

Abstract

Evidence-informed parenting programs have been shown to reduce internalizing behaviors and substance use, but reach is limited. Mobile technology has the potential to aid in the dissemination of evidence-based parenting programs. The long-term goal of this research is to reduce depression, anxiety, and substance use among Latino adolescents through a mobile application with parenting content and personal biofeedback. The goal of this proposal is to build and test a baseline mobile application with a skills-based parenting curriculum for Latine immigrants, *Padres Informados*. The first aim is to build the baseline application and test the prototype that has already been developed in interviews with 20-30 of parents who completed an earlier survey. Specific research questions include 1) How do Latine parents use technology in their everyday lives for parenting?, 2) What avenues of coping with parenting stress using technology appear relevant to this population?, and 3) What are the features that parents would most prefer and least prefer to have in a mobile app? The second aim is to assess the functionality of the baseline mobile app and the acceptability of using a wearable through qualitative interviews. Specific research questions of the second aim include: 1) What changes would parents recommend in the mobile application? and 2) After trying a wearable device for two weeks, what aspects of the wearable device do parents find most useful and least useful? Bridging research and theory, this proposal is responsive to the NIH goal of smart, connected health and the need for interdisciplinary collaboration to address complex health issues. The conceptual rationale for the proposed research is that dissemination of evidence-informed parenting programs will have the following community health impact: increase parenting skills, reduce parental stress, improve parent-adolescent relationships, thereby reducing adolescent internalizing symptoms and substance use. The mobile app will have the potential of increasing community accessibility to evidence-based parenting programs and enhancing existing delivery of the program by providing mobile supplementary information and goal tracking capabilities.

Specific Aims

Family stress processes are related to adverse outcomes for children, including poor mental health.^{1,2} Parenting programs have improved parent-child relationships, reduced parental stress through mindfulness, and restored normative biological stress systems in children.^{3,4} The reach of evidence-informed parenting programs is limited.⁵ Technology shows promise as a cost-effective public health strategy for delivering programs to diverse populations and overcoming barriers of access to achieve widespread dissemination of parenting programs.^{6,7} Specifically, a *mobile health (mHealth) approach has the potential to meet critical needs of disseminating evidence-informed parenting programs and providing personal biofeedback to reduce parents' stress and improve child outcomes.*

The long-term goal of this proposal is to reduce depression and substance use among Latine adolescents through a mobile application with parenting content and personal biofeedback. The goal of this proposal is to research the feasibility of disseminating a mobile phone app of *Padres Informados*, an evidence-informed parenting curriculum for Latine immigrants. To develop the app, initial interviews with 20-25 parents will assess the prototype mobile app adaption of the parenting program which incorporates stress reduction components. After development, the parents will be invited to give feedback on the baseline mobile app and test a wearable for two weeks. Bridging research and theory, this proposal is responsive to the NIH goal of smart, connected health and the need for interdisciplinary collaboration to address complex health issues.⁸ The conceptual rationale for this research is that dissemination of evidence-informed parenting programs will have the following public health impact: 1) increase parenting skills and reduce parental stress and 2) improve parent-adolescent relationships and parental coping responses, thereby improving adolescent outcomes.

The proposed research will pursue the following specific aims:

Aim 1: Determine healthy ways Latine parents of adolescents use technology through qualitative thematic analysis and identify parents' preferred features of the mobile app prototype via consumer preference research methods.

- RQ¹ How do Latine parents use technology in their everyday lives for parenting?
- RQ² What avenues of coping with parenting stress using technology appear relevant to this population?
- RQ³ What are the features that parents would most prefer and least prefer to have in a mobile app?

Aim 2: Develop the mobile app based on *Padres Informados* and the findings from Aim 1 and determine the feasibility of disseminating the app by testing the functionality of the baseline mobile app and the acceptability of integrating a wearable device.

- RQ¹ What changes would parents recommend in the mobile application?
- RQ² After trying a wearable device for two weeks, what aspects of the wearable device do parents find most useful and least useful?
- H¹ Parents will rate the functionality of the baseline mobile application and wearable device as useful.
- H² Parents will report a high intention to use the mobile application and wearable device.

This research will provide a foundation to complete the development of the mobile app for further testing in a pilot trial. Building on the results of this work, I will apply for a career award to further my professional development and pilot a comparative effectiveness trial that examines the mobile app effectiveness, alone or integrated with a face-to-face program, in comparison to a control group. The results of the trial will inform the use of mHealth to disseminate parenting programs to improve adolescent mental health and reduce substance use.

Community Significance

The development of the *Padres Informados* mobile app for Latine parents is a significant contribution because it will benefit Latine immigrant parents and adolescents in the greater Twin Cities area and potentially nationwide by providing access to an evidence-based parenting program. The *Padres Informados* parenting program was developed through community-based participatory research with community partners in the Twin Cities metro. Based on initial findings from an efficacy trial,⁹⁻¹¹ we expect that dissemination of the *Padres Informados* program via mobile app will improve parenting skills, parent mental health, and reduce substance use. We will test the potential for the app to also address family stress, which in turn could enhance the intervention to reduce adolescent internalizing symptoms and substance use.

Latine Families and the Family Stress Model. This proposal builds on the family stress model,¹² highlighting points of intervention to improve effective parenting and healthy child outcomes (see Figure 1; dotted lines represent adaptations). The family stress model draws attention to the disruption of family processes as contextual adversity affects family stress indicators and parenting processes. For Latine immigrant families, contextual adversity may include the process of acculturation and the tension that often arises between parents and children as they navigate between two cultures.¹³ In the adapted model, biological stress reaction to context moderates the effect of family stress and effective parenting. When parents receive feedback about their parenting interactions, they have increased motivation to change.¹⁴ We posit that biofeedback and personalized prompts will work in the same way, motivating parents to be mindful of their stress reactions and mindful of how they parent when they are under stress. Wearable devices are currently available to monitor heart rate, breath, motion, and

temperature, opening new possibilities of interventions to regulate stress.¹⁵ Because parents are foundational in providing emotional support and helping children develop emotional regulation skills that underlie mental health, supporting parents' emotional regulation through the innovation of biofeedback has potential to positively affect youth outcomes. The current study is an important first step in determining the feasibility of Latine parents using a wearable device or receiving biological feedback (e.g., breath data) in the context of a parenting mobile application.

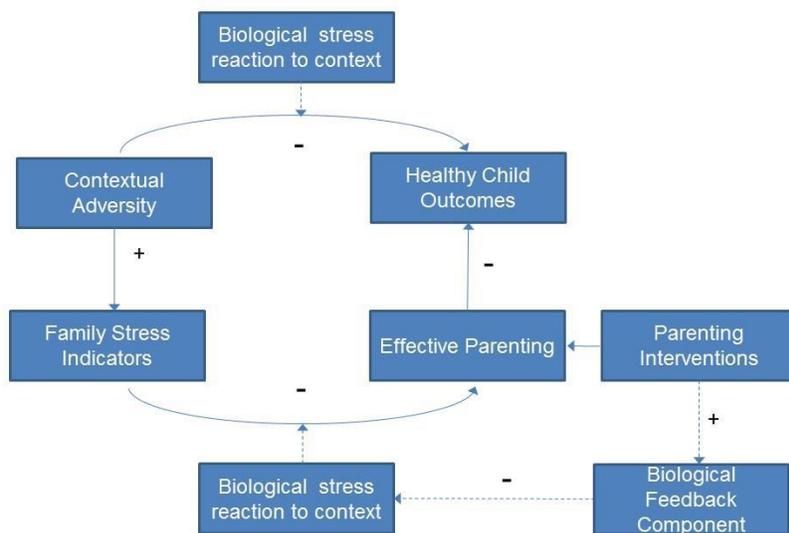


Figure 1. Family Stress Model (Conger et al., 2000) adapted to include biological stress reaction as a moderator and parenting interventions as a mediator.

Community Involvement in Research Design and Execution

Community involvement is inherent in community-based participatory research, and these methods will be used in the design and execution of the proposed research. Core members of the *Padres Informados* collaborative meet monthly to provide input for ongoing research projects. Currently, a prototype of the app is being developed and each of the core members of the collaborative (including community members from our partners at *Aqui Para Ti* and *Centro Tyrone Guzman*) have been invited to participate in stakeholder interviews to share their views

on important functions of the mobile app. A parent advisory group met regularly for a trial of a shortened web version of the *Padres Informados* program which included short videos and weekly phone support.¹⁶ Additionally, we are currently collecting survey data from Latine immigrant parents about their use of technology and preferences in the potential mobile application. For the design of the mobile app, we plan to continue to engage the *Padres Informados* collaborative and the ongoing parent advisory group at *Aqui Para Ti*. As outlined in the research methods below, parent feedback from qualitative user experience interviews will be incorporated iteratively into the design of the mobile app.

Scientific Significance

This contribution is significant because developing a mobile application will expand the evidence base and dissemination of the *Padres Informados* program to improve parenting skills and reduce stress, which will reduce adolescent internalizing symptoms and substance use. The app will provide new possibilities for pediatricians to prescribe the app or clinicians to incorporate it into face-to-face services. This study will also explore the possibility of providing a mindfulness approach to parenting programs through biofeedback, in line with NIH strategic goals to develop methods to leverage available technology and data.¹⁷ Because access to mobile devices is nearly universal, even among low income, racial/ethnic minorities,¹⁸ this application will have the capacity for wide reach among Latine parents. This research will contribute to development and testing of a baseline parenting mobile application to improve final design and will result in an abstract submission and a manuscript. Exploring the feasibility of integrating a wearable into the app is an innovative aspect of this proposal, which reflects a new research area promoted by the 2017 NIH Office of Behavioral Health strategic plan.⁸ The degree to which a stress reduction mobile application with parenting content can provide public health benefit as a stand-alone program compared to a face-to-face program needs further study. Therefore, based on the proposed research, I will apply for an NIH career¹⁹ training grant to pilot a comparative effectiveness trial that examines the effectiveness of the mobile application alone or integrated with a face-to-face program in comparison to a control group.

mHealth as a Prevention Strategy. Web-based parenting programs have been successful, and informational parenting applications have been developed for mobile devices,²⁰ but no mobile application is available to support parents of adolescents and reduce parental stress. The *Technology Acceptance Model* (TAM) guides the proposed research to determine the feasibility of parents using a parenting mobile application.²¹ The TAM posits that perceptions of ease of use (e.g., functionality) and technology usefulness (e.g., practicality) predict intentions to use and actual use. Growth in the use of cell phones is projected with high technology use by parents,¹⁸ and mobile phones have increased reach among Latine families.²² A review of trials incorporating mobile prevention programming found evidence of effectiveness and potential for tailoring preventative programs to individual participants.²³ In particular, Internet and mobile technologies have been identified as a way to meet increased need in real world settings and encourage sustainability and fidelity of prevention programs.

The NIH Office of Behavioral Health has included testing of wearables, which can share data with mobile devices, as a strategic priority.¹⁹ To date, though, few family-based prevention programs have integrated wearable devices. One notable exception was a study in the obesity prevention field which found that a wearable and data collection system was helpful in reinforcing desired youth behaviors and providing education to mothers.²⁴ Although several commercial wearable products have been developed to measure stress, few have been empirically tested. In contrast, Bioharness and Authosense are professional systems with multiple sensors, and evidence suggests the validity of these devices to measure stress.^{25,26} However, these systems may be difficult for participants in a family-based intervention to use.

We propose to use Spire because it is a user-friendly commercially available product that has empirical evidence of effectiveness and sophisticated software for biofeedback that can be integrated into an app. In a randomized controlled trial, participants who wore the Spire product and used the app to track their breathing for one month had reduced stress and anxiety.²⁷ This product is ideal for a feasibility study and will lead to the next logical step of future research—measurement and validity testing of multiple products to determine the best to use in an intervention study. In the meantime, testing the usability of wearable devices with end users is needed to work with developers in creating an app that can be used in prevention programs.

Preliminary Studies. First, in an adaptation designed to increase participation of fathers, a personalized version of PIJP with eight 15-minute sessions of videos on a website and weekly 15-minute personal phone calls was presented to participants recruited from a primary care setting. In the feasibility evaluation (N = 36), participants had high satisfaction in the video/phone call version and a higher proportion of fathers participated in this adapted version of the program compared to the group version, suggesting that online programming may be an important way of reaching fathers in Latine immigrant families.¹⁶ Second, in our current data collection regarding Latine parents' technology use and preferences regarding a components of an app (n = 63 of ongoing recruitment; 71% female, M age 41), parents have demonstrated engagement with technology and support for a parenting mobile app. Access to mobile technology was high: 98% reported that they have access to a mobile phone, 51% had access to a tablet, and 81% had a data plan. Also, 70% reported that they use the internet several times a day. Parents estimated that if a mobile app were available, within a month, 81% would use the parenting component and 79% would use the stress reduction component.

Mission Significance

Although evidence-based parenting programs improve the mental health and substance use of adolescents, the reach of these programs is limited. This project fills a critical gap by testing an innovative delivery of a parent program via mobile application, which may overcome barriers of cost, travel, and time. The mobile application has potential to include interactive components associated with high interest among users (e.g., videos that demonstrate key skills or personalized reminders).²⁸ Mobile delivery of parenting programs could provide one of multiple delivery options for parents and allow personalized components that may increase parental engagement. The use of smart phones will enable the development of biofeedback technology to allow parents to monitor their own stress levels. As parents receive feedback on the mobile device from wearable technology indicating high stress levels, they will receive a cue to relax and be mindful of their parenting practices. Because stress has been implicated as a key disruptor of effective parenting practices,² this innovation will contribute to the use of technology to encourage improvement in parenting behaviors.²⁹

My research on parenting and technology establishes the feasibility of conducting this research to improve adolescent mental health and well-being. In my research on the long-term impact of parent-child relationships on mental health, I conducted latent class trajectory analyses and found that at-risk trajectories (low levels of parent-child closeness in adolescence or young adulthood) were related to increased depressed mood and decreased self-esteem in adulthood, controlling for adolescent depressed mood, self-esteem, and negative life events. I have also examined the protective association of parents on peer harassment. My research on parents use of technology has focused on using technology as a tool for parent education.

Evidence-Based Program

Padres Informados. Parenting programs with Latine families improve effective parenting and thereby impact healthy adolescent outcomes. In the current proposal, the parenting content of mobile application is from *Padres Informados*, an evidence-informed parenting program

developed via community-based participatory research. The full program, *Padres Informados/Jovenes Preparados* (PIJP), has 8 sessions for parents conducted in Spanish and 4 sessions for youth of Latine immigrants. The proposed mobile app focuses on the parenting components, which directly address both parent skills and cultural transitions.³⁰ The curriculum encourages a mindful approach to parenting, covering topics such as parenting styles, navigating between two cultures, parent-adolescent communication, discipline, conflict resolution, and connectedness. In a randomized controlled trial, *PIJP* reduced smoking among families low in traditional Latine values at baseline.¹⁰ Compared to the control group, those who participated in *PIJP* also had improved parenting practices and parent-adolescent relationships, key components of improving healthy youth outcomes. A preliminary analysis also showed that the intervention was related to reduced parental psychological distress and increased parenting efficacy among younger parents. The stress awareness component in the mobile version of the program will allow parents to receive personalized cues in their natural environment and encourage parents to engage in mindful parenting practices when they feel stressed.

Project Design and Methods

Aim 1. The goal of Aim 1 is to conduct qualitative interviews to inform the feasibility and acceptability of a mobile application with *Padres Informados* content among immigrant Latine parents and the possibility of integrating biofeedback into the design via a wearable device. In a mixed methods design, participants will be randomly selected from parents who recently participated in a survey and agreed to be contacted about interviews (initially recruited through our partner clinic, *Aqui Para Ti*; *APT*, and social services partner, *Centro Tyrone Guzman*). As in the original *PIJP* study, parents were eligible for the study if they were born in South America, Central America or Mexico; speak Spanish; and live with a child between the ages of 12-18. One hour interviews will be conducted in Spanish by the *APT* outreach specialist and the PI with 20-25 parents of adolescents—considered manageable in size yet large enough to identify themes.³¹ Interviews will end when saturation is reached. Using an interview guide and follow-up probe questions, interviews will be conducted at the community partners' clinic/agency. Example questions include: "What websites or apps do you use that help you in parenting? What strategies do you use to deal with parenting stress?" Based on prototype sketches, parents will rank their favorite and least favorite features of the app using a best-worst scaling, a consumer marketing method.³² Qualitative data will be translated and transcribed using a professional transcription service. *Initial coding* will be conducted in NVivo, version 11. A thematic analysis using a quasi-deductive approach will be conducted by two independent researchers who will meet regularly to ensure inter-rater reliability. Inter-rater reliability will be determined by Cohen's kappa generated in NVivo; differences will be resolved by consensus. Using *pattern coding*, themes will be identified and categorized into larger groups. A frequency analysis using bootstrapping will be used to assess best-worst rankings.³²

Aim 2. The purpose of Aim 2 is to develop a baseline mobile application and solicit feedback on the functionality and usefulness of the app and the wearable. The results of Aim 1 qualitative work will be used to inform development of the baseline app. The home page will direct parents to one of three locations (see figure 2): *Padres Informados* content, stress reduction content, and personal goals. Parenting content will be presented in 8 modules including a short didactic lesson, videos, and interactive quizzes. *APT* developed videos based on *PIJP* to be used by families in their clinic (see <https://padresinformados.wordpress.com/>). Videos were made for Latine backgrounds including actors from Mexico, Colombia, Ecuador, and Argentina. The stress reduction content will include three modules with short didactic scripts about general stress, parenting stress, and cultural stress, relaxation exercises. Finally, a goal setting section of the app will enable parents to set parenting and stress reduction goals. Parents will have the

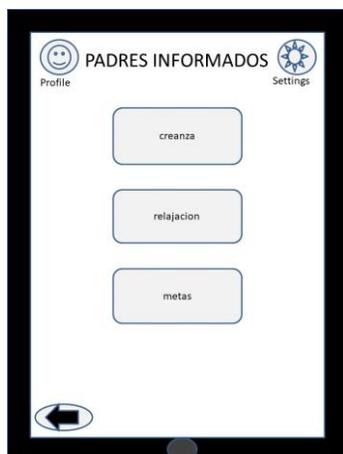


Figure 2. Home page mock up.

option to track goals daily and receive personalized cues reminding them to keep their goals. Additionally, for two weeks parents will try out the Spire wearable, which measures breathing rates, and see examples of the biological feedback available on the Spire app. Feasibility interviews will be conducted with 20-25 participants—originally recruited for Aim 1—to solicit feedback on the functionality and usefulness of the app while interacting with the prototype. Questions on the functionality and usefulness will assess the construct of technology acceptance,³³ a predictor of technology use. Participants will be recorded as they click through the interactive prototype and “think aloud” about their experience. The interviewer, an ATP outreach specialist, will ask in Spanish about the ease of use, functionality, and intention to use the application and the wearable; invite participants to perform tasks (e.g., If you wanted to get ideas on dealing with cultural stress, what would you click?);

and note barriers to using the app and the wearable. Interactions with the prototype will be recorded using Silverback software and transcribed using a professional transcription service. The audio transcript and video recording will be analyzed by a user experience professional and an information systems student via principles of user-friendly design.

Community Partnership and Key Personnel

Padres Informados, an evidence-informed program which directly addresses both parent skills and acculturation, was developed through a seven-year community-based participatory research collaboration. Community partners continue to meet monthly to discuss dissemination. Partners include a health clinic (*Aqui Para Ti, APT*) and a health education partner (*Centro Tyrone Guzman, CTG*) that participated in the development of the *Padres Informados* program. These organizations have been active research partners in the development and testing of the *Padres Informados* program. *APT*, lead by Dr. Veronica Svetaz, has become a behavioral health home, integrating primary care and mental health services. Five staff members coordinate care and provide patient education. Javi Monardez, a staff member from ATP who is well connected in the community and has extensive experience conducting research, will be the outreach specialist on this project. *Centro Tyrone Guzman*, lead by Roxana Linares, has 25 staff members including three health and wellness staff and two youth assistants. CTG will provide space for interviews and some office support coordinating the study.

The PI, Dr. Jennifer Doty, is a postdoctoral fellow at the University of Minnesota in the Department of Pediatrics, Division of General Pediatrics and Adolescent Health. She has access to the expertise of an interdisciplinary group of mentoring faculty and resources of the *Healthy Youth Development*Prevention Resource Center* housed in the division. She has been participating in the *Padres Informados* collaborative for 1 year and 9 months. Dr. Iris Borowsky, the primary mentor, is a practicing clinician and head of the division. She has experience in parenting-based prevention program delivery. Additional members of the interdisciplinary mentoring team include Dr. Michele Allen, the PI of the *Padres Informados* program and Dr. Lana Yarosh, an expert in app development.

Future Research and Next Steps

This research will contribute to development and testing of a parenting mobile application prototype and will result in an SPR abstract submission and at least two manuscripts (to be submitted 3/18 and 8/18). In addition, the PI will gain expertise in community-based research and mHealth. Based on this work, she will apply for a K99 or a K01 career award to develop the full app and pilot a comparative effectiveness trial that examines the effectiveness of the mobile application alone or integrated with a face-to-face program in comparison to a control group.