy care and lacked *awareness* of the effects of accessing prenatal care. Often these interviewees were fearful of engaging with the healthcare system. Still, most of the interviewees who had immigration concerns decided to engage with medical care despite these fears.

In the **Cultural Differences** domain, traditional medicine was discussed as part of cultural traditions but not a central component of their care. When asked about *care alternatives*, eleven participants mentioned using medicinal teas, such as valerian tea or anise star tea, to address joint discomfort. A few also noted that while they might consume the tea occasionally, they did not feel like it was necessary to talk to their provider about it and considered these drinks harmless.

In **Healthcare Accessibility**, interviewees also commonly discussed significant differences between *patient-provider relationships* in the U.S. and their home countries. Many talked about having a more amicable relationship with their medical providers in their home countries compared to the U.S., which was seen as transactional. Some discussed that they could have more ultrasounds in their home countries, which they found reassuring and a way to connect with their baby. Participants observed that providers in the U.S. tended to come into a room and ask quick questions but were not interested in understanding the patient's feelings or developing a relationship, limiting their *comfort* in asking additional questions. Another issue raised by interviewees in their limitation to access services was navigating the complexities of the U.S. healthcare system due to language issues and the intricacies of health insurance.

Brought up by the patients was the complexity of accessing and connecting with **Community Resources**, as some participants discussed how difficult it had been to find local resources for support as they attempted to navigate their pregnancy. Most had resorted to word-of-mouth as they slowly met more Latino immigrants and wished they had a way to access a comprehensive list for all services. Results from the interviews are summarized in Table 3.

Table 3

Patient Interview Results

Barrier Discussed	Specific Codes Identified	Exemplar Quote	Finding
Language	**Language appropriateness:** Lack of language appropriate services **Translation quality:** Poor quality of translation services **Access to Information:** Lack of language appropriate information on what to expect	*Sometimes the language. There are some doctors who, when they know that your native language is not English, speak slowly or take more pauses, they ask you several times if you understood, and then there are others who don't. It has happened to me that sometimes I leave, not knowing if they really understand what I am trying to say. I believe that language is one of the biggest obstacles. [P008]*	Interviewees feel that they are not getting comprehensive information due to language barriers. Additionally, some had bad experiences requesting translation services.
Access to Health Insurance	**Access:** Limited access to Federally Qualified Health Centers **Cost of services:** Inability to pay out of pocket for prenatal care and delivery services	*For the time I am going to have a baby, I do not have the information, in what hospital or how much it will cost me. [P002]*	Financial issues generate stress and anxiety. Often this is linked to feelings of insecurity due to immigration status.
Social Support	**Community Support:** Lack of community support	*The postpartum experience, I would have liked it better if it was in Colombia and not here because here, I am alone. There you are already incredibly supported, your family arrives, takes care of the baby so that you rest, the meals are great, they are more suitable for the moment of recovery and in general they help you a lot. [P006]*	Interviewees expressed feeling that they lack emotional support from family members and the need to have someone that cares for them.
Immigration Status	**Awareness:** Lack of access to information on how immigration status will influence access to care	*Yes, thinking that in case of an emergency there will be costs to get treatment because since one does not have any papers, I thank God that I have not gotten seriously ill, I have not needed to go– To go to the hospital with an emergency, but they tell me that it costs because you do not have papers and it costs to be seen. As I say, thank God I*	Interviewees recognized that they need to seek care eventually but often consider access through the emergency room as their only option.

		have not needed to go to a hospital; I have not gotten sick. [P011]	
Cultural Differences	**Importance of family:** Currently away from extended family **Care alternatives:** Limited information on potential alternative care **Nutrition:** Nutritional advice based on staples of an American diet	*I have been worried about not having many ultrasounds, here in the United States, only two are done, I did not know if this was normal or not, but doctors have told me that two is enough and necessary unless there are any complications, but I would have liked to see the baby a little more, have many more options to see the ultrasound. [P003]*	There is an understanding of traditional medicine, but it is not necessarily considered an essential part of care. There are different expectations on what prenatal care will involve and how it may differ from care in other countries.
Healthcare Accessibility	**Patient-Provider Relationships**: Differences in a doctor-patient relationship compared to what is expected in Latino cultures **Comfort:** A feeling of being unable or uncomfortable asking questions **Decision Making:** Limited participation in their own healthcare decisions	*In the beginning, it was pretty difficult [to access prenatal care], at some point, because I did not know that I was pregnant, and I came to find out when I was at three months. I did not know how it was here in the United States; how to get [prenatal] care, how to make an appointment, more than anything they told me they spoke to you in English, I don't know any English. For me, it was pretty difficult in that aspect; that's why I started [prenatal] care when I was 28 weeks pregnant. [P002]*	It was difficult for interviewees to find ways to access the healthcare system.
Connection to Local Resources	**Community Resources**: Lack of a local network to support Latino individuals	*Yes, yes, I would like, let's say, to be able to expand that network of resources and, above all, that they were Latino. Because we know that this city doesn't have a lot of Latino immigrants and we don't have many services… Yes, we don't have many services specific to Latino people. [P003]*	Interviewees emphasized that a critical step is to have a centralized place to access resources available for Spanish-speaking individuals.

App design considerations

As outlined in Table 4, the feedback received from our interviewees highlights the critical importance of language on the effectiveness of a mHealth implementation for pregnant immigrants. It highlights a series of topics to address to minimize some existing health disparities in this Emerging Latino Community. These concerns include a lack of information about which Federally Qualified Health Centers they could access, local resources that offer Spanish language services, and awareness about immigrant rights about access to care, among others.

Table 4

New updates to add to the MyHealthyPregnancy Prototype

Area	Topics	Suggested App Content
Language	Language appropriate services	Include direct links to access translation services available at different healthcare providers, including ways to schedule them ahead of time
	Translation services	Provide in-app information on what to expect during appointments and during labor, including questions to discuss with the provider
	Language appropriate information on what to expect	
Financial Barriers	Access to Federally Qualified Health Centers	Include in-app information on how to access care in Federally Qualified Health Centers and how to apply for different types of medical assistance
Social Support	Support programs for language-appropriate services	Include information on how to access programs with Spanish-speaking doulas
		Discuss different available services that cater to Spanish speakers in the area.
Immigration Status	Access to information on how immigration status will influence access to care	Include in-app information on access to prenatal care and alternatives to emergency room care
Cultural Differences	Acknowledge the importance of family and advice received about traditional care practices	Update nutritional information to include staples of Latino/Hispanic diets
	Nutritional advice based on staples of Hispanic diets	Provide in-app information on what to expect during an appointment, highlighting possible differences from care in other countries
Healthcare Accessibility	Educate providers in the different doctor-patient relationships in Latino cultures	Present in-app information on the different healthcare resources available and how to access each level of care

	Educate users to ask questions and participate in their own healthcare decisions	Offer information on how to facilitate involvement in their healthcare
Connection to Local Resources	Offer spaces for community organizations to collaborate and form a network to support users	Maintain an up-to-date list of appropriate language resources that have been verified as accessible to pregnant Latino individuals independent of their immigration status

Systematic Translation

As part of our efforts to support a language-appropriate app, we applied a systematic approach to translating the existing content in the MyHealthyPregnancy app to Spanish, which is outlined in Figure 2. We identified two goals for culturally-sensitive language translation. The first was that the translation and validation process would incorporate the nuances in language specific to Spanish-speaking populations from different countries of origin. Our translation team included native speakers from different Latin American countries validating Ecuador and Venezuela, which served as a first pass to identify discrepancies in words. The second was that the translation of questionnaires and data collection mechanisms would ensure that the answers were not shaped by how questions were worded.(33)

Discussion

Adequate prenatal care, initiated within the first trimester of pregnancy and increasing in frequency as the delivery date approaches, is associated with a lower risk of prematurity, stillbirth, and neonatal death.(34) Latino pregnant individuals have lower timely initiation of prenatal care, measured by access to care during their first trimester, compared to non-Hispanic whites.(35) For non-US-born Latino pregnant individuals, late prenatal care initiation rates are significantly higher than their US-born counterparts.(36–38) This work adapted a mHealth intervention, the MyHealthyPregnancy app, to acknowledge and offer education on the barriers that may prevent immigrant Latino pregnant individuals from engaging in care.

Our first goal was to understand the existing health disparities for Latino pregnant individuals who seek to access care in an emerging Latino community and how these could be addressed in a mobile health app. We started by identifying possible barriers in the context of this local population and then talked to Latino peripartum individuals to understand their experiences with those barriers to determine the necessary app updates.

While not a monolith, the Spanish-speaking immigrant interviewees face barriers specific to communities with few Spanish-speaking services. For each of the barriers discussed, we were able to identify critical concerns that could be addressed in a pregnancy app by designing communication with an equity focus. Regarding language barriers, interviewees discussed how lack of language proficiency limited their ability

to ask questions and understand recommendations. Previous work has identified communication problems between patients receiving prenatal care and providers.(36,37) Similar to our results, communication problems have also been identified as a factor limiting the value of information from providers.(38,39) Interviewees often left appointments with questions about the following steps. mHealth tools that are language appropriate can help bridge the communication gap by offering additional educational content with critical physician-approved information in a proper context, which can aid in interpreting provider instructions and facilitate a clear understanding of medical recommendations.

Interviews with patients were analyzed to identify content requirements to adapt the application. These content requirements include patient education and educational content that could support prenatal care goals. Existing content was translated through a systematic process that considers qualitative feedback from target audiences.

While existing translation methods have attempted to address translation issues specific to data collection assessments,(40,41) by following recommendations from implementation science and involving native speakers who were end-users of our product to supplement our translation, we can also address the particular needs of an emerging Latino community and existing health disparities. The systematic method used also facilitates the implementation of best practices outlined in the previous eHealth literature, including respecting the cultural characteristics of present and future users and respecting the level of literacy of the target population.(42)

Conclusion

Mobile health smartphone applications offer support to patients outside of the clinical setting and between routine prenatal care. However, when expanding the access of these tools to otherwise underserved populations, particularly individuals who speak Spanish as a primary language, there is a need for a comprehensive approach that does not exacerbate existing disparities. Our results show the importance of a systematic approach to understanding this population's cultural, language, and environmental needs. Our approach highlighted the existing disparities that Latino pregnant people face in an emerging immigrant community when accessing prenatal care. This approach offers a method to tailor communication initiatives to address these disparities based on implementation science frameworks.

Declarations

Ethics declarations

The Institutional Review *IntegReview IRB* approved interview data collection using expedited review procedures (Protocol #201902). Patient informed consent was obtained. The participants were not exposed to any risks or harmed in any way by participating in the study. All research processes were performed in accordance with the Declaration of Helsinki.

Availability of data and materials

The data that support the findings of this study are not openly available due to the risks in identifying participants as true anonymization would be difficult to guarantee, but subsets of the data are available from the corresponding author, AC, upon reasonable request.

Consent for publication

Not applicable.

Competing interests

AFC is a full-time employee of Naima Health LLC, the company that developed the MyHealthyPregnancy app. TK, and ALD are cofounders and equity holders of Naima Health LLC, but they did not receive compensation for conducting this study or disseminating the MyHealthyPregnancy app.

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Authors' contributions

Study conception and design: AFC, TK, ALD; Acquisition of data: AFC; Analysis and interpretation of data: AFC; Drafting of manuscript: AFC; Critical revision: TK, ALD. All authors approved the manuscript before submission. All authors read and approved the final manuscript.

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References

1. Martin JA, Hamilton BE, Osterman MJK. Births in the United States, 2018. NCHS Data Brief. 2019 Jul; (346):1–8.
2. Kline M. National immigration policy and access to health care. American College of Physicians Observer. 2011;
3. Butkus R, Rapp K, Cooney TG, Engel LS. Envisioning a Better U.S. Health Care System for All: Reducing Barriers to Care and Addressing Social Determinants of Health. Ann Intern Med [Internet]. 2020 Jan 21 [cited 2020 Dec 3];172(2_Supplement):S50–9. Available from: https://www.acpjournals.org/doi/full/10.7326/M19-2410
4. Derose KP, Escarce JJ, Lurie N. Immigrants And Health Care: Sources Of Vulnerability. Health Affairs [Internet]. 2007 Sep 1 [cited 2018 Nov 20];26(5):1258–68. Available from: https://www.healthaffairs.org/doi/abs/10.1377/hlthaff.26.5.1258
5. Grobman WA, Bailit JL, Rice MM, Wapner RJ, Reddy UM, Varner MW, et al. Racial and ethnic disparities in maternal morbidity and obstetric care. Obstet Gynecol [Internet]. 2015 Jun [cited 2018 Nov 21];125(6):1460–7. Available from: https://europepmc.orghttp://europepmc.org/articles/PMC4443856/
6. Tolbert J. Health Coverage and Access to Care for Hispanics in" New Growth Communities" and" Major Hispanic Centers". Henry J. Kaiser Family Foundation; 2006.
7. Bucay-Harari L, Page KR, Krawczyk N, Robles YP, Castillo-Salgado C. Mental Health Needs of an Emerging Latino Community. J Behav Health Serv Res [Internet]. 2020 Jul 1 [cited 2021 Mar 31];47(3):388–98. Available from: https://doi.org/10.1007/s11414-020-09688-3
8. Frey WH. Diversity explosion: How new racial demographics are remaking America. Brookings Institution Press; 2018.
9. Campos B, Schetter CD, Abdou CM, Hobel CJ, Glynn LM, Sandman CA. Familialism, social support, and stress: Positive implications for pregnant Latinas. Cultural Diversity and Ethnic Minority Psychology. 2008;14(2):155–62.
10. Sumner LA, Wong L, Schetter CD, Myers HF, Rodriguez M. Predictors of posttraumatic stress disorder symptoms among low-income Latinas during pregnancy and postpartum. Psychological Trauma: Theory, Research, Practice, and Policy. 2012;4(2):196–203.
11. Hughson JP, Daly JO, Woodward-Kron R, Hajek J, Story D. The Rise of Pregnancy Apps and the Implications for Culturally and Linguistically Diverse Women: Narrative Review. JMIR Mhealth Uhealth [Internet]. 2018 Nov 16 [cited 2019 Jan 8];6(11). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6269626/
12. Perrin A, Turner E. Smartphones help blacks, Hispanics bridge some–but not all–digital gaps with whites. Washington, DC: Pew Research Center. 2017;
13. Bender MS, Choi J, Arai S, Paul SM, Gonzalez P, Fukuoka Y. Digital Technology Ownership, Usage, and Factors Predicting Downloading Health Apps Among Caucasian, Filipino, Korean, and Latino Americans: The Digital Link to Health Survey. JMIR mHealth and uHealth [Internet]. 2014 [cited 2020 Jun 24];2(4):e43. Available from: https://mhealth.jmir.org/2014/4/e43/

14. Chilukuri N, West M, Henderson JL, Lawson S, Ehsanipoor R, Costigan K, et al. Information and Communication Technology Use Among Low-Income Pregnant and Postpartum Women by Race and Ethnicity: A Cross-Sectional Study. Journal of Medical Internet Research [Internet]. 2015 [cited 2020 Aug 10];17(7):e163. Available from: https://www.jmir.org/2015/7/e163/
15. Wallwiener S, Müller M, Doster A, Laserer W, Reck C, Pauluschke-Fröhlich J, et al. Pregnancy eHealth and mHealth: user proportions and characteristics of pregnant women using Web-based information sources—a cross-sectional study. Arch Gynecol Obstet [Internet]. 2016 Nov 1 [cited 2020 Feb 3];294(5):937–44. Available from: https://doi.org/10.1007/s00404-016-4093-y
16. Krishnamurti T, Davis AL, Rodriguez S, Hayani L, Bernard M, Simhan HN. Use of a Smartphone App to Explore Potential Underuse of Prophylactic Aspirin for Preeclampsia. JAMA Network Open [Internet]. 2021 Oct 29 [cited 2022 Jan 14];4(10):e2130804. Available from: https://doi.org/10.1001/jamanetworkopen.2021.30804
17. Huh J, Koola J, Contreras A, Castillo AKP, Ruiz M, Tedone KG, et al.Consumer Health Informatics Adoption among Underserved Populations: Thinking beyond the Digital Divide. Yearb Med Inform [Internet]. 2018 Aug [cited 2020 Dec 3];27(1):146–55. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6115231/
18. Brewer LC, Fortuna KL, Jones C, Walker R, Hayes SN, Patten CA, et al. Back to the Future: Achieving Health Equity Through Health Informatics and Digital Health. JMIR mHealth and uHealth. 2020;8(1):e14512.
19. Overdijkink SB, Velu AV, Rosman AN, Beukering MD van, Kok M, Steegers-Theunissen RP. The Usability and Effectiveness of Mobile Health Technology–Based Lifestyle and Medical Intervention Apps Supporting Health Care During Pregnancy: Systematic Review. JMIR mHealth and uHealth [Internet]. 2018 [cited 2020 Jan 31];6(4):e109. Available from: https://mhealth.jmir.org/2018/4/e109/
20. Krishnamurti T, Davis AL, Wong-Parodi G, Fischhoff B, Sadovsky Y, Simhan HN. Development and Testing of the MyHealthyPregnancy App: A Behavioral Decision Research-Based Tool for Assessing and Communicating Pregnancy Risk. JMIR mhealth uhealth [Internet]. 2017 Apr 10 [cited 2018 Oct 25];5(4). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5404142/
21. Krishnamurti T, Davis AL, Castillo AF, Martin KL. Mobile Remote Monitoring of Intimate Partner Violence Among Pregnant Patients During the COVID-19 Shelter-In-Place Order: Quality Improvement Pilot Study. Journal of medical Internet research. 2021;23(2):e22790.
22. Nápoles AM, Stewart AL. Transcreation: an implementation science framework for community-engaged behavioral interventions to reduce health disparities. BMC Health Services Research [Internet]. 2018 Sep 12 [cited 2021 Jun 18];18(1):710. Available from: https://doi.org/10.1186/s12913-018-3521-z
23. Documet PI, Troyer MM, Macia L. Social Support, Health, and Health Care Access Among Latino Immigrant Men in an Emerging Community. Health Educ Behav [Internet]. 2019 Feb 1 [cited 2021 Apr 5];46(1):137–45. Available from: https://doi.org/10.1177/1090198118763870

24. Woodward EN, Matthieu MM, Uchendu US, Rogal S, Kirchner JE. The health equity implementation framework: proposal and preliminary study of hepatitis C virus treatment. Implementation Science [Internet]. 2019 Mar 12 [cited 2021 Jun 18];14(1):26. Available from: https://doi.org/10.1186/s13012-019-0861-y
25. Proctor K, Wilson-Frederick SM, Haffer SC. The Limited English Proficient Population: Describing Medicare, Medicaid, and Dual Beneficiaries. Health Equity [Internet]. 2018 May 1 [cited 2020 Oct 8];2(1):82–9. Available from: https://www.liebertpub.com/doi/10.1089/heq.2017.0036
26. Edward J, Morris S, Mataoui F, Granberry P, Williams MV, Torres I. The impact of health and health insurance literacy on access to care for Hispanic/Latino communities. Public Health Nursing [Internet]. 2018 [cited 2021 Mar 31];35(3):176–83. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/phn.12385
27. Topmiller M, Zhen-Duan J, Jacquez FJ, Vaughn LM. Place Matters in Non-Traditional Migration Areas: Exploring Barriers to Healthcare for Latino Immigrants by Region, Neighborhood, and Community Health Center. J Racial and Ethnic Health Disparities [Internet]. 2017 Dec 1 [cited 2021 Mar 31];4(6):1214–23. Available from: https://doi.org/10.1007/s40615-016-0329-6
28. Cabral J, Cuevas AG. Health Inequities Among Latinos/Hispanics: Documentation Status as a Determinant of Health. J Racial and Ethnic Health Disparities [Internet]. 2020 Oct 1 [cited 2021 Mar 31];7(5):874–9. Available from: https://doi.org/10.1007/s40615-020-00710-0
29. Doshi M, Lopez WD, Mesa H, Bryce R, Rabinowitz E, Rion R, et al. Barriers & facilitators to healthcare and social services among undocumented Latino(a)/Latinx immigrant clients: Perspectives from frontline service providers in Southeast Michigan. PLOS ONE [Internet]. 2020 Jun 5 [cited 2021 Mar 31];15(6):e0233839. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0233839
30. Gresenz CR, Derose KP, Ruder T, Escarce JJ. Health Care Experiences of Hispanics in New and Traditional U.S. Destinations. Med Care Res Rev [Internet]. 2012 Dec 1 [cited 2021 Mar 31];69(6):663–78. Available from: https://doi.org/10.1177/1077558712457242
31. Martínez G. Language and power in healthcare: Towards a theory of language barriers among linguistic minorities in the United States. Readings in language studies: Language and power. 2010;2:59–74.
32. Timmins CL. The impact of language barriers on the health care of Latinos in the United States: a review of the literature and guidelines for practice. Journal of Midwifery & Women's Health [Internet]. 2002 Mar 1 [cited 2021 Mar 31];47(2):80–96. Available from: https://www.sciencedirect.com/science/article/pii/S1526952302002180
33. Schwarz N. Self-reports: How the questions shape the answers. American Psychologist. 1999;54(2):93–105.
34. Lipski JM. Varieties of Spanish in the United States. Georgetown University Press; 2008. 317 p.
35. Partridge S, Balayla J, Holcroft CA, Abenhaim HA. Inadequate Prenatal Care Utilization and Risks of Infant Mortality and Poor Birth Outcome: A Retrospective Analysis of 28,729,765 U.S. Deliveries over

8 Years. Amer J Perinatol [Internet]. 2012 Nov [cited 2018 Nov 7];29(10):787–94. Available from: http://www.thieme-connect.de/DOI/DOI?10.1055/s-0032-1316439

36. da Conceição F. Santiago M, Figueiredo MH.Immigrant Women's Perspective on Prenatal and Postpartum Care: Systematic Review. J Immigrant Minority Health [Internet]. 2015 Feb 1 [cited 2018 Nov 14];17(1):276–84. Available from: https://doi.org/10.1007/s10903-013-9915-4
37. Shaffer CF. Factors Influencing the Access to Prenatal Care by Hispanic Pregnant Women. Journal of the American Academy of Nurse Practitioners [Internet]. 2002 Feb 1 [cited 2018 Nov 6];14(2):93–6. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1745-7599.2002.tb00097.x
38. Tandon SD, Parillo KM, Keefer M. Hispanic Women's Perceptions of Patient-Centeredness During Prenatal Care: A Mixed-Method Study. Birth [Internet]. 2005 Dec 1 [cited 2018 Nov 14];32(4):312–7. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.0730-7659.2005.00389.x
39. Wallace SP, Mendez-Luck C, Castañeda X. Heading South: Why Mexican Immigrants in California Seek Health Services in Mexico. Med Care [Internet]. 2009 Jun [cited 2018 Nov 21];47(6):662–9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2711545/
40. Sartorius N, Kuyken W. Translation of Health Status Instruments. In: Orley J, Kuyken W, editors. Quality of Life Assessment: International Perspectives. Berlin, Heidelberg: Springer Berlin Heidelberg; 1994. p. 3–18.
41. Carroll JS, Holman TB, Segura-Bartholomew G, Bird MH, Busby DM. Translation and Validation of the Spanish Version of the RELATE Questionnaire Using a Modified Serial Approach for Cross-Cultural Translation*. Family Process [Internet]. 2001 [cited 2021 Jan 11];40(2):211–31. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1545-5300.2001.4020100211.x
42. Latulippe K, Hamel C, Giroux D. Social Health Inequalities and eHealth: A Literature Review With Qualitative Synthesis of Theoretical and Empirical Studies. Journal of Medical Internet Research [Internet]. 2017 Apr 27 [cited 2021 Jun 18];19(4):e6731. Available from: https://www.jmir.org/2017/4/e136

Figures

Figure 1

Implementation and Health Equity Determinants Adapted from Woodward et al.

Figure 2

Translation Process for mHealth App