Opportunities For Wearables to Support Mental Well-being in Low-Income Latine Communities

Stefany Cruz
stefanycruz2024@u.northwestern.edu
Northwestern University
Evanston, USA

Josiah Hester
josiah@gatech.edu
Georgia Institute of Technology
Atlanta, USA

Stephen Xia
stephen.xia@northwestern.edu
Northwestern University
Evanston, USA

Maia Jacobs
maia.jacobs@northwestern.edu
Northwestern University
Evanston, USA

ABSTRACT

Advances in wearable devices and digital health tools have transformed the way mental well-being is managed. However, these tools have primarily been designed with, and therefore serve, only small groups from high socio-economic backgrounds, leaving out the needs of minoritized low-socioeconomic (SES) groups. As members of these communities face unique socio-economic challenges, there is a growing recognition of the potential of technology to bridge gaps in accessing mental health support. In a series of semi-structured interviews with 19 individuals from low-income Latine communities, we found that participants are interested in using mHealth wearables and digital health tools to support their mental well-being. Using qualitative analysis of participants' lived experiences and technology preferences we make recommendations on how to develop wearable mental health technology interventions for underrepresented communities.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in ubiquitous and mobile computing**; *Ubiquitous and mobile computing systems and tools.*

KEYWORDS

mHealth, wearables, digital tools, digital divide, low-socioeconomic status

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1 INTRODUCTION

As of 2021, it is estimated that one in five adults in the United States struggle with mental illness [10]. Individuals from low-Socioeconomic (SES) backgrounds are reported to have higher rates of mental illness and are less likely to seek care due to health disparities [7]. Given the increasing prevalence of mental health disorders, there is an increasing need for digital support tools to offer care to populations where immediate mental health care is unavailable. In this work, we report our findings from a study aimed at understanding the perspectives and barriers to the adoption of wearable technologies amongst low-income communities in the U.S. Though our research questions were purposefully broad, our analysis revealed a common interest among members of low-income Latine communities in adopting wearable technology to enhance their mental well-being. We explore how wanting to passively monitor mental well-being and the need for greater contextual awareness of their lived experiences hinder the full utilization of existing wearables. Additionally Based on these findings, we provide suggestions for how wearables designed to support mental well-being can be developed more inclusively to democratize their usage.

2 METHODS

2.1 Study Design

We performed a qualitative study to understand low-income community members' interest in using wearable devices for daily usage. This work was part of a larger project investigating low-SES community members' perspectives of wearable devices and the barriers and facilitators toward adoption [4, 5]. We performed 19 semi-structured interviews with members of low-SES Latine communities from 2 metropolitan cities in the United States. The study involved two rounds of interviews, each conducted separately. More details about the interview topics and procedure are described below. From these interviews we found that participants showed interest in using wearables for mental health support. This research study was conducted from December 2021 to March 2022. Due to the COVID-19 Pandemic, all interviews were conducted in English over a Zoom video call.

2.2 Recruitment

The research team was interested in collaborating with low-SES community members in the United States. To facilitate participant recruitment, the team disseminated informational flyers on its social media platforms, including Facebook and Instagram. These flyers contained details about the study and a link to a Qualtrics screening survey. Interested participants completed a screening

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ID:	Gender	Age Range	Education Level	Income Range	Household Number	Owns Wearable
P1	Female	18-29	Bachelors	less than 26K	3+	No
P2	Male	18 - 29	Two year/Some College	less than 26K	1	No
P3	Female	18 - 29	Two year/Some College	26 - 50K	2	Apple Watch
P4	Male	18-29	Bachelors	26 - 50K	2	Apple Watch
P5	Female	30 - 44	High School	26 - 50K	2	Samsung Galaxy
P6	Female	30 - 44	Bachelors	less than 26K	1	No
P7	Male	18 - 29	Bachelors	26 - 50K	1	No
P8	Male	18 - 29	Bachelors	26 - 50K	1	No
P9	Female	30 - 44	Two year/Some College	26 - 50K	2	No
P10	Female	18 - 29	High School	less than 26K	1	No
P11	Female	18 - 29	Bachelors	26 - 50K	3+	Apple Watch
P12	Female	18 - 29	Two year/Some College	less than 26K	1	Apple Watch
P13	Female	18 - 29	Two year/Some College	less than 26K	2	No
P14	Female	18 - 29	Bachelors	less than 26K	1	No
P15	Male	30 - 44	Two year/Some College	50 - 75K	2	No
P16	Female	30 - 44	Two year/Some College	50 - 75K	3+	No
P17	Female	45 - 54	Two year/Some College	50 - 75K	2	Fitbit (in the past)
P18	Female	30 - 44	Bachelors	26 - 50K	3+	Apple Watch
P19	Female	18 - 29	High School	26 - 50K	1	Fitbit (in the past)

Table 1: Participant demographics (All participants identified as Hispanic/Latine)

survey that asked for basic demographic information such as race, education level, household income, and the number of people in the household). Participants were eligible to participate if they identified as: (1) adults over the age of 18, (2) BIPOC (Black, Indigenous, People of Color), and (3) of low-income. Criteria 3 was met if an individual's income level fell at or below the low-income threshold according to their county's Department of Housing and Community Development[1]. After an eligible participant signed a digital consent form, an online semi-structured interview session was scheduled. We emphasize that all participants resided in two US metropolitan cities; however, the specific city or location of residence was not a determining factor in the eligibility criteria.

We recruited a total of 19 adults from low-SES communities in two metropolitan cities in the United States (see Table 1 for participant demographics). In the first round of interviews, participants (P1-P8) were recruited from December 2021 to January 2022. Participants (P9-P19) from the second round were recruited from mid to late March 2022.

2.3 Data Collection

Interview sessions were conducted by the lead author. All interviews were 45 to 60 minutes in length and were conducted over a Zoom video call. In these interview sessions, we sought to learn about participants' perspectives regarding wearable technology and how they feel these tools can help support them in their everyday lives.

In the first round, 8 participants were interviewed to understand the perspectives of individuals from socioeconomically disadvantaged communities regarding wearable technology in a broader context. This phase aimed to gain insights into the needs and expectations of community members concerning wearable technology in their everyday lives.

The first round of interviews uncovered strong interest in using wearables for safety and health. Hence, a second round of interviews were conducted with 11 more participants to gain a deeper understanding of participants interests in using wearables to help increase their safety [5] and manage their health [4]. Interviews were concluded upon reaching saturation. All interview sessions were audio recorded, and participants received a US $40 gift card at the end of the interview.

[1]In the United States, the Department of Housing and Community development uses State Income Limits provided by the US Department of Housing and Urban Development https://www.huduser.gov/portal/datasets/il.html

2.4 Data Analysis

Audio recordings of the interviews were transcribed manually by the lead author, resulting in 21 hours of interviews. The data set included the transcripts from both rounds of interviews. We began data analysis by open coding the transcripts. We analyzed the data using a grounded theory approach, following the methods defined by Charmaz and Belgrave [2]. After open coding, the research team reviewed the transcripts and collaboratively discussed associated codes to look for consistencies and differences in the data. Through a collaborative process involving group discussions, an iterative refinement of themes was conducted. In the analysis of emerging themes, one common theme we found was the unmet potential for wearables to provide mental health support to participants and members of their community.

3 RESULTS

Despite no interview questions directly addressing mental health needs, 8/19 participants shared the belief that wearable tools could offer valuable mental health support to them and others in their community. However, there are several ways in which current tools do not support their needs. Below we share both the ways in which participants want to use these tools in the future, and gaps in current digital support.

3.1 General Interests in Wearables for Mental Health in Latine Communities

Participants mentioned that they would like to use wearables and other digital health tools to support their mental wellbeing passively, where a user does not have to initiate an action. We identified desired features they believe would be beneficial. Participant 9 recounted an incident where a call from their insurance company triggered by their phone made them feel secure.

> *P9: I liked that and it felt helpful that someone is gonna be there. That's something I would kind of want in a wearable device. Just to have somebody check up on you when experiencing something high impact makes me feel more sane.*

What made this event significant for P9 was that the phone passively sensed that something was wrong, triggering an action that made the participant feel cared for and supported. Additionally, in other examples, we found that participants expressed a desire for wearables to passively aid in addressing mental health challenges like anxiety, as evidenced by the following statements from P10 and P11.

> *P10: "I think wearables and health apps can help to reduce anxiety"*
>
> *P11: I had an anxiety attack a month ago and [my smartwatch] vibrated and said are you OK? Do you need help? Maybe you should breathe. I felt it cared more about me than my own friends..*

Participants felt that the absence of passive sensing capabilities in wearables hindered their ability to manage incoming stressful or anxiety-inducing events, as expressed by P5:

> *P5: When I am feeling stressed I press a button that checks if I am stressed and if I am [my wearable] tells me to breathe. I just wish it could detect it automatically instead of me manually doing it. It be nice too if it had an alarm that detects a symptom like an anxiety or ptsd attack before it hits you.*

These findings highlight the role of passive sensing in wearables in supporting participants' mental well-being while revealing the challenges associated with its absence. Our results suggest that these devices can provide enhanced functionality for participants' needs, including automated detection of mental health conditions and providing a sense of comfort.

3.2 Lack of Contextual Awareness and Considerations: Community Safety and Work Schedules

Though participants expressed interest in using wearable health tools to support their mental wellbeing, participants mentioned barriers to taking advantage of wearable features such as community safety. For instance, participants were aware that going outside and performing physical activities is beneficial for their mental wellbeing. However, due to their contextual circumstances, going outside and performing physical activities are not always safe options for them.

> *P13: They always say if you are depressed or have anxiety or any kind of mental disorder, they always tell you go outside or exercise, and you couldn't do that.*

Though participants acknowledge the benefits of outdoor activities, the safety of venturing into their neighborhoods is often compromised due to systemic challenges such as police violence or gang-related activities.

> *P14: Sometimes I am scared to just even go outside for fear of getting pulled over and having to deal with a power-hungry cop that goes rogue, and they might do something to me. So that's kinda stressful.*

> *P10: Even though you might not have any affiliations with gangs or anything that might put you in harm, there has been so many cases where people are sitting in front of their house and then a drive by happens and then someone gets injured...It's like you can't do anything that's normal. You can't hang out with your friends and go to a park.*

While wearables monitoring physical activity can aid in mitigating stressors, **it is imperative to develop interventions that account for the contextual and cultural nuances of low-SES communities confronting systemic issues like police and gang violence.**

In addition to exploring current wearable usage among participants, we also identified desired features that they believe would be beneficial for both them and their community members. A recurring theme amongst participants is the desire for technology to offer comfort and support for their well-being. However, some participants also noted the limitations in current wearable devices, which prevent them from fully utilizing support tools and sensors. Specifically, users expressed the inability to personalize reminders and notifications according to their daily routines. P5 said the following:

> *P5: I work night shifts and [my wearable] tells me to go to sleep but I can't because I am at work. I want to measure my sleeping patterns but it can't because I sleep in the day. It tells me to move around during the day, but I am sleeping. There should be something on the settings that lets you flip when you get notifications and reminders according to people's schedules that could help night shift workers, which a lot of people in the community are.*

The inability to allow users' to customize their settings according to their routines provides a tangible example of how digital and wearable tools have not yet been developed with a basic level of personalization needed to make them useful within low-SES communities. Unfortunately, the current limitations of wearable devices hinder users from accurately tracking their sleep and physical activity if their daily routines deviate from the norm. This lack of personalization impacts not only members of low-SES communities but also a broader population, particularly night shift workers, thereby increasing barriers to use.

4 DISCUSSION AND LIMITATIONS

To the best of our knowledge, although our research inquiries were not explicitly directed towards elucidating the role of wearables in supporting the mental well-being of low-income Latine communities, we are the first in collecting data concerning the receptivity towards such tools, and in comprehending how the lived experiences of these individuals influence the likelihood for adoption.

4.1 Barriers for mental healthcare in low-SES Communities

Prior research has shown that living in low-income households is associated with increased risk of mental health conditions [7]. Factors such as systemic barriers, misallocation of accessible healthcare resources, and limited access to digital healthcare technology further hinder this population's ability to seek care [4, 12]. Digital mental health tools can play a critical role in helping individuals who can't seek mental health care to access evidence-based treatments. In contrast to prior research indicating lower utilization rates of wearable devices among children from racial and ethnic minority backgrounds in low-SES households [8] and digital support tools for mental health purposes amongst adults from Latine communities [11], our study reveals receptiveness towards the adoption of such technologies.

We have identified one main motivator and one main barrier for participants wanting to use wearables as supportive tools for mental well-being. The main motivator is the desire to monitor mental well-being passively, while the primary barrier is a lack of context awareness, including factors such as neighborhood safety and daily routines. For instance, participants mentioned they are unable to engage in physical activity due to safety concerns in their neighborhoods, and individuals who are night shift workers cannot

fully utilize the features in current wearables to track their sleep and physical activity data due to the lack of algorithmic personalization. Understanding the necessary contextual factors of these communities' lived experiences and how current wearable technologies affect or do not align with these experiences is essential if these devices are to be made more inclusive. In the next section we discuss recommendations of sensor technologies through technical approaches.

4.2 Opportunities in mHealth tools Informed by the Lived Experiences of Marginalized Groups

Although current body sensor networks used for managing mental well-being can help indicate mental state through a collection of multimodal or passive sensing parameters over a period of time, there is a disconnect linking captured data with an individual's context. Technologies, such as wearables, can detect indicators of mental health, such as habits, emotion, physical activity, etc., which are typically observed and assessed by mental health professionals during client interactions [9]. However, little work exists on creating "autonomous" systems that can both be personalized to individuals and scale to large populations. While wearables are currently adept at understanding the user's physical state, they have difficulty sensing and incorporating information about environmental or societal factors (e.g., dangerous neighborhoods or stresses from the user's career). Understanding a user's lived experience can give a wearable richer contextual data, enabling it to offer tailored behavioral suggestions that align with an individual's daily schedule and lifestyle demands.

For instance, our findings indicate that amongst participants, a sense of insecurity in their neighborhood can lead to reduced physical activity, even though they are aware that outdoor walks could potentially benefit mental well-being. If a wearable device could discern an individual's environmental challenges based on sensed behavioral or physiological data, such as location data, phone usage, or heart rate signals, it could offer tailored behavioral recommendations accordingly that would suggest alternatives to taking a walk outside. However, gathering and incorporating contextual data from individuals is challenging for several reasons.

First, gathering and sensing environmental and contextual information poses privacy concerns because it requires access to more of the user's personal data and more invasive sensing modalities such as video and audio. The extent of data sharing with clinicians, wearables, and mobile devices should be in the control of the user. Providing users with customizable settings to control the amount of data shared would be essential, allowing wearables to generate different tiers of recommendations based on the provided data.

Second, incorporating contextual information and personalizing to users in marginalized communities is difficult due to algorithmic biases and a lack of data from these populations. For example, mental health models have been shown to generalize poorly because of these reasons [1]. Possible solutions to overcoming these issues are diversifying recruitment population in user studies and understanding the lived experiences of users through co-designing methods [4, 5]. However, Calster et al. suggest, populations can change over time, hence it may be more beneficial to train and validate detection models within specific targeted populations and reassess performance over time [13]. Additionally, more research into how we can incorporate models that continually learn and adapt based on use over time is crucial to creating solutions that automatically personalize to individuals and scale to large populations. We leave an open question to the research community: How can we enhance the collection and processing of contextual data by wearables?

Lastly, we highlight the lack of personalization in managing sleep and activity data for participants who are night shift workers. Studies show that night shift workers tend to be minority individuals from low-SES communities and are more likely to experience health problems such as poor sleep, diabetes, and obesity than traditional scheduled workers [6]. Though many users have raised the issue on the lack of personalization for user's daily routines of night shift workers, current wearables on the market have not addressed this issue in their products. Further, we only found one study that investigates the bias in daytime sleeping using commercial wearables [3], pointing to a glaring lack of research in this space. We draw attention to this disparity within the research community, urging further exploration in this area. Potential solutions to mitigate this issue for existing wearable devices may involve refining or adjusting the features within their algorithms utilized for capturing sleep data.

5 CONCLUSION

We recommend that the research community prioritize understanding the contexts and lived experiences of diverse populations and explore how existing and emerging sensing modalities can democratize the use of wearable technology for mental well-being.

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