UNIVERSITY OF CALIFORNIA,
IRVINE

Design and Evaluation of Culturally Responsive Digital Mental Health Technology for
Racial-Ethnic Minorities

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Informatics

by

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DEDICATION

To

My ancestors who paved the way for me to have the opportunities I have today.

My parents for their unwavering support.

All the quirky Black girls from inner cities.

Those who were counted out.

My two brothers who walked so I could run.

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ACKNOWLEDGEMENTS

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[C.6] Lucretia Williams, Arpita Bhattacharya, Melissa Pinto, Candace Burton, Jon McIntyre, Lobsang Negi, Timothy Harrison, Gillian Hayes. "Designing an Evidence-based Mental Health Intervention Alongside University Students." HCI International July 2023

[C.5] Lucretia Williams, Leah Clements, Candace Williams, Michael Allotey, Gloria Washington, Rebecca Black, Gillian Hayes. "Improving On-Campus Digital mental Health Support for Underrepresented University Students." International Conference on Applied Human Factors and Ergonomics, 95-100, 2021.

[C.4] Lucretia Williams, Leah Clements, Candace Williams, Michael Allotey, Gloria Washington, Rebecca Black, Gillian Hayes. "Analysis of Distance-Based Mental Health Support for Underrepresented University Students." In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems, pp. 1-6. 2021

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ABSTRACT OF THE DISSERTATION

Design and Evaluation of Culturally Responsive Digital Mental Health Technology for
Racial-Ethnic Minorities
by
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Doctor of Philosophy in Informatics
University of California, Irvine, 2023
Dr. Gillian R. Hayes, Chair

Mental health disparities for racial-ethnic minorities are a significant concern due to barriers to access, cost, and adequate mental health care. Digital mental health technology holds promise for alleviating these barriers; however, these solutions often lack the cultural responsiveness that is necessary to meet the specific needs of these communities. This dissertation examines the presence of cultural responsiveness in digital mental health solutions for three different racial-ethnic minority groups. Through four research studies, I explore the ways in which social determinants of health impact how racial-ethnic minorities engage and seek digital mental health support, provide evidence of how community-based research is beneficial for ideating and designing for cultural responsiveness, and emphasize the ways researchers can design accessible, scalable, and inclusive digital mental health solutions. To highlight the various levels of influence contributing to mental health disparities and how they impact the design of digital mental health technology, I analyze each study using the National Institute on Minority Health and Health Disparities research framework and discuss how to use this framework to implement culturally responsive design for mental health technologies. Drawing from these findings, I discuss the overarching themes: 1) health-seeking behaviors of racial-ethnic minorities; 2) means of mental healthcare access through technology; 3) research to

implementation practices, and 4) implications for design to argue why culturally responsive design is necessary for mental health technologies. Overall, these studies show that designing culturally responsive mental health solutions should be implemented to help reduce mental health disparities for racial-ethnic minority populations and the possible ways it can be accomplished. The findings highlight the importance of designing solutions that consider the unique needs and challenges of diverse communities to ensure increased access and appropriate support.

CHAPTER 1. INTRODUCTION

1.1 Motivation

Mental health disparities for Racial-Ethnic Minorities (REM)[1] remain a significant concern due to barriers to access, cost, and adequate mental health care (Cook et al., 2017; Williams et al., 1997). The scarcity of comprehensive information on mental healthcare services and providers and how to access them is still a significant challenge overall (Olfson, 2016). However, REMs tend to have smaller social networks (Cornwall et al., 2009), which can impact the circulation of accurate healthcare information and services (Choi et al., 2019). Researchers have also identified individual and institutional factors that may hinder access to appropriate treatment. For instance, self-stigmatization and difficulties in recognizing symptoms of mental health disorders may prevent individuals from seeking help. Additionally, prolonged wait times (Edbrooke-Childs and Deighton, 2020) and the overwhelming demand for mental healthcare services pose a significant challenge once individuals establish a connection with a suitable service.

The cost of mental health services becomes a challenge for individuals with low income (Walker et al., 2015) or living in rural areas with little to no access to in-person treatment (Graham, Weissman, and Mohr, 2021). Mental health disorders can also result in higher health costs, such as hospitalization, medication, and treatment (Knapp and Wong, 2020). The economic burden of mental healthcare extends beyond the individual to their families and communities (Kazdin and Rabbitt, 2013) when there is

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[1] Racial-Ethnic Minority: refers to a group of people who are identified as belonging to a specific race or ethnicity that has less societal power compared to the dominant racial or ethnic group in a particular region or society.

treatment-related expenses. The cumulative costs of therapy sessions, medications, and other essential treatments can accrue rapidly, resulting in a financial burden for those with low income status. Consequently, individuals in such circumstances may be compelled to seek assistance from their support system as a means of alleviating the financial strain.

The lack of culturally competent therapists deters REMs with intersecting identities from seeking services (Al'Uqdah, Hamit, and Scott, 2019; Flynn et al., 2020; Kivlighan III et al., 2019; Litam, 2020; Williams et al., 2021). For instance, the COVID-19 pandemic has led to an increase in reports of verbal and physical assaults against members of the Asian community (Litam, 2020). The traumatic effects of these incidents may manifest in various psychological conditions, such as anxiety and post-traumatic stress disorder (Allwood et al., 2022). To address the unique needs of REMs, mental health practitioners must adopt culturally responsive approaches that account for the individual's cultural background, values, and beliefs. Additionally, mental health practitioners must remain cognizant of intersectionality, which may result in poor mental health outcomes for REMs. For instance, Black, Disabled, and Transgender people's intersectional identities are underrepresented in image descriptions for assistive technologies (Bennett et al., 2021). This underrepresentation may lead to misrepresentation in technology and adversely affect the self-worth of individuals within this community.

Experts have used several technical solutions to address the barriers to access and inclusion of mental health services (Philippe et al., 2022). Teletherapy software and mobile applications have rapidly increased to provide mental health services at an

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affordable cost intended to reach communities that have limited access to adequate

mental health care (Whaibeh, Mahmoud, and Naal, 2020), but their use has not

necessarily grown at the same rate as their development (Zhong et al., 2023). Some

examples of digital mental health solutions include popular mobile applications such as

Calm[2], Headspace[3], and BetterHelp[4] and video conferencing software with Health

Insurance Portability and Accountability Act (HIPAA) compliance such as Zoom (Zoom

for Healthcare, 2021) and Google Meet (*Secure and Scalable Telehealth Using Google

Meet*, 2020). Health researchers are designing mobile applications for evidence-based

mental health interventions (Bakker et al., 2016) to ensure that individuals who are

seeking help are receiving evidence-based treatment. The increase in the production of

mental health applications has garnered the attention of software developers,

irrespective of their affiliations with health organizations or their expertise in mental

health (Clay, 2021; Hwang et al., 2021). While this trend appears to provide a myriad of

opportunities for addressing mental health challenges, concerns have emerged about

the efficacy and safety of these applications developed by non-experts. The digital

mental health space has become an interdisciplinary field of health researchers,

Human-computer Interaction (HCI) researchers, designers, and tech developers all

working to create these solutions, sometimes together but often in different silos. In this

dissertation, you will be able to see how my collaboration with those three fields

contributes to designing evidence-based mental health interventions for REMs.

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[2] https://www.calm.com/
[3] https://www.headspace.com/
[4] https://www.betterhelp.com/

1.2 Gaps in Digital Mental Health Technology for Racial-Ethnic Minorities

The inequities that contribute to REM's limited access to mental health services, such as lack of representation, language and cultural barriers, and trust and privacy concerns (Cummings et al., 2017), are being reinforced by technology companies in the development of digital mental health solutions. The underrepresentation of REMs in research leads to a lack of understanding of the unique needs, preferences, and barriers of these populations (Yancey, Ortega, and Kumanyika et al., 2006). This results in a lack of culturally responsive and inclusive digital mental health resources and services. For instance, many digital mental health technologies are not multilingually supported (Ayobi et al., 2022; Muñeton-Castaño, Hull, and Graham, 2022), making it difficult for those who do not speak the dominant language to access and use these services. In addition, REMs that have experienced discrimination and mistrust in healthcare institutions (Bazargan, Cobb, and Assari, 2021; López-Cevallos, Harvey, and Warren, 2014; Scharff et al., 2010) worry about data privacy (Renn et al., 2019) and potential exploitation (Bucci, Schwannauer, and Berry, 2019), which may contribute to their reluctance to use digital mental health services.

Most mental health applications developed by software developers lacking affiliations with health organizations or specialized knowledge in mental health tend to be overly generic (Clay, 2021). These apps may not garner the level of interest and utility required to address the mental health concerns of such populations, who may require more personalized and culturally sensitive mental health support (Williams et al., 2021). Additionally, the marketing strategies of mental health applications that involve

overselling the potential benefits of the product have raised ethical concerns (Wykes, Lipshitz, and Schueller, 2019). This can often create unrealistic expectations, resulting in worsening the mental health of individuals who've participated in usage.

The monetization of mental health applications through paywalls or subscription fees can limit individuals from using the applications to their fullest potential (Hudson et al., 2022). The ethical implications of overselling mental health applications highlight the need for more transparent and equitable approaches in the development and deployment of these digital mental health solutions. Marginalized groups' difficulty with seeking and engaging in-person mental health services and resources has been transferred and embedded into remote and online self-help mental health services and resources. There is not enough evidence to show effectiveness of evidence-based digital mental health interventions across diverse populations.

1.3 Cultural Responsiveness

Cultural responsiveness refers to the awareness of diverse identities and responding to the combination of cultural variables and the diverse experiences of an individual (Jones-Smith, 2018; Vivo, 2023; Hopf et al., 2021). Whereas Cultural Competency tends to take on a one-sized approach, being defined as the integration and transformation of knowledge about individuals and groups of people into specific standards, policies, practices, and attitudes used by organizations and health practitioners to increase the quality of services, thereby producing better outcomes (Kirmayer, 2012).

Additionally, the term Diversity, Equity, and Inclusion (DEI) refers to ensuring the fairness of all individuals regardless of the range of differences such as age, gender,

race, ethnicity, etc., to create an environment where all feel a sense of belonging (JHM Office of Diversity, 2023). The terms DEI and Cultural Responsiveness both conceptually aim to create inclusive environments but have distinct differences in meaning. While DEI generally focuses on the promotion of inclusion and valuing diverse individuals, cultural responsiveness aims to understand and respond to the needs of diverse communities and cultural backgrounds. Cultural responsiveness does not hold the same meaning as cultural competency and DEI based on the definitions explained above, despite the common interchangeable use of these terms. I use the term cultural responsiveness throughout this dissertation to demonstrate the importance of HCI researchers needing to not only promote the need for inclusive digital environments but also understand in its entirety the diverse needs and perspectives of diverse people to design digital mental health interventions.

Designing cultural responsiveness into technology-enabled mental health solutions is a complex challenge that requires forethought and considerable work to understand the intersectional factors that influence mental health access and utilization among different marginalized communities. If not carefully designed, digital mental health solutions can unintentionally perpetuate bias and harm (Timmons et al., 2022; Naslund and Deng, 2021); therefore, design researchers must be vigilant in identifying appropriate technology, algorithms, and methods for REM populations. Culturally responsive digital mental health requires a deeper understanding of socio-cultural contexts that influence mental health challenges and disparities.

Researchers mention that designing culturally tailored digital mental health solutions should include diverse visual representations, content in multiple languages,

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and be accessible on all devices (Ramos et al., 2021). This work adds another layer of responsibility for researchers and designers to design their digital mental health solutions with cultural responsiveness in mind. Like other movements for inclusion in HCI research, designing technologies with multiple layers of inclusion in mind can lead to more equitable and empowering technologies for all people. For example, accessibility design researchers create inclusive technology by carefully understanding the needs and experiences of the disabled community (Bergman and Johnson, 2001; Das, Piper, and Gergle, 2022) and co-creating (Colin Gibson, Dunlop, and Bouamrane, 2020; Winters, Harden, and Moore, 2020). The results of this work have led to policy changes and industry design standards (Lazar et al., 2016), such as the Web Content Accessibility Guidelines (WCAG) (Caldwell et al., 2008). Digital mental health researchers can use accessibility research as a guide to design for cultural responsiveness.

1.4 Minority Health and Health Disparities Research Framework

Understanding and addressing minority health disparities can be complex due to the multitude of factors involved that contribute to these disparities. However, it is necessary to delve into these complexities to foster the advancement of fair and inclusive health solutions (Cooper et al., 2015). To comprehend the extensive array of determinants that influence health outcomes, the National Institute on Minority Health and Health Disparities (NIMHD) has developed a framework that emphasizes a wide range of factors vital for comprehending minority health and disparities, enabling the assessment of gaps, and identifying opportunities for improvement (National Institute on Minority Health and Health Disparities, 2017). This framework highlights the different

levels of influences that shape an individual's health based on key domains of influence

(Biological, Behavioral, Physical/Built Environment, Socio-cultural Environment,

Healthcare System) across different levels of life influence (Individual, Interpersonal,

Community, and Societal) within those domains.

Key Domains of Influence:

- Biological Domain: Refers to the influence of genetics and biological processes that impact health. This includes genetic predispositions, environmental exposures, community illness exposures, and physiological functioning.

- Behavioral Domain: Refers to the individual behaviors that impact health. This includes health behaviors, coping strategies, family functioning, school/work functioning, and community functioning. Behavioral factors are often targeted through interventions and behavior change programs.

- Physical/Built Environment Domain: Refers to the physical or built environment factors that influence the physical surroundings on an individual's health. This includes access to safe housing, air and water quality, access to green spaces, digital infrastructure, transportation infrastructure, and institutional structures.

- Socio-cultural Environment Domain: Refers to the social and cultural factors that influence health outcomes. This includes sociodemographic factors, individual cultures, responses to discrimination, social networks, family and peer support, and community and social norms.

- Healthcare System Domain: Refers to institutional healthcare system that contributes to the organization, access, and delivery of healthcare services. This includes health literacy, insurance coverage, policies, quality of care, and culturally competent providers.

This framework recognizes that an individual is not solely responsible for the

entanglement of circumstances that contribute to mental health disparities. For

example, economic and structural barriers are common factors within community and

societal levels of influence that can impede a person's access to quality mental health

care (Macintyre et al., 2018; Carbonell, Navarro-Pérez, and Mestre, 2020). The NIHMD

Research Framework highlights community and societal engagement, which is

important in carrying out design solutions of this nature. This can assist HCI

researchers, who frequently perform community-based research, in identifying particular

health determinant variables to investigate during the research process in order to aid in

designing for cultural responsiveness.

Within the socio-cultural environment domain of influence, the framework

highlights individual cultural factors, such as cultural identification, religious, and

spiritual practices. These factors need to be addressed (e.g., language and identity)

when providing culturally responsive support for REMs. By further examining these

disparities, HCI researchers can address challenges that go beyond the surface level of

simply providing an intervention and adapt digital mental health solutions for REMs to

be equitable. I focus on two domains of influence that come up frequently in my study

results (the Physical/Built Environment and Socio-cultural Environment) to address this

goal. The other domains of influences are not strongly supported by the study findings,

hence why I will only be discussing the two noted above.

Figure 1.1: National Institute on Minority Health and Health Disparities Research Framework

National Institute on Minority Health and Health Disparities Research Framework

		Levels of Influence*			
		Individual	**Interpersonal**	**Community**	**Societal**
Domains of Influence *(Over the Lifecourse)*	**Biological**	Biological Vulnerability and Mechanisms	Caregiver–Child Interaction Family Microbiome	Community Illness Exposure Herd Immunity	Sanitation Immunization Pathogen Exposure
	Behavioral	Health Behaviors Coping Strategies	Family Functioning School/Work Functioning	Community Functioning	Policies and Laws
	Physical/Built Environment	Personal Environment	Household Environment School/Work Environment	Community Environment Community Resources	Societal Structure
	Sociocultural Environment	Sociodemographics Limited English Cultural Identity Response to Discrimination	Social Networks Family/Peer Norms Interpersonal Discrimination	Community Norms Local Structural Discrimination	Social Norms Societal Structural Discrimination
	Health Care System	Insurance Coverage Health Literacy Treatment Preferences	Patient–Clinician Relationship Medical Decision-Making	Availability of Services Safety Net Services	Quality of Care Health Care Policies
Health Outcomes		Individual Health	Family/ Organizational Health	Community Health	Population Health

National Institute on Minority Health and Health Disparities, 2018
*Health Disparity Populations: Race/Ethnicity, Low SES, Rural, Sexual and Gender Minority
Other Fundamental Characteristics: Sex and Gender, Disability, Geographic Region

1.5 Research Approach

I present my thesis statement:

Cultural responsiveness should be incorporated into the design of technology-enabled mental health solutions to provide interventions for increased mental health support access and engagement for racial-ethnic minorities.

To investigate this thesis statement, I used the NIMHD Research Framework to show how researchers can move from conceptualizing to operationalizing culturally

responsive design processes for mental health technologies. Within the existing HCI

literature, there is limited evidence on providing specific strategies and guidance for

designing and implementing cultural responsiveness within digital mental health

solutions through empirical studies that show it to be effective. There are mainly calls to

action that promote the need for such work (Alvarez et al., 2022; Garfield and Watson-

Singleton, 2021; Naeem et al., 2020). Research has consistently shown the ways REMs

experience barriers to accessing healthcare services and engaging with healthcare, and

such barriers can be attributed to factors such as limited access to health facilities,

language and cultural barriers, distrust in the healthcare system, and financial

constraints. HCI researchers will be able to develop practical solutions if they have a

deeper understanding of how various levels of social determinants of health affect

health-seeking behaviors and engagement with these technology tools. Additionally,

addressing these issues from a culturally responsive lens should better enable

researchers to respond to the cultural needs of REMs through the creation of effective

solutions rather than merely acknowledge the disparities within the socio-technical

interventions.

Collectively, these studies provide a comprehensive overview of the needs,

challenges, and opportunities for designing digital mental health solutions for REMs in

diverse communities. Findings highlight the complexity of designing solutions and the

need for a deeper understanding of real-world contexts for implementing interventions

and culturally responsive resources. The goal of this thesis is to pinpoint how

understanding the determinants of health can aid in the design of culturally responsive

solutions for REMs, identify the necessary variables to design digital mental health

interventions for real-world settings, and create culturally responsive content within these solutions. I examine the presence of cultural responsiveness in digital mental health solutions across three different REM groups. This work investigates the following research questions:

RQ1: How do intersectionality and social determinants of health affect how racial-ethnic minority communities seek and engage with digital mental health solutions?

RQ2: How do racial-ethnic minority communities envision the design of digital mental health support?

RQ3: How can designing for cultural responsiveness contribute to the engagement of digital mental health technology for racial-ethnic minorities?

RQ4: What opportunities exist for designing digital mental health support to promote and improve emotional and social well-being for racial-ethnic minority communities?

To answer these four research questions, I conducted four studies to investigate the ways in which culturally responsive design can be incorporated into digital mental health solutions. Taken together, these studies provide empirical data on the need for cultural responsiveness in digital mental health solutions through the perspectives of multiple REM communities and the vital insights that improve design solutions when researchers include REMs in the early stages of the design process. Furthermore, these studies contribute significant insights to the opportunities that exist for designing culturally responsive digital mental health support and design considerations to carry

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out implementation. I unpack design implications for digital mental health solutions, tensions and trade-offs, areas of benefit, and evaluate the current landscape of mental health technology. I use focus groups, design workshops, content analysis, and surveys to examine the multitude of perspectives on access and engagement of digital mental health solutions from marginalized groups (i.e., BIPOC university students and Home Visitors in Cape Town, South Africa).

Following the introduction of this dissertation, I provide an overview of the background and related work (Chapter 2) situated in the context of my core research studies. In Study 1 (Chapter 3), I investigate the experiences of home visitors that support early childhood development in low-income communities in Cape Town, South Africa, to better understand their perceptions of using a WhatsApp tool to help assess children's social and emotional well-being. I highlight the tensions of designing technology for low socio-economic environments facing many inequities, such as the Global South, that can make it difficult to benefit from technical solutions. In Study 2 (Chapter 4), I involve REM university students in the design process of designing an evidence-based mental health app geared towards the university student population. I provide design considerations for the unique needs of university students. Study 3 (Chapter 5) explored the access and availability of mental health services on campuses through a survey study and a content analysis of 60 university counseling websites. I highlight the complexity of enterprise systems and the dissemination of mental health resources for university students. Based on the recurring finding of the need for culturally responsive mental health resources in Study 3 and viewing numerous web pages of self-help resources on university counseling websites, I wanted to build on this

work by investigating whether the current digital mental health apps are culturally responsive. In Study 4 (Chapter 6), I conducted a content analysis of commercialized mental health apps for anxiety and depression to evaluate cultural responsiveness and provide a set of design recommendations on components that should be included to design culturally responsive mental health applications. To close, I discuss a few main components that were prevalent across the studies that show why designing culturally responsive digital mental health solutions for REMs is necessary: 1) health-seeking behaviors of REMs; 2) means of mental healthcare access through technology; 3) research to implementation practices; 4) implications for design. I further discuss how to operationalize designing for trust, community, and engagement based on the levels of influence present in each study.

1.6 Contributions

My dissertation work contributes to the fields of HCI and Digital Mental Health. My work adds a unique contribution to understanding the multitudes and nuances of REM groups with intersecting identities who are seeking mental health resources through digital platforms by ideating and designing alongside them. This work focuses on designing and evaluating cultural responsiveness in digital mental health solutions.

The main contributions of this work are: 1) the characterization of the ways in which social determinants of health impact how marginalized groups seek and engage with digital mental health solutions; 2) empirical examination of how designing alongside individuals within REM groups shapes ideation and design outcomes 3) emphasize the deeper work that mental health technology researchers must conduct in order to develop inclusive, scalable, and accessible digital mental health solutions.

Table 1.1: Overview of research problems, research questions, and contributions

Problem	Research Questions	Contributions
In the creation of digital mental health solutions, technology companies are exacerbating the injustices that contribute to REM's limited access to mental health services, such as a lack of representation, linguistic and cultural barriers, and trust and privacy issues.	RQ1: How do intersectionality and social determinants of health affect how racial-ethnic minority communities seek and engage with digital mental health solutions?	An empirical investigation of the community work processes of early childhood development through the lens of home visitors in low-income Cape Town, South Africa, and understanding the various health determinants that impact the success of children's health and wellbeing and the use of a socio-technical tool to do so. (Chapter 3) An empirical understanding of how Black and Latinx university students seek and engage with mental health resources on their respective campuses (Chapter 5)
The underrepresentation of racial-ethnic minorities in research leads to a lack of understanding of their unique needs, preferences, and barriers to engaging with digital mental health applications.	RQ2: How do racial-ethnic minority communities envision the design of digital mental health support?	Empirical understanding through focus groups to gather perspectives from Home Visitors in Cape Town, South Africa, on the design of a concept and prototype for REM children's wellbeing assessments through WhatsApp. (Chapter 3) Design contributions and artifacts of an evidence-based mental health application alongside REM university students through design sessions. (Chapter 4)
The lack of culturally responsive digital mental health solutions contributes to the low use and engagement of racial-ethnic minorities.	RQ3: How can designing for cultural responsiveness contribute to the engagement of digital mental health technology for racial-ethnic minorities?	Empirical data that shows the need for culturally responsive mental health support for Black and Latinx university students through a survey study and university mental health resources through a content analysis of 60 university counseling websites. (Chapter 5) Empirical data that shows the current landscape of cultural responsiveness within digital mental health applications and design considerations on ways to implement culturally responsive design. (Chapter 6)
There is limited evidence of to what extent the current landscape of digital mental health applications is culturally responsive.	RQ4: What opportunities exist for designing digital mental health support to promote and improve emotional and social well-being for racial-ethnic minority communities?	Design considerations for researchers designing digital mental health solutions to design for cultural responsiveness. (Chapter 6)

| | | Design considerations for designing digital mental health support for REM university students. (Chapter 4 & 5) |
| | | Design considerations for designing socio-technical tools to improve wellbeing for children in low-income communities in South Africa. (Chapter 3) |

Chapter 2. Background and Related Work

In my dissertation work, I focus on the design and evaluation of digital mental health solutions with a focus on cultural responsiveness for REMs. This chapter begins with an overview of culture and the social determinants of mental health, serving as a framework to comprehend the intricate factors affecting REM's access to and engagement with mental health interventions. I review a variety of technological tools to contextualize the digital mental health solutions available for mental health disparities, with a particular emphasis on mobile and web-based interventions. I specifically focus on mobile and web-based interventions to give context to my four studies throughout this dissertation. Subsequently, I review the current state of cultural responsiveness within digital mental health solutions, followed by a review of the design considerations for marginalized communities with the aim of gaining further insights into their efficacy.

2.1 Culture and Social Determinants of Mental Health

Culture and the social determinants of mental health largely influence and shape one another and, as a result, significantly impact mental health disparities. For example, the cultural stigma that inhibits people from seeking mental health care, along with limited access to mental health practitioners and resources, can exacerbate mental health disparities. This section aims to provide a succinct overview of the multifaceted aspects of social determinants of mental health as well as the pivotal role of one's culture in accessing and engaging with mental health resources.

2.1.1 Social Determinants of Mental Health

      According to the World Health Organization and the Calouste Gulbenkian Foundation (2014), socioeconomic status affects how people experience common mental health issues like anxiety and depression at various stages of life. A child born into severe poverty is at significant risk of developing mental health conditions that may persist even as the child ages (Peverill et al., 2021; Reiss et al., 2019). The institutional power of politics, economics, social policies, and environmental policies shapes the set of non-medical conditions that people are born into and live under (Allen et al., 2014). The institutions of healthcare (Amutah et al., 2021; Yearby, Clark, and Figueroa, 2022), education (Riddle and Sinclair, 2019; Wallace et al., 2008), law (Crenshaw, 2010), and corporate employment (Emerson and Murphy, 2014) have all generated systemic disparities and ideologies (Williams and Rucker, 2000) that can have a negative influence on the mental health of REMs (Castro-Ramirez et al., 2021; McKnight-Eily et al., 2021). The establishment of these institutions was founded on principles of colonialism and racism (Cloete and Muller, 1998; Daffé, Guillaume, and Ivers, 2021), which still produce unequal treatment of REMs.

      The social determinants of mental health are the intervening factors that shape a person's mental health and well-being, such as poor education, environment, unstable living conditions, and unemployment (Allen et al., 2014; Compton and Shim, 2015). Structural racism is a large component of the social determinants of mental health (World Health Organization, 2008). Structural racism is characterized as large-scale systems, social powers, organizations, philosophies, and processes interacting to create and strengthen inequalities between racial and ethnic groups (Powell, 2007).

Examples of structural racism, such as residential segregation, institutional

discrimination, inequities in health care, police brutality, and mass incarceration,

contribute significantly to mental health disparities for racially minoritized groups (Gee

and Ford, 2011). Structural racism produces social conditions that contribute to a

disproportionate burden of trauma exposure (Woods-Jaeger, Cho, and Briggs, 2020)

that can also be experienced vicariously (Truong, Museus, and McGuire, 2016).

Vicarious racism is an individual's indirect encounter with racism as a result of racism

directed specifically at one or more other people in their community (Harrell, 2000).

Individuals' experience with vicarious racism results in psychological trauma due to their

realization that they are also vulnerable to the negative outcomes of racism (Giordano

et al., 2021).

Understanding how structural and vicarious racism impact the mental health of

REMs emphasizes how mental health technology should be designed with a trauma-

informed approach. A trauma-informed approach understands and acknowledges the

pervasiveness of trauma and supports healing and recovery environments rather than

practices that may unintentionally re-traumatize an individual (Huang et al., 2014). In

regard to designing digital mental health technology, recognizing diverse identities and

experiences, and prioritizing cultural sensitivity, it is important (Ayobi et al., 2021;

Williams et al., 2021; Cheng et al., 2021) to design in a way that is respectful, inclusive,

and culturally relevant to REMs. A trauma-informed approach aims to minimize re-

traumatization (Isobel et al., 2021; Grossman et al., 2021). For design researchers, this

means avoiding delivering content (language and images) that can possibly be

triggering. Recognizing the impact of trauma on mental health can inform researchers

on how to facilitate the creation of digital mental health interventions that foster a safe and empowering digital environment while allowing for the choice of intervention.

Residential segregation has a direct effect on health and well-being (Black et al., 2017; Burgos and Rivera, 2012; White and Lawrence, 2019), which exists at higher rates for families and individuals who have previously lived in redlined areas (geographic areas marked for denial of services such as mortgages, insurance loans, and other financial services to residents based on their race or ethnicity (WEX Definitions Team, 2022)). Residential segregation refers generally to the spatial separation of two or more social groups within a specified geographic area (Timberlake and Ignatov, 2014).

Countries such as the United States, South Africa, Brazil, and India have a long-standing history of residential segregation (Yang, Emily Choi, and Sun, 2021; Saff, 1995; Van Eeden, 2015; da Rocha Valente and Berry, 2020; Feitosa et al., 2021; Singh, Vithayathil, and Pradhan, 2019; Vithayathil and Singh, 2012). The South African government enforced apartheid, a system of racial segregation, from 1948-1994 resulting in residential segregation (Mini, 2016; Pieterse, 2009). The classified racial groups (White, Black, Colored, and Indian) were to relocate to segregated areas known as "townships" (Beavon, 1982). Residential segregation persists in South Africa almost thirty years after the end of apartheid (Van Rooyen, 2022). In Brazil, Black and mixed-race low-income populations live in favelas - shanty towns, or slum areas (de Antuñano, 2021). Brazil has the second-largest Black population outside of the continent of Africa due to the transatlantic slave trade (Taylor, Gordon, and Pereira, 2023), which accompanied socioeconomic disparities and discrimination that contributed to

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residential segregation in Brazil (da Rocha Valente and berry, 2020). In India, caste-based discrimination (Jadhav, Moose, and Dostaler, 2016) has resulted in residential segregation, with people from lower castes living in segregated areas in informal settlements that tend to be overcrowded with limited access to basic necessities (Singh, Vithayathil, and Pradhan, 2019).

One study in the United States measured the stress responses of participants in a Philadelphia neighborhood walking past vacant lots before and after greening remediation treatment on randomly selected lots. The study demonstrated that being in view of a green vacant lot decreased heart rate significantly more than being in view of a non-greened vacant lot or not in view of any vacant lot. Improving the amount of green space may relieve stress and increase well-being (South et al., 2015). Individuals from these communities have higher levels of trauma, stress, and anxiety due to the negative impacts of living in underserved communities with inequitable access to health and educational resources during childhood and adolescent development (Black et al., 2017).

To address the impact of residential segregation on mental health, digital mental health interventions should consider enhancing innovative strategies that promote equitable access to mental health services, such as store-and-forward (Jannati et al., 2021) and remote patient monitoring (Jeddi and Bohr, 2020). Store-and-forward is a communication method used to send patient clinical information to a specialist and can be in the form of audio, video, or data (Chakrabarti, 2015). Remote patient monitoring allows technology to monitor patients outside of the traditional clinical setting (Hood et

al., 2023). Researchers should think about how to provide these solutions in a way that is culturally responsive.

Police brutality is a public health issue classified, but not highly recognized, as a social determinant of mental health (Strazewski, 2020). The chances of having an encounter with a police officer are frightening and, at times, humiliating, which may lead to a high level of psychological stimulation (Outlaw, 1993). Research shows that many African Americans partake in a wide variety of coping strategies, such as defensiveness and acute stress response, that prevent or reduce vulnerability to discrimination, including police incidents (Plummer and Slane, 1996). Mistrust in law enforcement has a knock-on effect on the mistrust of other institutions as well. For example, findings from a mixed-methods study suggest that people who get treated unjustly by institutions outside of the health care system are likely to go without using mental health services (Alang, 2019). Researchers discovered a relationship between police brutality and mistrust in medical institutions in a large survey study of people living in urban areas regarding their experiences with police brutality (Alang et al., 2021).

Knowing and understanding the complex, nuanced relationships marginalized groups have with institutions that are meant to heal and serve them provides better opportunities for researchers to position themselves to ideate tangible solutions alongside these communities. Research evidence suggests that designing effective digital mental health interventions for marginalized communities requires researchers to be cognizant of potential biases and to decenter themselves and their lived experiences to allow marginalized communities to guide the ideation process of designing culturally responsive digital mental health solutions (Pendse et al., 2022). My dissertation studies

contribute to understanding how several marginalized groups ideate and discuss various digital mental health solutions.

2.1.2 The Cultural Impact of Mental Health

The views of one's culture and community have a direct impact on seeking out and engaging in mental health treatment (Corrigan, Druss, and Perlick, 2014). I define culture in this context as a set of beliefs, values, practices, and norms among a group of people that influence their actions and decisions (Schatell, 2017). Mechanisms for addressing mental health, such as the recognition and interpretation of symptoms (Caplan and Buyske, 2015; Jang et al., 2015), and health-seeking behaviors (Amri and Bemak, 2013; Han and Pong, 2015; Lindinger-Sternart, 2015), are impacted by elements of the various cultures that people are part of. Individuals from ethnic backgrounds who are part of a culture that celebrates courage and bravery in the face of adversity may view the diagnosis of a mental health disorder or the need for mental health assistance as an indication of vulnerability and weakness (Alvidrez et al., 2008).

Finding coping mechanisms can help individuals who are part of racial minority groups manage their mental health. Coping is a mechanism by which individuals modify their attitudes and behaviors in order to react to the growing pressures that outweigh currently available resources (Aldwin and Revenson, 1987). Coping strategies include relying on supportive family members, and religious practices, remaining resilient, and engaging in prosocial activities. Religious or spiritual orientation has been a frequent coping response among those who identify as Black or Latinx (Broman, 1996). Being heroic and strong despite the odds has become heavily associated with these cultures and turned into a way of coping with life's obstacles through a coping mechanism

characterized as "John Henryism," based on the African American folk tale of a steel driver working himself to death to win a race against a machine (Adams, Aubert, and Clark, 1999).

In countries with a legacy of discriminatory practices, ethnic minority communities have a long-standing history of mental health stigma that prevents individuals in these communities from seeking help (Fripp and Carlson, 2017). Stigma is characterized as the existence of naming, stereotyping, exclusion, loss of identity, and prejudice that exist in contexts where power imbalances are prevalent (Link and Phelan, 2013). Public stigma arises as the population at large upholds stereotypes about those identified as having a mental illness, which, as a result, affects the pursuit of treatment as it contributes to the prevention of labeling (Link and Phelan, 2013). Individuals try not to engage with mental health services affiliated with stereotyping (Corrigan, 2004). An example of public stigma is anti-immigration, which further exacerbates mental health disparities towards immigrant groups, undocumented persons, and people of color (Morey, 2018). Self-stigma exists when a person experiencing a mental health issue internalizes the stereotypes and prejudices associated with mental health (Link & Phelan, 2013). The pervasive influence of stigma substantially affects the mechanisms involved in addressing mental health, manifesting as reluctance or hesitation in seeking appropriate treatment due to the fear of being stigmatized.

2.2 Technical Tools for Addressing Disparities in Mental Healthcare

To close the access gap in mental health care, varying technologies have been deployed with the intentional goal of broadening the accessibility of mental health treatment. In this section, I discuss a few tools aimed at reducing cost, access, and

mental health stigma. The tools I mention are not an exhaustive list, but they do provide context for the types of solutions I design and ideate in my research.

2.2.1 Evidence-based Mental Health Technology for University Students

The number of young adults with mental health difficulties attending university in the United States has considerably grown in the past decade, with a 135% increase in depression and a 110% increase in anxiety from 2013 to 2021 (Lipson et al., 2022). Yet, university students report not receiving services at an alarming rate (37% to 84%, depending on the concern) in one study (Eisenberg et al., 2007). Administrative personnel at university counseling centers can struggle to address students with numerous coexisting mental health conditions as well as the usual developmental obstacles of adapting to university life (Pedrelli, 2015). As growing concerns about university students' mental health and mobile technology solutions become more pervasive, HCI researchers (Lattie et al., 2020) and health researchers (Alqahtani et al., 2021; Fripp and Carlson, 2017; Morey, 2018) have been working to create digital mental health solutions for university students.

University students with mental health concerns engage in a wide variety of coping and management strategies (Kumar et al., 2013) to meet their own specific set of needs, many of which are technology-supported. Like many other people their age, university students gravitate towards using applications on mobile devices for managing and self-coping with their mental health (Huberty et al., 2019). These applications tend to be an affordable option (Parks, 2018) and help overcome mental health stigma (Bakker et al., 2016). Medical literature suggests that most young adults see mobile mental health tools as a viable alternative or adjunct to in-person services (Horgan and

Sweeny, 2010). Individuals who are self-managing their depression and other mental health disorders have repurposed a variety of digital tools that were not specifically created for mental health, such as digital calendars and to-do lists (Mohr, 2017). However, evidence-based interventions have been proven to show some efficacy for university students (Huberty et al., 2019; Tomoiagă and David, 2022; Barnett et al., 2021).

Prior research has investigated how technology may promote skill practice for several skill-based psychotherapies. A feasibility study using Pocket Skills, a mobile web app based on Dialectical Behavioral Therapy (DBT), found increased participant engagement with DBT and applying learned skills to their current environment (Schroeder et al., 2018). mHealth researchers created a framework, IntelliCare, derived from the Behavioral Intervention Technology (BIT) Model, to provide a suite of skills-focused apps to help reduce anxiety and depression (Mohr et al., 2017). The feasibility study of IntelliCare demonstrated substantial decreases in depression and anxiety symptoms. Skills-based psychotherapy apps have the potential to decrease anxiety and depression in the college student population. However, there has been limited involvement of university students in the early design of these applications, resulting in a limited understanding of their challenges and ability to adapt the design of these skills-based apps to their specific context.

Telehealth, also referred to as telemedicine, is a commonly used method for providing a way to connect to distant healthcare services through phone or video conferencing (Langarizadeh et al., 2017). Telehealth services are being used at universities across the country and have gone full-fledged since the start of the recent

pandemic, leaving the only option for students to interact with counselors through video conferencing, phone, or chat (Dosaj et al., 2021). Telehealth services help tackle the stigma associated with seeking mental health treatment. A literature review of college students' perspectives on telehealth services revealed that college students consider telehealth services practical, affordable, easy to use, and helpful (Hadler et al., 2021). While this is a great service option for students, researchers from a study received student feedback about the lack of customization or access to the provider on telehealth platforms (Hadler et al., 2021). During the COVID-19 pandemic, the lack of access to counseling services grew from being slightly problematic to a crisis as students returned to their homes, cut off from any traditional campus resources they might access (Bhatia, Manish, and Gupta, 2021).

Evidence-based internet-based and mobile application interventions for mental health offer a promising solution to address the growing mental health crisis, particularly for REM students. These applications can provide a convenient, accessible, and tailored approach to mental health care, overcoming many of the barriers faced by marginalized groups in accessing mental health care.

2.2.2 Ethical Concerns

Digital mental health technology that collects sensitive data can be misused (Martinez-Martin et al., 2018); therefore, researchers and designers have an ethical responsibility to protect users' information (Rossi and Lenzini, 2020). With the constant changing of digital mental health technology, it is imperative that the upkeep of data protection is done in a proper manner with respect to the technological solution to address ethical concerns. Usage of some mental health applications involves entering

personal information, such as contact information or health records, creating a major

risk to the safety of the user in case the data is exchanged, stolen, or compromised

(O'Loughlin et al., 2019). A cross-sectional analysis showed that 29 of the 36 highest-

ranked apps for depression and smoking cessation transmitted user data to Facebook

and Google. Only 12 of these apps disclosed data transmission in their privacy policies

(Huckvale, Torous, and Larsen, 2019).

In addition, many applications have non-evidence-based tools and programs that

can provide misleading information that can hurt the user (Robillard et al., 2019). A

small percentage of mobile applications are developed based on evidence-based

medical practices by mental health professionals, while a large majority are developed

by independent companies that do not have any ties to the mental health care field

(Aguilera and Muench, 2012). These applications are quickly developed with little

regulation due to the increasing need for mental health apps.

The technology industry has seen the potential monetary value in developing

mental health apps (Herzog, 2020), whereas health professionals realize the greater

need to provide affordable and accessible mental health services (Ransing et al., 2020).

Some health professionals have expressed their concern about the validity of the many

mental health apps being developed, with the fear of companies exaggerating the

effectiveness and benefits of their app (Landi, 2021). With over 10,000 mental health

applications commercially available to users, research reveals that less than half of

applications collecting consumer data have a privacy policy and that the regulations lack

relevant data management information (Carlo et al., 2019). Findings from a focus group

study with Institutional Review Board (IRB) officials to collect their perspectives on

ethical challenges among digital health apps demonstrate the need to strengthen

stakeholder involvement with respect to aggregated resources to increase technology

awareness and reduce potential barriers to privacy, data confidentiality, and the

implementation of adequate ethical standards (Nebeker et al., 2017). This can be done

by holding required project meetings dedicated to discussing potential ethical concerns

and strategizing how to mitigate them. An active database can be created to house the

necessary resources and standard operating procedures for addressing ethical

concerns. As applications quickly become incorporated into daily healthcare systems,

strict standards and qualification programs that address privacy, efficacy, and usability

for such technologies for mHealth apps seem to be essential (Liew et al., 2019).

Users are often apprehensive about using apps that require them to input a great

deal of personal information. For example, a survey revealed that 60% of the application

downloaders did not install an app because of the amount of personal data that the

application required from users (Olmstead and Atkinson, 2015). Another study

discovered that participants thought privacy issues were a crucial factor in the design of

mental health applications and a significant explanation for why some people would be

unwilling to use these apps (Proudfoot et al., 2010). People are less willing to input

personal information into a health app than an app they use for pleasure, such as social

media (Arigo et al., 2018). Some mental health applications may use less intrusive or

straight-forward methods of getting your personal information, such as location tracking

(Luxton et al., 2011). For example, some app developers may track personal data such

as geo-location that can track your identity—residence, workplace ethnicity, relationship

ties, etc. (Braghin, Cimato, and Della Libera, 2018). Personal data is then often sold to

businesses to use for advertising to individuals on the frequent online platforms they

visit (Braghin, Cimato, Della Libera, 2018). This causes a major ethical concern

because big tech corporations are using mental health apps to profit with personal data

(Herzog, 2020) instead of developing technology for the greater good. Law enforcement

has also started using personal tracked data collected by smartphones to convict

civilians (Valentino-Devries, 2019), which is one of the ways Black and Latinx

communities are overly tracked and surveilled in their communities, which results in

poorer mental health.

Inaccurate information in mental health apps can also be unsafe by providing

information about mental health that has not been professionally proven. According to a

content analysis of mental health applications developed by independent companies

with no research or medical experience, they do not strictly adhere to evidence-based

standards and can provide potentially harmful knowledge (Miah, Gammack, and Hasan,

2017). For example, there are over two million downloads of suicide and depression

applications that offer incorrect or nonexistent information about suicide crisis helpline

assistance (Martinengo et al., 2019). This is extremely harmful to active users, who can

potentially be in a crisis and rely on the app for more assistance. Health services and

technical organizations, on the other hand, have sought to resolve these safety and

service concerns by directing patients and physicians to high-quality applications

because there are currently no set ethical standards for assessing mental health apps.

Assessment frameworks, such as Psyberguide (Neary and Schueller, 2018), were

established to assess mental health apps for usability, accessibility, data protection,

security, and research practice. Research institutions have an opportunity to develop

evidence-based mental health interventions in a digital format that will provide safe and accurate information for users.

Research teams are critical to supporting and crafting the ethical principles of new technical mental health interventions. Data must be gathered to determine the likelihood and extent of possible harm to app users and study participants (Rooksby et al., 2019). Despite the nonexistence of industry standards for ethical practices in mental health apps, defining these standards for communicating personal data usage in a transparent, accessible, and substantive manner will aid in the improvement of informing users on the privacy policy (O'Loughlin et al., 2019).

2.3 Cultural Responsiveness in Digital Mental Health Interventions

Digital mental health interventions (DMHI) have great opportunities to expand access to mental health care. However, there are still major challenges with the lack of cultural responsiveness in these tools (Ramos et al., 2021). Digital inequalities are a significant barrier for marginalized communities to access and benefit from digital mental health interventions. Factors such as low literacy and education levels, poor quality of social support networks, and limited access to the Internet are identified as social determinants that contribute to this issue. Tailoring DMHI to be culturally responsive results in low usage and limits its effectiveness for ethnic minority groups (Ellis, Draheim, and Anderson et al., 2022).

Cultural responsiveness refers to the awareness of diverse identities and experiences to provide therapy that is unique to a specific individual's life experience (Jones-Smith, 2018). Currently, the state of research providing cultural responsiveness for ethnic minority populations is still limited. Health behavior and HCI researchers are

currently exploring this new area. A systematic review of culturally adapted DMHIs for racial-ethnic minorities conveys that there is limited research conducted with BIPOC populations and feasibility studies lack active comparison treatments (Ellis, Draheim, and Anderson et al., 2022). The studies reviewed show the most effective DMHIs included cultural adaptations, such as partnerships with community leaders and language translation.

Cultural adaptation refers to the modification of an evidence-based intervention to align with the cultural norms of the client. (Bernal, Jiménez-Chafey, and Domenech Rodríguez, 2009). One research study conducted focus groups to investigate the acceptability of an internet-based cognitive-behavioral therapy self-help program for Arabic-speaking immigrants (Nygren et al., 2018). The program received a positive rating from the focus group participants; however, participants also expressed a desire for improvement in certain areas. Specifically, the need for improved language translation, less academic jargon, the ability to listen to text, and addressing mental health stigma within the Arabic culture were highlighted as areas requiring attention.

Another internet-based self-help program for depressive symptoms in Mexico was rated highly for usefulness but dropped in user retention from 12,366 to 626 users across the seven modules (Lara et al., 2014). Additional research is warranted to ascertain the optimal delivery modes and design considerations for these interventions, with the potential for cultural responsiveness to play a valuable role in this regard. A text-based therapy study found that the majority of low-income African American mothers experiencing postpartum depression preferred motivational and inspirational messages and noted a preference to receive more individualized messages; however,

cellular service may be a significant barrier (Broom et al., 2015). The study researchers highlighted future research directions for optimal message frequency and cultural aspects embedded in the design of the intervention. These studies highlight that DMHIs are widely accepted among marginalized groups (Ramos and Chavira, 2022); however, evidence of efficacy is still lacking.

Existing research has demonstrated cultural adaptations of mental health interventions that are primarily delivered through traditional face-to-face therapy. However, there are limited studies that investigate the cultural adaptations of evidence-based mental health interventions designed for digital platforms. Nevertheless, leveraging insights from these existing frameworks, we can develop culturally responsive digital mental health tools.

2.4 Designing Digital Mental Health Interventions with REM Communities

In this section, I highlight the common methods employed to design interventions involving communities and Information and Communication Technologies (ICTs) in South Africa that are relevant to the study presented in Chapter 3.

2.4.1 Methods

Not all REMs are represented in research studies involving DMHIs (Ramos and Chavira, 2022). To mitigate the perpetuation of systemic exclusion within the field of research, it is essential that scholars adopt a conscientious approach. I do not believe that this work should fall under one specific research field; instead, researchers should work as a collective to do so. Research experts should continue to explore and incorporate methodologies that are specifically tailored to work with marginalized populations. Participatory design methods (DiSalvo, Clement, and Pipek, 2012;

Garrigou et al., 1995; Muller and Kuhn, 1993; Robertson and Simonsen, 2012) and community-based participatory research (Chen et al., 2020; Harrington, Erete, and Piper, 2019; Wallerstein and Duran, 2006) are some of the approaches that provide individuals in these communities with the opportunity to co-design interventions with stakeholders, thereby enabling them to voice their own expertise and opinions concerning their community. By embracing such strategies, researchers can mitigate the potential for inadvertent marginalization and create solutions that are equitable, accessible, and inclusive. Replicating the same methodology and strategies that have unintentionally created marginalization is the type of approach researchers need to stray away from.

Designing for underserved populations necessitates an engagement strategy that is attentive to the dangers of potential stigmatization as well as an awareness of the obstacles to active participation (Harrington, Erete, and Piper, 2019). Participatory design is the active participation of people in the co-design of technologies, systems, and social structures by using a diverse set of activities to promote and facilitate this active interaction (Hansen et al., 2019; Muller and Kuhn, 1993). Professional researchers commonly use participatory design for projects that require designing a technical solution for marginalized groups. This is because it empowers these groups and gives them a sense of responsibility to work collaboratively with researchers on a project that has the potential to significantly impact their community (DiSalvo, Clement, and Pipek, 2012).

Researchers frequently support community members as equal research partners through community-based participatory research (Cooper et al., 2022; Shalowitz et al.,

2009; Wallerstein and Duran, 2006). The aim of community-based participatory

research is to first understand the social and cultural dynamics of the community before

implementing a plan of action (Winterbauer et al., 2016). There will always be a power

dynamic between the researcher(s) and the participants working in marginalized

communities, but these methods are a way to lessen those power dynamics. These

research methods allow researchers to discuss their positionality with the community,

even if there is a researcher who has an immense amount of privilege amongst the rest

of the group.

However, to confidently state the efficacy of DMHIs for marginalized groups

where intersectionality is evident, researchers must address the challenge of recruiting

participants from underserved populations (Nagler et al., 2013; Paskett et al., 2008).

This calls for intentional recruitment efforts that prioritize the inclusion of historically

marginalized and underrepresented populations, which requires culturally sensitive

recruiting efforts and a significant amount of time. Working with community-based

organizations can help accomplish this goal, as they can assist in building rapport and

trust with potential participants, reducing cultural and language barriers, and addressing

potential concerns about research participation. Furthermore, researchers must include

a large sample size of different marginalized populations in efficacy studies to ensure

that research findings are representative and applicable to all members of society. This

approach not only enhances the potential for meaningful change but also ensures that

the voices and needs of underrepresented communities are heard and incorporated into

the design of DMHIs.

2.4.2 Information and Communication Technologies for Health and Wellbeing in South Africa

ICT has a significant impact on creating, disseminating, and managing information (Blurton, 1999). Specifically, ICT has been used for various health purposes, such as maternal health (Obasola, Mabawonku, and Lagunju, 2015; Obasola, 2021), HIV (Sørensen, Rivett, and Fortuin, 2008), and the Covid-19 pandemic (Samarthya, 2020). Mobile phones, in particular, have shown great potential for health communication using short message service (SMS) and mobile applications (Abroms, Padmanabhan, and Evans, 2012; Mukund Bahadur and Murray, 2010).

One notable example of ICT-enabled health information dissemination in South Africa is the MomConnect program, which was established in 2014 with the support of the National Department of Health, Johnson & Johnson, and other philanthropies (*MomConnect: Connecting Women to Care, One Text at a Time*, 2017). MomConnect provides maternal health care information to pregnant women through text messages (Barron et al., 2016). Several pilot and feasibility studies have been conducted to assess the impact of this intervention (Kabongo et al., 2019; Peter, 2018; Skinner et al., 2018; Xiong, Kamunyori, and Sebidi, 2018). A user assessment study of the MomConnect service revealed findings that highlight the cultural responsiveness of text-based information services, which are relevant not only to this study but also to other studies in this dissertation (Skinner et al., 2018). The findings showed that users reported using the information from MomConnect to make informed decisions about their health, seek appropriate care, and adopt healthy behaviors during pregnancy and early motherhood. However, users also faced challenges with understanding the information due to language barriers or technical issues with the service. Privacy

concerns were also raised, particularly regarding the confidentiality of personal

information shared through the service. Nevertheless, the MomConnect project serves

as a blueprint example for the research team in designing a WhatsApp chatbot.

Another noteworthy example of ICT-enabled health information dissemination in

South Africa is the COVID-19 Connect platform developed by Praekelt.org during the

COVID-19 pandemic (Samarthya, 2020). COVID-19 Connect is a WhatsApp helpline

that provides accurate and up-to-date information on the coronavirus outbreak (Shawn,

2020). Within just three days of its launch, the platform surpassed 10 million users

(Shawn, 2020). The World Health Organization later adopted this platform to reach

people globally (World Health Organization, 2020). The messaging service provides the

latest news and information on coronaviruses, including details on symptoms and

measures to protect oneself and others, in multiple languages. As of the time of writing

this dissertation, the WhatsApp service is still available for use. However, it should be

noted that the updates on coronavirus cases and deaths may not be real-time and may

lag by a few months.

ICT has played a significant role in creating, disseminating, and managing health

information in South Africa for various health purposes, including maternal health, HIV,

and the COVID-19 pandemic. Mobile phones, in particular, have shown great potential

for health communication through SMS and mobile applications. Examples such as the

MomConnect program and the COVID-19 Connect platform demonstrate the impact of

ICT-enabled health information dissemination in South Africa. However, challenges

related to language barriers, technical issues, and privacy concerns have also been

identified. These examples serve as valuable insights for the design and implementation of future ICT-based digital mental health interventions.

2.5 Summary

To summarize, the literature reviewed in this chapter highlights the importance of incorporating cultural responsiveness into the design of DMHIs as a means of addressing mental health disparities among REMs. In this dissertation, the design of DMHIs is approached from a culturally responsive perspective that utilizes the National Institute on Minority Health and Health Disparities Research Framework. While the use of DMHIs holds great promise for improving access to care, challenges such as engagement, data privacy, and efficacy research persist, particularly for underserved populations. Hence, it is crucial that researchers collaborate with community partners and adopt participatory design approaches to ensure the inclusion of REMs in the design process. This approach will yield insights into how one's identity, culture, and lived experiences influence their health-seeking behavior and engagement with digital mental health solutions.

Chapter 3: "Mazi Umntanakho": A WhatsApp Chatbot for Assessing Children's Social-Emotional Wellbeing in South Africa

Through focus groups across four diverse communities, I examined the work processes, experiences, and preferences of Home Visitors (HVs) to design an assessment tool via a WhatsApp chatbot to explore how cultural responsiveness should be incorporated into the design of technology-enabled mental health solutions for increased mental health support access and engagement for REMs. In this chapter, I describe the motivation for this work and then present the methodology that was used to complete it. This study provides empirical evidence of perspectives from HVs in Cape Town, South Africa, on the design of a concept and prototype for REM children's wellbeing assessments through a WhatsApp chatbot. Additionally, empirical evidence of the community work processes of ECD and the various health determinants that impact the success of children's well-being and the use of a socio-technical tool to do so.

Through this research, I offer insight into designing culturally responsive ICT for home-based ECD work that prioritizes data privacy and retention and provides assessments in home languages, accessible jargon, and simplicity. I complete the chapter with a discussion and summary showing how this work indicates the importance of considering societal constraints that shape home-based work in low-income environments when designing technical tools for sustainable impact. I use the NIHMD Research Framework to identify the challenges that need to be further explored and lead to new contributions in the field. This research contributes to the field of HCI by providing valuable insights into the design of culturally responsive technical tools that effectively support HVs and the families they serve in low-income communities. In

addition to offering design implications for deploying ICT in complex real-world settings.

Furthermore, I advocate for more design work to be done in the Global South and

emphasize the significance of including users in the design and decision-making

processes. This exploratory study addresses the first two research questions of this

dissertation:

RQ1: How do intersectionality and social determinants of health affect how

racial-ethnic minority communities seek and engage with digital mental health

solutions?

RQ2: How do racial-ethnic minority communities envision the design of digital

mental health support?

3.1 Motivation

The advancement of information and communication technologies (ICT) for

health in South Africa has shown promising potential for supporting low-income

communities (Aruleba and Jere, 2022; World Health Organization, 2019). In South

Africa, high levels of inequalities such as poverty, residential segregation, hunger,

violence, and substance abuse have negatively impacted early childhood development

(ECD) (Draper et al., 2022; Du Plessis and Conley, 2007). Young children from low

socioeconomic backgrounds are vulnerable to excessive stress (Lefmann and Combs-

Orme, 2014), which can adversely affect their social-emotional well-being (Walker et al.,

2011). In response to these challenges, various community-based organizations have

initiated programs aimed at supporting the ECD of young children (Atmore, 2013).

Home-based ECD programs can be particularly advantageous for families

residing in areas where access to transportation is limited and for whom affording

school fees presents a significant financial barrier. Home Visitors (HV) are trained

professionals who are a part of the community and provide support and guidance to

families with young children in their homes. These individuals are impactful in ECD work

by improving the health, learning, and emotional well-being of young children (Schmidt

and Azzi-Lessing, 2019).

Recently, technology has been deployed to facilitate ECD activities in low-income

communities (Ogegbo and Aina, 2020). Most research surrounding ECD mainly focuses

on the feasibility of interventions (le Roux et al., 2011; Betancourt et al., 2018) and little

on the facilitation of technology used to support these interventions. Designing effective

and sustainable technical solutions requires carefully considering the unique work and

societal constraints that shape these environments.

3.2 Methods

In this section, I aim to provide a comprehensive overview of the research

methodology used in this study. I outline the ECD assessments chosen for the

WhatsApp chatbot, the research design, how data was collected and analyzed, and

qualitative coding analysis. Additionally, I will describe how ethical considerations were

addressed in the study.

3.2.1 Assessments

The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 2001) and the

social-emotional component of the International Development and Early Learning

Assessment (IDELA) (Pisani, Borisova, and Dowd, 2015) were the assessments that

were proposed to be completed through the WhatsApp chatbot. The SDQ is a brief

emotional and behavioral screening tool (caregiver-administered) that is widely used to

assess a child's mental health symptoms. The IDELA is a direct assessment to be

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completed with the child, designed by Save the Children for use in a variety of global settings with children aged 3 to 6 years. It produces scores in four domains: motor, literacy, numeracy, and social-emotional. The social-emotional component comprises 16 questions that assess self-awareness, friends, emotional awareness, empathy, and conflict resolution. Children are asked to complete 23 tasks and are scored on a total of 102 items. These tools were selected due to its use across diverse settings, their ability to be translated into local South African languages (with some translations already available), the feasibility of administration by community-based workers, the salience of the outcomes assessed, and their potential acceptability in the contexts where the project was being conducted.

3.2.2 Study

In this study, I conducted focus groups as part of a four-person research team to gather feedback from HVs affiliated with a community-based organization that provides support for home-based ECD within low-income urban and rural communities in the vicinity of Cape Town, South Africa. The urban communities are located within the Cape Town Metropolitan area and are characterized by a mix of formal and informal housing with high population density. Typical challenges in these communities include high rates of unemployment, food insecurity, substance abuse, crime, and gang activity. The rural communities are located in the Cape Winelands District Municipality and are located between 30 and 45 minutes outside of the city of Cape Town. These communities experience similar social and economic challenges, although they are not as densely populated. Employment in these areas is mainly through the wine and fruit farms, although the seasonal nature of this employment contributes to the economic

challenges experienced. The legacy of the 'dop' system (payment of farm laborers in alcoholic beverages) remains and contributes to the prevalence of fetal alcohol spectrum disorders in these areas, although the prevalence of these disorders has increased in urban areas as well (May et al., 2019).

The focus groups were conducted in May 2022 and were approved by the institutional review board at the University of Witwatersrand. The primary objective of these focus groups was to obtain insights on the applicability and appropriateness of the assessments intended for use within the sociotechnical platform, as well as gauge the HVs' perceptions and attitudes toward the concept of using WhatsApp as a platform for the development and hosting of the assessments. I conducted a total of 19 60-minute onsite focus groups with HVs in four communities (two urban and two rural) over a period of two weeks. The research team worked in collaboration with the local leaders of the community-based organization to meet with participants at a designated location in their community. The team traveled to these locations to meet with participants to further reduce the burden of travel. During each session, a translator was available to ensure that participants were able to share their experience in their home language (e.g., Xhosa, Afrikaans, or English). Participants engaged in two sessions over the course of two weeks and were compensated monetarily for their attendance each week. During focus groups, another researcher and I took turns leading each session, thus there was always at least one other researcher took notes and kept a running journal of observations that were reviewed. At the end of each group session, researchers briefly discussed interesting observations and findings that were noted.

Week one focus group discussions focused on exploring the work routines, procedures, and social-emotional developmental needs of the children in their communities to help determine the potential impact of the WhatsApp tool on their existing work processes and gather their perspectives on the assessments chosen. As such, questions in this session focused on understanding participants' work responsibilities, the community's attitude towards social-emotional development, common work-related challenges, and the resources used to facilitate ECD. This session concluded with a brief introduction to the assessments and a WhatsApp paper prototype, and HVs were asked to give general feedback (e.g., first impression) on the tool. Figure 3.1 shows a screenshot of the prototype the team printed out to solicit general feedback.

Figure 3.1: First proposed solution for WhatsApp chatbot
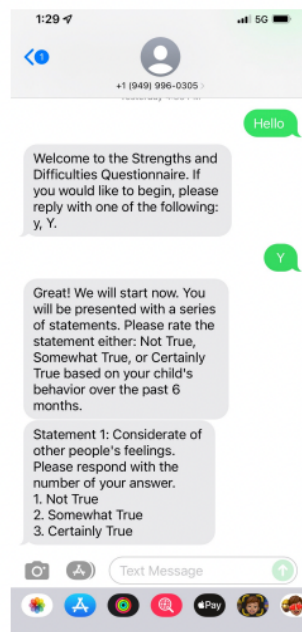
In week two, the second set of focus group discussions was conducted with the aim of obtaining feedback on the implementation of the WhatsApp chatbot and assessing the willingness of caregivers to participate in the assessments. The participants listened to three scenarios read aloud that each described the steps taken by HVs to administer the SDQ with a caregiver, then responded to a series of questions. The SDQ assessment was chosen as the primary focus due to the previous set of focus group discussions, in which the HVs highlighted building trust with caregivers and engaging them in their child's early learning as their main challenge during the week one focus group.

Table 3.1: Focus Group Participant Data

Focus Groups	Session 1: # of HVs	Session 2: # of HVs
Urban Group 1	6	6
Urban Group 2	7	7
Urban Group 3	4	4
Urban Group 4	5	5
Urban Group 5	8	8
Urban Group 6	4	4
Rural Group 1	5	5
Rural Group 2	5	5
Rural Group 3	4	7 *Rural groups 3 and 4 combined
Rural Group 4	3	

3.2.3 Data Analysis

Throughout the study, the research team maintained personal notes and reflections for the sessions. I met with the other researchers at the conclusion of week one focus groups and conducted an affinity diagram activity (Martin, Hanington, and Hanington, 2012) where we clustered notes regarding our observations for each focus group community. We then went through the process of journey mapping (Howard, 2014) the HVs ECD work experience, noting strengths, challenges, concerns, and opportunities for technology, as well as the assessments. This initial analysis helped to create the scenarios for the second focus group session during week two. At the end of the week, after the two focus groups, the research team met again to discuss key insights, tensions, barriers, and opportunities for the technological design of the WhatsApp chatbot. Large parts of the conversations uncovered tensions between technology constraints and HVs in low-socioeconomic environments in South Africa. This called for analyzing the data to understand design and technical considerations when creating technological solutions for REM populations in low socioeconomic environments in South Africa.

A transcription service in South Africa verbatim translated and transcribed the focus group data. On receiving the transcriptions, I analyzed the data through the process of provisional coding (Saldana, 2013). Provisional coding is a qualitative coding method that begins with a list of researcher-generated codes based on what preparatory investigation suggests might appear in the data before they are analyzed (Saldana, 2013). These codes were initially developed from early reflections and notes taken during the interviews prior to transcription and confirmed by the research team prior to analysis. After analysis, I met with the research and development team to

discuss findings and any modifications or additional findings noted in the coding

process.

3.3 Results

I present findings on the perspectives, work experiences, and preferences of HVs

for the use of ECD assessments via a WhatsApp chatbot. These findings highlight the

importance of building community trust, striving for a healthy work-life balance, and

overcoming constraints based on socio-economic inequities when designing a long-term

technical tool for low-income communities in South Africa.

3.3.1 Building Community Trust

The impact of home-based work for ECD is predicated on the establishment of

trust between HVs and caregivers (Munns et al., 2016). The cultivation of a trustworthy

relationship between these two parties is required to maintain frequent home visits and

foster the development of young children. However, in the early stages of collaboration,

HVs may encounter challenges in building trust with the caregiver. In some instances,

caregivers may be hesitant to allow other HVs into their personal space and may not

readily extend trust. This reluctance to trust can impede the ability of home visitors to

work with children within the designated time frame and may pose challenges to the

implementation of new assessments.

3.3.1.1 Challenges When There Is Little to No Trust

Home visitors have reported encountering a range of challenges in working with

caregivers who are skeptical or cautious of the ECD program. These challenges may

manifest in caregivers viewing HVs as government social workers who could potentially

report them to the Department of Social Development (government child protective

services) for perceived wrongdoings in the household or with the child.

> *"We advise them to take their kids to school, some kids are not going to school. As my colleague said that is why they see us as social workers because they think when you do that [give advice] you are going to take the kids from them or you are going to call the police and that results in the kids being taken away." - **Urban1**

In turn, caregivers may exhibit blocking behaviors, such as refusing to open the

door for the HV to complete a visit with the child or refusing to answer any questions

during a home visit. Caregivers may sometimes withhold information from the HV about

the child's well-being because they are afraid of being reported.

> *"Because even with the projects that we are doing, they don't really trust us. They think we're going to report whatever they're telling us, so, with these questions [assessments], they'll make them more suspicious." - **Rural3**

Additionally, HVs stated that some caregivers are hesitant to reveal their

personal circumstances to them due to them living in the same community as one

another. Some caregivers may express concern about other members of the community

becoming privy to their private affairs, thereby hindering their willingness to disclose

pertinent information to home visitors.

> *"Yes some of them are scared but some of them are excited because they want to see how it works and how will they at the end of the day save their babies; because some of them can't trust to just talk to someone because they're scared you'll talk to someone else and tell them about their problems." - **Urban4**

This illustrates the conflicting feelings that some caregivers are experiencing,

with tensions between wanting to receive assistance and the apprehension of being

vulnerable and opening up about their circumstances.

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3.3.1.2 Strategies to Build Trust

To build a trustworthy relationship with caregivers, HVs practice professionalism, share personal experiences, and act empathetically toward their circumstances. One urban community explored role-playing as a tactic for a workshop with caregivers to get them to share their own experiences with one another.

> *"And with the ladies we also do role play like for women's day, there are people who sit there with their pain unable to express it and then the role-playing helps to bring it out and they start crying and telling you what happened to them." -**Urban4***

HVs mentioned that it can take weeks or months for some caregivers to be willing to participate in an assessment. HVs have a natural tendency to create trustworthy relationships with the caregivers and children they assist based on shared life experiences and community connections. Due to the lack of trust some caregivers may have, introducing a new assessment tool that they are unfamiliar with can be a challenge. People living in low-resource communities in Cape Town have mistrust and hopelessness in institutional systems like education and healthcare because of the history of the government not helping to address issues in providing adequate service delivery and resources (Masuku, Mlambo, and Ndlovu, 2022).

3.3.2 Striving for a Healthy Work-Life Balance

Home visits for ECD attract passionate individuals who are committed to driving change (Sandstrom et al., 2020). Those who pursue careers in community work often invest significant personal time and energy outside of their work hours on necessary duties, such as client management and travel (Alitz et al., 2018). I define healthy work-life balance as an optimal balance between work obligations and personal life. Maintaining a healthy work-life balance is crucial for individuals engaged in community work, as it enables them to sustain their efforts over the long term. HVs, for instance,

report a strong sense of fulfillment in their community work. Nevertheless, they also face

challenges related to their work-life balance, particularly in terms of setting clear

boundaries. It is essential to recognize that extended periods of community work without

adequate attention to work-life balance can quickly lead to burnout and high turnover

rates for the ECD program (Burrell et al., 2009). Therefore, it is important to prioritize

and implement design solutions of less complexity to prevent adding extra labor.

3.3.2.1 Challenges: Boundary Setting and Time Management

During the focus group sessions, HVs discussed the challenges they face with

regard to maintaining boundaries and establishing a balance between professional

responsibilities and personal lives. They highlighted the unique difficulties of working in

the same community as the people they serve, given the close proximity and blurred

lines between their personal and professional lives. HVs elaborated on how the

absence of strict boundaries could present difficulties at work, affecting her home life.

For instance, one HV recounted an instance in which a caregiver crossed a boundary.

> *"when people come there for the porridge on the weekend, we get those big adults who say it's for the child but then the child already got their wheat porridge. So, we had to be very assertive, me and [redacted] because it would also cause problems in her house, you see with her husband because they came knocking [at HV's home] on a weekend." - **Rural2***

In addition to boundary setting, HVs often struggle with time management due to

scheduling conflicts and unexpected circumstances. HVs are expected to visit at least

5–10 families a day for 45 minutes each during weekdays. The travel time required by

HVs varies based on where within the community each family lives. It is not uncommon

for HVs to encounter situations where they may need to allocate additional time for a

particular family during a home visit. Such scenarios may arise due to various factors,

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including but not limited to the complexity of the family's circumstances or unexpected

events that may require further attention from the HV. As a result, the HV's schedule

may experience some degree of disruption or deviation from the anticipated time

allocation. One HV recounted:

> *"...Where timeframes are concerned, we can't always go in the time that they say, that 45 minutes. If you open your eyes, you can see they need us. You can't just leave the parent and move on."* **Rural2**

Scheduling conflicts may arise, resulting in HVs being compelled to expedite their

home visits. This may call for the need to effectively manage their time to account for

travel time between households while also accounting for breaks to rest and recharge.

> *"Maybe, she can do 7 houses within those 30 minutes because they are all 10 minutes long and then she goes and says that she could only cover 6 or 7 houses but we must also think about the fact that she [FCW worker] needs to walk from house to house, from street to street. Within that time, she also needs a break."* - **Rural3**

The HV's ability to manage their time effectively while providing quality services

to families is critical to the success of home visiting programs. Thus, while occasional

deviations from the schedule may occur, HVs must endeavor to maintain a balance

between attending to the unique needs of each family and adhering to the program's

overall objectives and timelines.

3.3.2.2 Strategies to Maintain a Healthy Work-Life Balance

Throughout the focus group sessions, HVs emphasized the significance of

maintaining a healthy work-life balance and shared various strategies for practicing self-

care and achieving balance in their work. Notably, HVs discussed the importance of

performing daily mental health checks to ensure that their personal concerns do not

interfere with their work. They stressed the importance of approaching everyone they meet with respect, particularly as they enter people's homes, and of bringing positive energy to their work. Some groups reported meeting regularly to plan for the week, which helps them ground themselves before starting work again. The focus group sessions not only served as a platform for gathering data on the perspectives of HVs but also functioned as a therapeutic space for HVs to discuss issues that they may not typically have the opportunity to discuss with one another, which is also seen in other literature (Lehoux, Poland, and Daudelin, 2006). Given that many HVs have minimal daily contact with each other, the focus groups provided an opportunity for them to connect with and learn from one another.

According to an HV in a rural community, HVs who have been active in the program for a longer amount of time educate newer HVs on how to maintain a healthy work-life balance.

> *"When we were still young in the program, people used to walk all over us. We didn't know how to balance, but as we got older on the program, we start to learn how to find a balance. As I said, we don't really structure our day as we don't know how it's going to be out there, but balancing is very important, otherwise, it's going to tire you." - Rural2*

She continued to explain her personal account of receiving guidance on how to balance this work with her personal life.

> *"I told her I can't take this, she told me no, no, no, you have to split this thing; you have to you know, so, that's where the balance is concerned where [redacted] taught me not to get emotional or angry and too involved in this thing because it does get to you. [Redacted] taught me how to balance the thing, otherwise, it's going to affect you in your personal life."- Rural2*

The insights provided by the HVs highlighted the importance of design considerations specific to designing a WhatsApp chatbot for long-term use in ECD community work. In particular, attention must be given to creating a tool that is simple, efficient, and user-friendly, given the time constraints and work demands of HVs' daily work.

3.3.3 Constraints Based on Socio-economic Inequalities

The socioeconomic inequalities present in South Africa pose significant challenges to the effective utilization of technology, both in terms of technical environmental constraints and social determinants of health. Technical environmental constraints, such as scheduled electricity blackouts, unreliable internet connectivity, and data storage, can impede the ability of HVs to complete their ECD home visits. Moreover, social determinants of health, including food insecurity, hunger, and unemployment, can shift the focus away from ECD, despite its critical importance. The findings present the ways in which technology can highlight and exacerbate the inequities present in low-income communities in Cape Town.

3.3.3.1 Technical and Environmental Constraints

Each HV is equipped with a dedicated smartphone for work-related purposes, which allows them to leverage the official work app for their organization, schedule home visits with caregivers, and download relevant resources for children's development. While the use of work phones has been beneficial in enhancing the efficiency of work processes for the HVs, it has also been observed that navigating the community with these devices can present certain challenges. In a specific instance, two HVs recounted being robbed at gunpoint for their work phones merely a week

before the scheduled focus group session, highlighting the potential risks associated

with using such devices in the context of community work.

> *"They were robbed with their devices, it was in their pocket still, but the guy came up and pointed them, and they had to empty their pockets.."* - **Rural1**

HVs in another community share similar experiences of needing to be careful

when using their phone in public or being recognized as an HV that may have a

smartphone in their possession.

> *"Oh ja you don't want to give it they will tell you they'll stab you if you don't give it, so you just give it because you don't want to get hurt."* - **Urban2**

Several HVs from the same community where the robbery occurred reported

feeling unsafe using their work phones during home visits, given that certain households

they visit may exhibit "*suspicious"* activities. As a possible solution to address this

issue, some HVs suggested carrying paper versions of the assessment during home

visits and completing the assessment through the WhatsApp tool once in the safety of

their own homes. Due to safety concerns, HVs often take precautions when navigating

the community by keeping their phones hidden.

The limited access to mobile phones also poses a challenge for communication

between HVs and caregivers outside of home visits, especially since many caregivers

do not possess mobile phones, particularly in rural areas. As an example, an HV

working in a rural community noted that only a few caregivers within her residential

block owned a phone. When an HV manages to get in touch with one caregiver, that

caregiver travels to each residence in the community to inform the other caregivers

about the schedule and timing of the upcoming home visit.

*"The families I work with you at least you know it's in one area, I know that people all of them are in one area so if I have one phone number and I call them then that one I'm calling will announce the message the whole or all of them, so Tuesday when I go here by the new house and I call two or three people there because I have three numbers for that, one of them will go and spread the news just like that." - **Urban2**

Additionally, internet connectivity and data accessibility are major challenges for those who own cell phones. A family may be residing in an area where there is little or no Wi-Fi connection, making it difficult to make and receive calls or text messages from HVs.

*"And also other parents don't even have internet or cell phones for the results to be sent via messaging." - **Urban6***

*"Network is beating us because I'm staying there by the shacks and MTN's connectivity is not strong, sometimes you have to go to the Pastor for network and then I have to walk from my area to the other area and sometimes even when we've walked to the Pastor, the network is still a challenge." - **Urban4***

The HV explained how the strength of the network connection in an urban community varies depending on your location within that community. To access a stronger network, you may need to travel to a different part of the community. However, popular areas known for having strong network connections may not always be reliable. South Africa has been experiencing an electricity crisis since 2008, which has led to scheduled electricity blackouts to avoid overloading the main power grid. The HVs also mentioned having an alternative method for completing the assessments in case their phones are inoperable due to these blackouts.

*"In case there's load shedding and the device is indeed dead and you can't... at least you've got a backup and you can manually do it, maybe go back when the device goes on and then put it on the phone and then do it... but I think... I don't know, I still like the old school; I like the manual…" - **Rural5***

Several HVs expressed interest in having a physical copy of the assessments as a contingency measure if access to the WhatsApp platform is not available when needed to complete the assessments.

3.3.3.2 Social Determinants of Health

Young children from low socio-economic backgrounds in South Africa are sometimes unable to attend preschool because their caregivers cannot pay the associated fees. The inability of families to meet basic needs can significantly impede the growth and development of children. As such, HVs must prioritize addressing any real-life challenges that may hinder a child's learning before engaging in learning activities during home visits. It is common for much of the allotted time for a home visit to be dedicated to addressing non-ECD-related matters such as scheduling conflicts with caregivers, seasonal changes, food insecurity, hunger, and household-related issues. One HV explained:

> *"Most children are suffering because you know, when the child doesn't get the…I don't want to say the basic needs but is not supported holistically, so the child suffers. You'll find that the child's body and mind are not corresponding, i.e., their brain is not functioning in accordance to their age you see and then you find that this child is slow because of the circumstances at home." - **Rural1***

Rural communities present unique challenges in terms of transportation accessibility to facilities, such as clinics and hospitals, as well as access to employment opportunities. For instance, an HV from a rural community highlights the challenges of working during the winter season. Farmland surrounds this particular community, and seasonal farm work is the main source of employment in the area (Cullis et al., 2019).

Consequently, many caregivers experience a period of unemployment during the winter season due to the lack of other employment opportunities available in the region.

> *"It affects us very much because no one is interested now in winter, they don't want to open the doors, like yeah, they are very negative this time."* - **Rural1**

This finding suggests that present circumstances impose notable difficulties for HVs in their engagement with children and caregivers, particularly during the winter season. These challenges hinder the ability of HVs to complete the proposed assessments effectively. The socioeconomic disparities that exist in these areas make these problems worse, necessitating the use of ad hoc techniques by HVs. Given their intimate familiarity with the communities they serve, HVs possess a unique understanding of the contextual factors that impact their work, enabling them to leverage this knowledge to better meet the needs of families. However, the digital divide—disparities between access to internet technology (Van, 2020)—remains a salient issue that impedes the implementation of technical solutions at scale in non-western societies. Any technical solution intended for community work in low-resource settings should incorporate specific features that mitigate the impact of interruptions and data loss.

3.4 Discussion

This study aimed to examine the work processes, experiences, and preferences of HVs to design an assessment tool via a WhatsApp chatbot for children's social-emotional well-being. It is widely recognized that low-income REM communities in South Africa experience significant challenges in accessing mental health support due to societal and environmental complexities (Marais and Petersen, 2015). By

incorporating cultural responsiveness into the design process of digital mental health interventions, researchers can tailor solutions to address the specific factors that impact these communities, thereby increasing access to and engagement with mental health support.

Digital support for mental health interventions provides a promising opportunity for increasing access to mental health services among REMs. However, there are several challenges associated with the implementation of such technologies. One critical factor is the establishment of trust between caregivers and HVs. Building trust is essential for the success of this digital intervention due to the environment in which it is being given. Home-based ECD work involves a non-family member who is also a member of the very same community to provide in-home ECD education. This can be deterring for some families; they may not feel comfortable disclosing personal information to another member of the community. Consequently, it is necessary to consider how technologies can be designed to foster trust.

One research study that explored design considerations for a mobile application to support the management of anxiety and depression among Black American women (McCall et al., 2022) found that trust about ownership of the application, privacy, and data use was a major concern. Researchers in the study recommend the need for transparency and clear communication within the intervention. A group of researchers exploring trust and human factors in the design of healthcare technology (Borsci et al., 2019) explains how aesthetically designed technology is deemed more reliable than those that are less visually appealing. Designers can establish trust in a product's experience by strategically designing specific elements to appeal more to their specific

audience. This strategy attracts customers who feel the system is well-designed, trustworthy, and satisfies their needs, irrespective of whether it is not trustworthy. They call for a better understanding of trust-building factors and dark patterns (deliberate designs that mislead) in healthcare technology, which is critical for preventing violations of trust and maintaining user safety. This chapter's research study contributes to the empirical findings that can aid in understanding specific factors within the social determinants of health presented in the NIHMD research framework that can impact REMs' trust relationships with technology-enabled mental health support. Researchers can continue to build upon this work by investigating the specific thought processes and experiences of REMs with healthcare technology to determine how we can best provide transparent health and data privacy information when designing digital support solutions. This can include investigating cultural differences, health literacy, and attitudes toward health technology.

Technical constraints pose another challenge in providing digital mental health solutions. Lack of digital infrastructure, community violence, and in-home conditions can all impede the usage and efficacy of digital support within the four low-income communities studied in Cape Town, South Africa. Therefore, a comprehensive understanding of the interpersonal and community environments, provided in the NIHMD research framework, is essential when designing digital mental health solutions. By considering the broader context in which these interventions will be implemented, designers can identify and address challenges within a specific level of influence that may arise.

The health technology field has vastly explored designing healthcare technology for low-resource environments. A study focusing on developing an early prototype of a low cost, portable dialysis device for the Indian market (Rose et al., 2020) explains the importance of making appropriate adaptations for the context and population depending on the community's or country's laws and circumstances. For digital mental health interventions, the NIHMD research framework can aid researchers in determining appropriate adaptations for specific REM populations by investigating the levels of influence of health determinants. By understanding the interpersonal and community environments and not just the individual circumstances that may challenge the use of the WhatsApp chatbot, I was able to design solutions for those challenges. The findings highlighted the need to incorporate culturally responsive design solutions that encompass the needs of the individuals both administering and receiving the well-being assessments, such as accommodating the multiple languages spoken within the communities and designing the flow of the assessment to be time-efficient and user-friendly to consider potential challenges such as rolling blackouts and limited access to work phones. This study emphasizes the importance of incorporating cultural responsiveness into the design of digital mental health interventions by considering the specific determinants of health that impact the design and implementation outcomes.

3.5 Summary

The goal of this research was to understand the challenges and opportunities of designing and implementing a socio-technical tool for home-based ECD assessments in South Africa. I present findings from 51 HVs in low-income communities in Cape Town, South Africa, on the work processes, experiences, and preferences of HVs with the goal

of designing an ECD assessment tool via a WhatsApp chatbot. Overall, the use of ICT for health and well-being in South Africa shows great promise for supporting low-income communities, particularly regarding ECD. However, the technology used to facilitate ECD activities requires careful consideration of the unique societal constraints and work processes that shape these environments, therefore requiring the design of culturally responsive and sustainable solutions.

In this chapter, I answer the research questions: How do intersectionality and social determinants of health affect how racial-ethnic minority communities seek and engage with digital mental health solutions? And how do racial-ethnic minority communities envision the design of digital mental health support? The findings highlight building community trust, a healthy work-life balance for HVs, and constraints based on socio-economic inequalities as barriers to seeking and engaging in digital support ECD assessments. HVs expressed that a non-technical paper-based solution will be useful in cases where their work phones are inaccessible.

My analysis contributes to the literature by providing insights into design considerations for culturally responsive technical tools in complex real-world settings. By offering design implications for deploying ICT in complex real-world settings, this research emphasizes the significance of including users in the design and decision-making processes, and advocates for more design work to be done in the Global South. Overall, this work provides important guidance for designing culturally responsive tools that prioritizes data privacy and retention, accessible language, and simplicity in home-based ECD work.

Chapter 4. Designing an Evidence-based Mental Health App Intervention Alongside University Students

This chapter describes the development of an evidence-based mental health application for REM University students. I provide a brief description of the research motivation, followed by the methods of the various design sessions. I then present the study results and discuss its context in relation to the NIMHD Minority Health and Health Disparities Research Framework.

4.1 Motivation

The number of university students experiencing mood disorders, such as anxiety has risen sharply over the last decade (Blanco et al., 2008). The social and economic difficulties that manifested during COVID-19 (e.g., public health mitigation efforts such as social distancing and loss of income) have resulted in increased stress and anxiety among students. Students' mental health has deteriorated significantly with full-time remote learning in March 2020 (Xiong et al., 2020), experiencing feelings of isolation, concern about their academic success, and significant financial pressures (Browning et al., 2021). Additionally, historically marginalized students report higher levels of anxiety and depression than their non-underrepresented peers (Eisenberg, Hunt, and Speer, 2013; Herman et al., 2011).

Counseling services are increasingly relying on digital mental health applications to bridge this gap, enhance counseling services, and give more access to mental health resources (Johnson and Kalkbrenner, 2017; LeViness et al., 2018). Because they are typically affordable and scalable (Donker et al., 2015), digital mental health applications are a viable strategy for college students who are tech-savvy and have easy access to

them (Lattie et al., 2020). However, participation remains low (Baumel et al., 2019; Flett et al., 2019; Pratap et al., 2020; Torous et al., 2018). Mental health applications were by and large not designed with the unique needs of university students in mind, and students tend to have poor views of them (Kern et al., 2018; Levin et al., 2020; Palmer and Henderson, 2019). Designing technologies for this population requires a comprehensive understanding of the unique needs of young adults and the social contexts within which they are situated.

In this study, I present findings from a series of participatory design sessions with 20 university students to aid in the design of a Cognitively-Based Compassion Training (CBCT) mobile application intended for the mental health of undergraduate and graduate-level students. The goal of this study was to understand how university students use and perceive existing technical and non-technical resources and envision support for their mental well-being. This is the first study to adapt strategies from CBCT into a mobile application for university students.

I identified key themes that college students consider when engaging in digital mental health applications. Findings from this study show that students perceived the need for the application to 1) provide healthy reminders 2) connect with peers and counselors 3) support personalized experiences; and 4) support informational and instrumental life skills. I discuss implications for designing evidence-based mental health applications for university students to balance their need for self-help and professional support, contextualize emotional skills with life skills, and balance trade-offs in personalization and privacy. The main contributions of this work are 1) designing an evidence-based mental health application alongside REM (majority Asian and mixed

race) university students, and 2) design implications for REM university students to use evidence-based tools to balance their need for self-help and professional support, to contextualize emotional skills with life skills, and to balance trade-offs in personalization and privacy. These contributions emphasize the type of community support and institutional resources that can be provided to address mental health disparities for REM university students. In addition to highlighting how to design with REM students rather than for them. This study addresses the following research questions:

> **RQ2:** How do racial-ethnic minority communities envision the design of digital mental health support?

> **RQ4:** What opportunities exist for designing digital mental health support to promote and improve emotional and social well-being for racial-ethnic minority communities?

This work is also published in the conference proceedings of HCI International 2023 (Williams et al., 2023).

4.2 Methods

In this study, I conducted a series of participatory design workshop sessions which each centered on a specific design activity: 1) card sorting 2) storyboarding and user personas; and 3) design mockups. All the activities were conducted via the Zoom video-conferencing platform and lasted approximately 90 minutes. Participants were recruited via email from the University of California Irvine listservs and student Facebook groups and then split into four groups per activity. Participating in all three design workshops was not required. However, all participants (N = 20) were invited to

all sessions, and the majority attended all three. Each workshop activity included 4-6

participants, depending on student availability during the times of the workshops.

Table 4.1: Participant Demographic Data

ID	Age	Gender	Race	Card Sorting (N = 18)	Storyboarding (N = 18)	Design Mockups (N = 19)
P1	19	Female	Asian	X	X	X
P2	20	Female	Asian	X	X	X
P3	20	Male	White	X	X	X
P4	21	Female	Asian	X	X	X
P5	22	Male	Asian	X	X	X
P6	20	Female	Mixed	X	X	X
P7	21	Male	Mixed		X	
P8	25	Female	Asian	X	X	X
P9	25	Female	Mixed	X		X
P10	21	Female	Asian	X	X	X
P11	24	Female	Asian	X	X	X
P12	22	Female	Asian	X	X	X
P13	22	Female	Unknown	X	X	X
P14	21	Female	Asian	X	X	X

P15	21	Female	Unknown	X	X	X
P16	24	Female	Asian	X	X	X
P17	21	Female	Asian	X	X	X
P18	20	Nonbinary	Asian	X	X	X
P19	18	Female	Asian		X	X
P20	20	Female	Asian	X		X

4.2.1 Card Sorting

There were 18 students who participated in the card-sorting activities. In this activity, participants organized pre-made "cards" of potential mental health app features. I asked participants to collaboratively discuss and vote together on whether a card that had a potential app feature should be placed in the following columns: a) absolutely want to have, b) potentially want to have, and c) would not want to have. As a group, students used Whimsical, a collaborative online application, to place a total of 20 cards across these categories. The card with the most votes was placed in its respective column. Figure 4.1 shows a completed card sorting question from a design session. As the lead facilitator, I shared my screen with the participants and moved cards to columns based on instructions from the participants. The Whimsical Board was not accessible directly to participants in order to maintain their privacy and anonymity. Lastly, a series of questions related to certain potential features of the app were asked of participants after completion of the card sorting activity.

Figure 4.1: Card sorting exercise from one design workshop session

Would Absolutely Want To Have	Would Potentially Want To Have	Would NOT Want To Have
Goal setting	Mood-boosting activities when you are low or anxious	Random pop-up tips to manage stress have its own section
Video chatting or texting with licensed therapist	Track and see your daily meditation progress	Themed missions and challenges
Daily meditations for your morning and evening	Selection of personalized content in the form of articles and videos	
Daily mood tracking	Connecting with peers	
Reward system for completing tasks	Daily affirmations	
Customizable avatar that serves as a coach	Set reminder notifications to complete activities	
Meditation options for people of all skill levels	Journaling space	
Different tracks/ categories that focus on specific areas of life	Support from an inclusive community and mental health experts	
Recommend suitable therapists	Dark mode and light mode settings	
Content customized based on your needs and goals	Customizable theme (choose your own color palette)	

4.2.2 Storyboarding and User Personas

A total of 18 students participated in the storyboarding and user-persona activities. Each of these workshops began with participants collectively creating two user personas. I asked participants to think about the types of students that will "most likely use or be in great need of a mental health app geared towards college students". Figure 4.2 shows a completed storyboard session of a student scenario who is seeking

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professional and self-help resources to alleviate anxiety. Participants listed pain points, wants/needs, and goals for the persona. After creating the two personas, participants collaboratively created a story about what an ideal experience would look like for a college student to use a mental health app geared towards them by choosing one app feature that a student would utilize based on the problem that they have.

Figure 4.2: Example of a storyboard completed during a workshop session
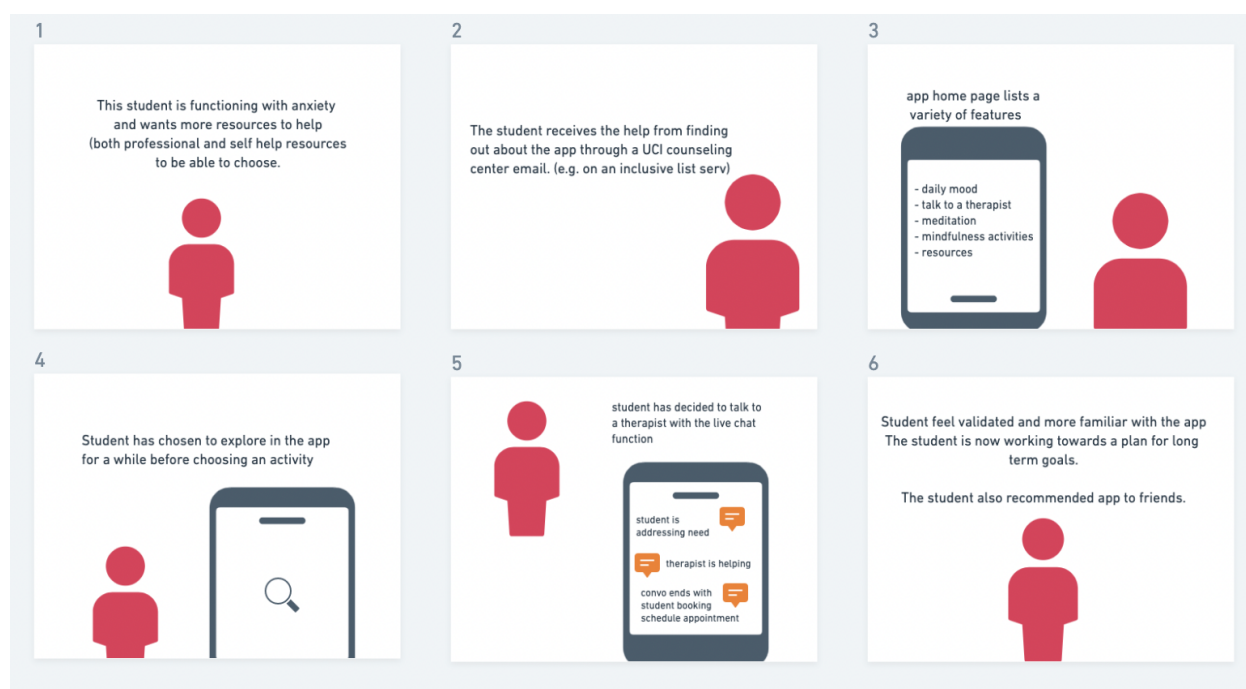
4.2.3 Design Mockups

A total of 19 students participated in the design mockup sessions. I asked participants to choose between two scenarios to design a mock-up for a mobile application: 1) finding a therapist in the app and 2) personalization features in the app. Each participant was given access to a design software called Canva[5] with a template

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[5] Canva: https://www.canva.com/

to create their app prototypes. Figure 4.3 displays a student-designed app landing page

mockup designed with Canva. Participants also had the option of using their own design

software or at-home materials to create their app prototype. One participant decided to

sketch with pen and paper to allow their best version of creativity to come to fruition.

Participants were given 45 minutes to design their prototypes following a series of

questions asking participants their opinions and preferences on popular health apps on

the market, such as Calm[6] and the Nike[7] app.

Figure 4.3: Example of an app landing page created during a design mockup session

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[6] Calm app: https://www.calm.com/

[7] Nike app: https://www.nike.com/ntc-app

4.2.4 Data Analysis

I, along with another researcher, analyzed the data using a combination of inductive and deductive approaches, as described in this section. Given the goal of translating an evidence-based intervention to the digital world, much of the analysis was centered around the elements of that intervention, just as many of the design activities were developed to explore those considerations. However, emergent themes were also uncovered during this process, as described in the results section. All twelve participatory design workshops were audio and video recorded and transcribed through Zoom video conferencing software, which was then manually corrected for transcription errors by the first and last authors. I facilitated all workshop sessions, de-identified participant information from the transcripts, and replaced participant names with their respective participant identification numbers.

Deductive coding focused on three key areas. First, I looked for evidence of interest in or concerns about specific elements of CBCT (e.g., reflection on emotions, mindfulness, and attention and focus). Second, I examined attitudes toward particular design heuristics that the research team had identified prior to the workshops (such as the protection of sensitive patient information and the usability of the tools under duress). Finally, I built on related research (Williams et al., 2021) that found that students want any new applications to integrate with existing campus services and support virtual connections among peers and professionals.

Inductive coding focused on emergent considerations that were not well articulated by our three areas of interest in deductive coding. To accomplish these goals, each of the researchers read all the transcripts independently to immerse themselves in the findings. We then met to discuss overall themes, identify key aspects

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of the student's feedback, and brainstorm about app engagement: in-app reminders, virtual connection to others (i.e., peers, counselors), personalization (i.e., aesthetic, content), and knowledge of evidence-based resources.

We then analyzed the transcripts again with specific attention to these categories, coding them and identifying evidence in the form of both quotes and artifact exemplars in each of these categories. Throughout this iterative process, I met regularly to discuss the findings and analysis of specific exemplars. Finally, we each wrote memos detailing our findings, both independently and collaboratively. These memos and the exemplars identified in this process, along with those identified through deductive coding, then became the basis for the results section that follows.

4.3 Results

The findings provide insight on the particular needs REM university students look for when seeking support through mental health applications. In this section, I highlight key themes from these results: 1) healthy reminders 2) human connection 3) personalized experiences; and 4) informational and instrumental life skills. The results of the analysis indicate that REM students value a variety of social, informational, and active intervention supports offered in a tiered and personalized fashion. Additionally, this support was seen to be most useful when delivered using modalities of interaction most appropriate to their needs and contexts.

4.3.1 Providing Healthy Reminders

CBCT uses contemplative exercises, such as training in emotional awareness and targeted reflective activities (Ash et al., 2019). Thus, the participatory design activities were initially scoped to include some discussion around reminders and

prompting of such activities through any technological system that might be developed. Additionally, notifications and reminders of this type have been demonstrated in other research to improve student self-regulation and well-being (Moraveji et al., 2012; Sullivan, 2019; Lee and Jung, 2018). A survey study of notification designs in commercial mHealth apps found a correlation between sending personalized health notifications and increased engagement (Woodard et al., 2021). However, despite their efficacy in research studies and potential to increase engagement, students in past co-design work reported not being interested in goal-setting or personal assistance to provide suggestions (Alqahtani et al., 2021).

Despite the clinical evidence of efficacy and the support of my clinical partners, the findings from analyzing the output of the participatory design sessions indicate that such implementations may not be as straightforward as translating traditional CBCT and mindfulness exercises to the digital realm. As students become more digitally connected (Arthur-Nyarko et al., 2020), and as universities attempt to automate and move student services online (Griffin, 2020), they will be increasingly interrupted by such reminders, which can be distracting and problematic (Rozgonjuk et al., 2019). Studies have demonstrated that mobile phone notifications can be a significant contributor to distraction and inattention among students, which can ultimately impact their productivity (Kaminske et al., 2022; Smith et al., 2021). Thus, a careful balance between the ability for reminders to be supportive and the challenge of interruptions will be essential in developing mobile tools for this population.

Students in the workshops, by and large, viewed reminders as generally helpful, despite recognizing that they can be intrusive and disruptive (Mark et al., 2008). For

example, one student described feeling frustrated about the volume of notifications while welcoming the ability to configure them.

> P8934: I feel like every single app has an option to opt-in for notifications so that's also based on the individual and they could just [decide] how [or] if whether or not they will want to be notified.

The students described how receiving reminders could be helpful, particularly in relation to outsourcing some of the cognitive load of their busy schedules. In particular, students who are adjusting to the transition from secondary to post-secondary school can struggle with the need to develop structure in their lives (Goudreau and Knight, 2018).

> P5531: I'm also thinking, maybe more like finding structure in the day, because I know that was something that I struggled with my first year of undergrad [...] just feeling very unstructured.

However, not all reminders are the same. Students expressed that notification prompts in the form of affirmations or reminders to relax or breathe would set a relaxing and encouraging tone in contrast to a notification prompting them to complete or start a task. For example, one undergraduate student described their interest in being reminded of positive approaches:

> P5628: You will be reminded to take the day in a very positive manner... Like 'oh don't forget don't forget that', 'don't forget [to] take a breath' and things like that. And this one [reminder feature] kind of ties in a little bit with affirmations but I think the affirmations one is my personal favorite.

A focus on positivity may help combat any challenges related to notifications that are perceived as too frequent. Overcoming such perceptions may be important to long-

term success given the potential for a greater frequency of notifications to encourage greater exposure to intervention content (Morrison et al., 2018).

Reminders can help students develop self-regulation between counseling sessions, classes, work, and other elements of their busy schedules. In particular, the students in the workshops frequently described stress and anxiety over coursework deadlines, a lack of socialization, and Zoom fatigue from attending the school year online during 2020-2021. One research study found that the volume of notifications from mental health apps did not necessarily lead to information anxiety and avoidance in university students, but their responses were dependent on the content and source of the app and their situational ability to attend to the notifications (Smith et al., 2021). This suggests that the usefulness of the content can determine whether students will pay attention to a notification. Health researchers and mobile application developers may benefit from this finding by ensuring that their app's notifications are tailored to the individual's situational abilities and preferences.

Most participants did not want high volumes of generic reminders but emphasized the need for tailoring the content of the reminder to their mental state (e.g., stressed and needing to relax) and to indicate the time needed for attending to that content. This way, the reminders would be sensitive to the situational ability of the participant, increasing the chances that students could actually attend to them and find them helpful. In figure 4.4, a student designed an app screen to display affirmations as a form of relaxing reminder.

Figure 4.4: A student design mockup displaying how they envision an affirmation being displayed in a mobile application
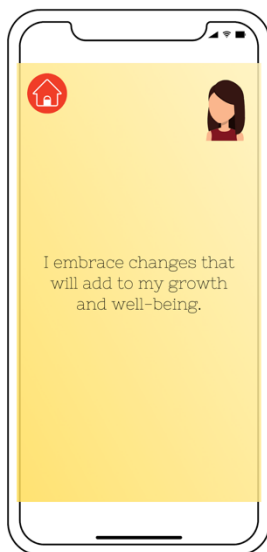
4.3.2 Human Connection

Within the context of this work, I define "human connection" as the interaction and relationship development between two or more people. Participants in the workshop emphasized the significance of human connection—in the form of both peer and professional support—just as a previous study (Bhattacharya et al., 2021) had done. Typically, a combination of in-person and online counseling and support groups provided peer and professional support. Since the start of the stay-at-home mandate, only virtual support has been provided. Naturally, students viewed technological support as beneficial to providing human connection. I examine students' interests as well as the possible effects of connectedness through mobile mental health solutions.

4.3.2.1 Seeking Peer Support

During the COVID-19 pandemic, students had little to no in-person social interaction with their peers (Foulkes and Blakemore, 2021). This puts an even bigger strain on students who are starting their first year of undergraduate (Goodwin et al.,

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2016) or graduate school or are new transfers (Mehr and Daltry, 2016). Students

expressed wanting in-app capabilities to connect with peers anonymously in a forum-

based setting. Students want such a peer-connected space for the purposes of venting

anonymously, listening to others' experiences, feeling heard, and connecting with

mentors.

> P9329: Probably just like a place to vent and honestly anonymously just to get things off your chest, because I think that would be very helpful for people who just want, I guess someone to hear, but have the safe space to do so.

As this quote exemplifies, university-run support structures can provide peer-

supported spaces. However, trust in the institution that the peer-support space is "safe"

and "anonymous" would have to be high. In the storyboarding session, the same

participant detailed the way in which they would like to connect with mentors, an

approach that would require some level of identification and connection with peers and

near-peer mentors:

> P9329: And then, this one [storyboard] is like me connect with mentors if people really need assistance like reaching out with similar majors or whatever field they want to go to and have some help in like assistance or advice basically or connections to actually have like to get into that field as well, so they can connect.

Another student similarly described wanting to browse the online contributions of

students that may have *"issues similar to theirs."* A space of this sort may expose a

student's identity, depending on the information they choose to share.

> P2049: To look for someone who had issues similar to theirs, and they can kind of read through their experiences and relate to their experiences and see how they ended up solving their problems or mitigating them.

Given the inherent risk inherent to such spaces, universities implementing them will have to assess the trade-offs between (1) truly anonymous spaces that could put students at risk for poor behavior by "trolls" and others, (2) confidential spaces that would require authentication of some kind but might still be "safe" in other ways, and (3) spaces that may identify students fully, thereby reducing the risk of certain poor behavior but exposing students more broadly. These trade-offs are not easily delineated as security, privacy, or even mental health concerns but demonstrate the overlapping challenges of tiered and technologically supported peer mental health engagement.

For example, P7142 spoke about the need for protecting a person's privacy while at the same time establishing a personal connection online. Students were apprehensive about having a virtual space for peer connection due to uncertainty about how anonymous the space would be and the regulations in that space.

> P7142: I definitely think that's a difficult one because you want to keep it anonymous. You want to give people privacy because it's a touchy subject for a lot of people, but you also want to develop relationships with other people and know that you're not alone.

Beyond the spectrum of anonymity, participants also described the challenges of synchronicity. The design workshops illuminated a variety of potential options for peer support, from real-time, high-bandwidth, media-rich, synchronous workshops to low-fidelity chat-based asynchronous engagements. For example, one student described the difficulty of attending wellness workshops when there is a lack of motivation or feelings of anxiety, particularly coupled with a tight schedule when they cannot afford to spare "time out of their day."

> P2049: And I think the problem is that nobody really wants to go to another [mental health] workshop. I think there's a lot of self-help stuff already available for someone going through these issues. They kind of already don't have much motivation, or they

feel anxious, and so they wouldn't really want to go to the workshop because it'll be time out of their day.

University students have some advantages over other communities in that they typically spend an enormous amount of time together, often live on or near campus, and have at least a minimal shared identity. Capitalizing on these connections should make the provision of peer support possible in a way that appropriately engages notions of privacy and synchronicity. However, peer support alone is insufficient. Peer support typically involves individuals with similar experiences and backgrounds offering each other emotional and practical support, but they may not necessarily have the clinical training and expertise to provide evidence-based interventions or treatments. Additionally, mental health conditions can vary widely in their presentation and severity, and some individuals may require more specialized or intensive interventions. Thus, technological platforms that engage this population must have a tiered-services approach that also engages mental health professionals.

4.3.2.2 Seeking Support from Therapists or Counselors

The students brainstormed self-help solutions but also acknowledged the need for professional support from a therapist or counselor on an "as needed" basis, depending on the context of their difficulty. Most of the participants expressed that having virtual access to counselors is necessary for students who really need to speak to a mental health professional rather than a peer. Friends and other peers may not be well equipped to handle certain situations and responses; so those receiving help would prefer guidance from a counselor. Professional support, particularly through on-demand digital services, was described as *"an absolute must"* (P4065), particularly when provided by *"reputable people"* (P5628).

Knowing when and how to access professional services can be difficult for students (Eisenberg et al., 2007). Students in the workshops spoke about the need for technological support to guide them through the "progression" of what they could work on with self-help content on the app and what issues they would need to access a therapist's help for.

> P7142: And after they try these [self-help] steps, if they're still going through this [difficulty], then I feel like that option to talk with a counselor or therapist would be really helpful whether it's through live chat or appointment. So it's kind of like a progression of steps that they can take so the first one just kind of, 'oh independent, these you can try for yourself'.

The idea of tiered support is common to mental health support strategies (Arora et al., 2019; August, Piehler, and Miller, 2018), in which general programs are provided for all students, some students seek peer support or self-help resources, and others receive professional support. However, what is notable here is that no mental health professionals were present in the workshops, and the students were not using the clinical language of tiered mental health support. Students were simply reflecting on an aspect of their reality that engaged a variety of supports for different contexts of need and differing levels of urgency. Not constrained by existing practices, the design sessions allowed students to go beyond current tiered models to describe more innovative approaches. For example, one student described how intelligent technologies can automatically identify certain issues and encourage the student to find professional help:

> P9398: So this is something different than just like you know, finding a therapist online or something. So it can integrate with the app a little bit more so it'd be like, 'oh you've been logging these the most, maybe you want to find someone that can help you with these issues.'

Not all groups suggested algorithmic approaches, but all four workshop groups described the need for help to access professional support. More detailed instructions on how to access services, including but not limited to concerns around what information would be needed to book an appointment and what health insurance options are available (this study was conducted in the United States, which has limited financial support for mental health services). For example, P9398 described needing a checklist of sorts before starting to find professional services:

> P9398: I think I would add a 'before you get started, how [to get] this information?', so that you don't get into it, you don't get like five steps into filling out like, 'Oh, I want to deal with this issue and whatever', and then it's like, 'have your insurance number ready', and you're like, 'Oh my God! I don't have it right now'. So something like, 'have this paperwork ready before you start with us.' I don't know how feasible this is but maybe you can have a little chat window. You know those ones that pop up and say, 'how can I help you or do you need any help with this website?'

Similarly, P5531 described the need for technologies to help people to be in the right mindset for seeking and navigating support from a therapist to find a therapist-client fit.

> P5531: This little blurb kind of talks about how finding a therapist takes time and to kind of have patience with that because I feel like that is something that is kind of difficult for folks to grasp sometimes like the first therapist isn't always the right therapist.

Finding the right therapist can be a challenging and overwhelming process, particularly for individuals who are stressed or have limited access to mental health resources. A student designed two app screens to showcase an ideal process for finding a therapist, as seen in Figure 5.5. In this regard, technology can play a crucial role in facilitating the process of seeking and navigating support from a therapist by

having online directories that showcase the credentials, specialties, availability, and

insurance acceptance of therapists.

Figure 4.5: Example of a student showing the steps they would like to see before choosing professional services (left) and the outcomes of therapists displayed after someone has gone through the process (right)
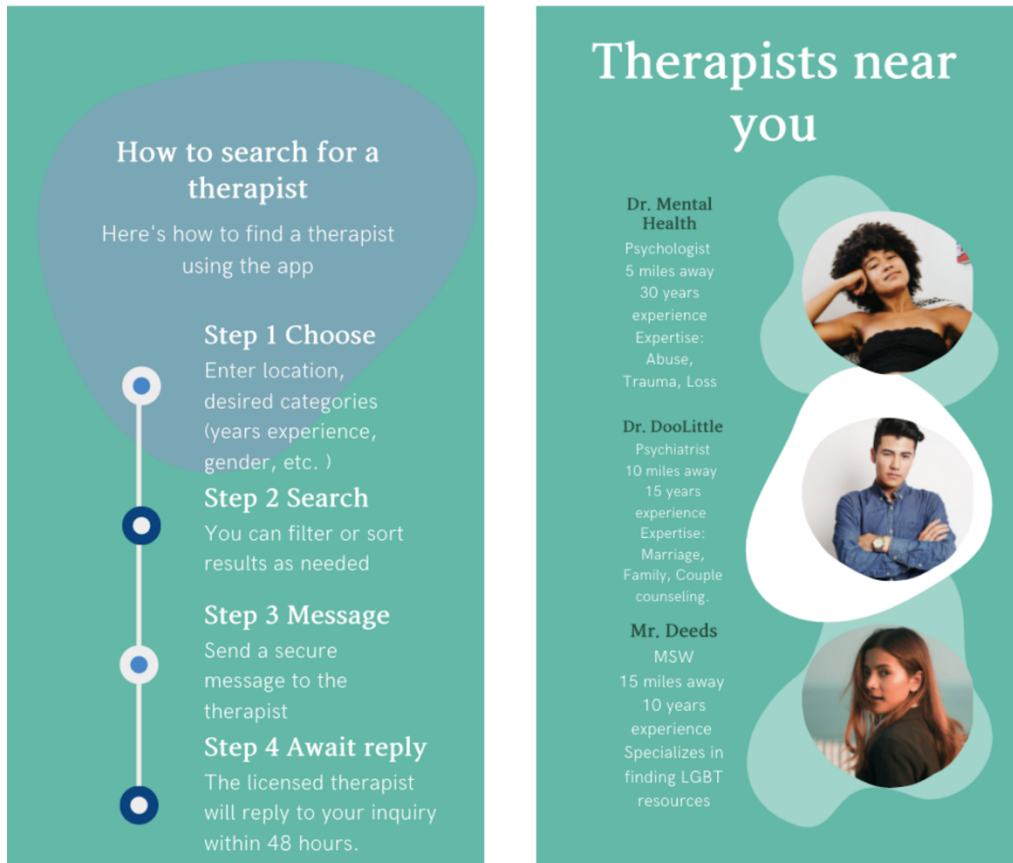
4.3.3 Support a Personalized Experience

Students were enthusiastic for a personalized app experience, wanting to

customize the aesthetic design of the app and content that is specific to their needs.

However, students described wanting self-help resources that focused more on

resources available to their specific preferences. For example, during the storyboarding

activity, participants predominantly presented features that were aligned with self-help resources and individualized activities such as professional resources, journaling space, and an online community forum in response to a student dealing with high stress and anxiety.

Personalized content and interaction styles can support students in gaining access to technical support for their particular concerns. They connected such personalization to motivation to use such a system as well as continued engagement. For example, one student described daily engagement (logging in) as a goal of such a system:

> P7142: [...]customization because I know for a lot of people when they want to use something, especially for something like a mental health app, they want it to be very personalized towards what they want to see if they're going to log into every day, which is the goal.

Although this example focuses on content personalization, students in the workshops described personalizing the aesthetics, information architecture, services offered, and other elements of the interaction as well. This kind of personalization matches well with the clinical evidence regarding therapeutic interventions.

Technological solutions that are translated from evidence-based practices, such as CBT or DBT, often include guided interactions wherein the participants learn and "unlock" certain skills, step by step, to progress to the next module (e.g., Schroeder et al., 2018). This kind of gamification is a type of personalization in that the leveling is associated with past engagement. However, the effectiveness of this approach and the associated skill development may differ based on individual characteristics and preferences (Schroeder et al., 2020). P6512 suggested allowing participants to select

option, in the beginning to select their own pathways through the different activities of a

mental health app.

> P6512: And I guess it can be something that's like filtered at the beginning, when they select their preferences and I know they could have the option later on to pick a different track, but yeah I agree that would be a good idea, absolutely.

The sheer amount of information that university counseling centers produce can

be overwhelming (Williams et al., 2021). Filtering, and other personalization solutions

can reduce the number of options within intervention modules and simplify the

experience for each individual user. For example, in response to some prototypes

drawn for the design mockups workshop, one participant described her response to the

multitude of items within the meditation menu on the calm app:

> P3183: The only issue, I think I have is just like when you click on one of the items on the left, it looks like there's just a lot of things under meditate so I feel like that, overwhelms me a little bit so maybe I don't know if we were able to filter the results, just because there's like a lot of options.

Additionally, in Figure 4.6, a student designed a simplistic app screen that shows

goal-setting topics a user can choose from to receive specific resources instead of

everything available. Too many options in a menu system feeling overwhelming is not in

itself a particularly surprising discovery. What is notable here, is the tendency of both

clinical design partners and the students themselves in the workshops to produce such

long lists, leading others to comment on them. As university counseling centers, and

other stakeholders race to make as much information and support available as possible,

this tendency to pack menus and apps with information must be monitored carefully and

addressed when possible.

Figure 4.6: A student design that shows various goal-setting topics to choose from in the mobile app
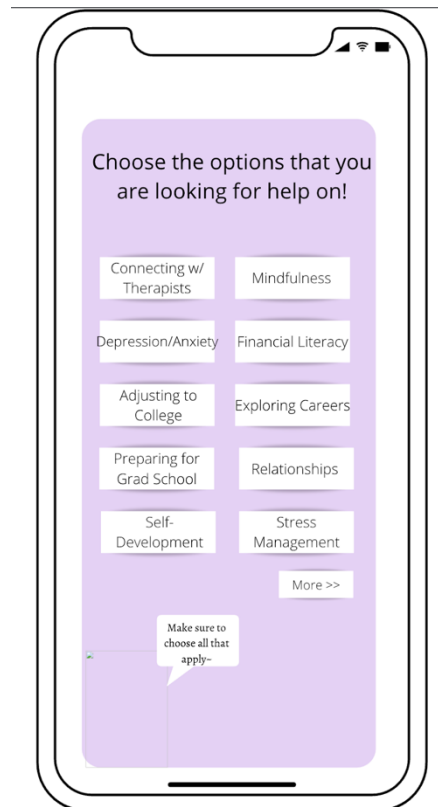
Even though having filters and selecting their own pathways through the skills was preferred for a personalized experience, there are trade-offs between not burdening the user with choices, preserving progression in learning skills, and providing appropriate support tailored to the context of the student. Since this study was conducted, the generative AI space has made significant advances, such as ChatGPT. I speculate that students would want to use generative AI to develop personalized support modules for their specific mental health needs. Algorithms can help reduce information overload (Kaufhold et al., 2020) by limiting options to only those most likely to be desirable for the student users or to those most clinically relevant, and so on.

Even in algorithmic approaches, though, care must be taken to consider which biases and priorities are baked into the design.

Beyond the kind of personalization required of the information architecture and intervention interactions, students, in general, described wanting a calming and simplified aesthetic. Students also described wanting personalized and aesthetically pleasing experiences on the app, such as picking out their own background colors and customizing dark and light modes.

> P6691: Other kinds of main settings if you want to change the colors which I also kind of tested different background colors to see what it looks like.

Technological platforms to support the mental health of REM university students should be customized to the particular needs of this population. However, results from this study indicate that these systems must go beyond even this kind of community-based, user-centered design to be truly customizable by the students themselves. By designing with them, it is possible to document the process of creating culturally sensitive mental health applications for college students. When seeking to provide services for tens or even hundreds of thousands of students at once, universities may find themselves struggling to provide this level of customization in their analog and human-based services beyond individual therapeutic sessions. Thus, systems that are either customizable by individuals themselves or built on learning platforms that algorithmically adapt can help scale support to an at-risk and underserved population that otherwise might struggle to access services.

4.3.4 Informational Life-Skill Development

The connection between satisfaction of basic needs and mental well-being has

previously been considered but needs additional research (Martinez et al., 2020;

Weaver and Hadley, 2009). According to preliminary studies, the pandemic may have

made such a connection worse (Cenat et al., 2020). In the results, this connection was

incredibly salient in the comments from participants. In every workshop, at some point,

the students turned the discussion to the importance of navigating the challenges of

adult life, which were very new for some of them. Students described needing a variety

of types of support, including both informational and tangible resources.

Informational support included the teaching of financial literacy skills such as

managing a budget, loan policies and practices, and tax filing. Time management, given

the busy schedules of students, was a frequently discussed feature, particularly if such

management could be tailored to their needs as described in the personalization

section:

> P9419: Knowing how to manage your time, but like your own system, because I know
> different people have different ways of managing their time. Some use planners, some
> use a calendar just like finding the right system just for you, based on your needs.

Financial management concerns were as popular as those related to time,

perhaps in part due to the challenges of transitioning from childhood to adulthood for

this population as well as in response to the growing cost of university undergraduate

and postgraduate education in the United States (Looney and Yannelis, 2015). For

example, in response to a question about what an ideal app might do given the pain

points they had identified, P2049 suggested:

P2049: Probably like financial and budget counseling... But again it's the problem of like I think it's pretty noticeable that especially at school there's a lot of different events that go on, and if you try to go to all of them, it can get a little overwhelming and even just looking at the events can be a little overwhelming.

In this age of misinformation (Zollo et al., 2015), students need ways to understand if the informational and instrumental support they find online is trustworthy (Horwedel, 2006; Phippen et al., 2021), a particular challenge for low-income and first-generation students, many of whom are otherwise very high performers (Hoxby and Turner, 2015; Carlana et al., 2018). While students described these concerns to some degree regarding financial, time management, and other somewhat transactional needs, this concern about what information is trustworthy appeared to be even more salient for information and concerns around mental health. When accessing information about mental health online, students spoke about wanting to verify whether the source of the information was trustworthy, such as from scientific sources.

P5628: ...but links, where you can scroll and see and see supported and well-cited sources, there were articles talking about it [mental health] in a very gentle manner, and I think being very compassionate about these topics are very important.

Students want to educate themselves on various mental health topics and gain the skills to actively meditate and relieve stress. Consuming content in small, easily digestible portions are ideal for current university students.

P1965: I don't know I think it's hard for to just for me to pay attention for like that long if it's like a super long article, so I guess like more to the point and maybe like instructional videos on like how to do a certain practice and very like yeah like demonstrators and like to the point.

P8934: These will be different types of helpful resources so research-based quick reads may range from five to 10 minutes...

Thus, designing to support the transitional needs of REM university students calls for combining emotional support from the CBCT modules with informational and instrumental support. These findings indicate that any intervention will have to be multi-layered, including both technological engagements as well as human and financial resource deployment. This is essential due to the mental health stigma and lack of health knowledge that impact the health-seeking behaviors of REMs. As I describe in the discussion section, the complexity of providing desirable outcomes with evidence-based interventions has both individual and institutional components.

4.4 Discussion

This study's findings provide insight into the challenges and preferences of majority Asian university students engaging with digital mental health support while experiencing anxiety and depression. By involving these students in the design process, a deeper understanding was gained of how they envisioned the design of technical support for their needs. These results offer important considerations for the design of culturally responsive digital mental health solutions tailored to this population.

The findings emphasize the need for both peer and professional support as essential forms of mental health support. Cultural stigma and interpersonal dynamics shaped students' willingness to seek help. At the individual level, cultural factors such as religious and spiritual beliefs and practices, as well as cultural identity, can significantly impact mental health-seeking behaviors among REM university students. Findings from this study show students are apprehensive about disclosing their mental health challenges with their family owing to the stigma they may face. These students are in search of finding evidence-based support to meet their needs. Within the

interpersonal level of influence, social networks, including peer groups, religious

organizations, and social organizations, can also impact mental health-seeking

behaviors among REM university students. For instance, students who belong to groups

that prioritize mental health and encourage seeking treatment are more likely to do so

themselves. On the other hand, students who belong to families or cultures that

perpetuate mental health stigma may be less likely to seek help when needed.

Discrimination, such as stereotypes, microaggressions, and hate crimes from the

community and institutions needed to navigate through society (e.g., schools and health

institutions), can also pose a significant challenge for REM university students

struggling with their mental health by creating a cognitive overload (Berger and Sarnyai,

2015; Suh et al., 2023) that can make it difficult to navigate their university studies and

seek support. Societal factors such as discrimination overlap with the community level

of influence as they can be present across a community.

Addressing the needs of REM students within the socio-cultural environment can

inform researchers on how to design for the inclusion of mental health literacy for

diverse groups of people. The multiple levels of influence that impact mental health

among REM university students require a nuanced understanding of the socio-cultural

environment in which they exist. Even within one ethnic group, there can be multiple

religions that have their own connotations about mental health. Additionally, these

students can possibly face public stigma and discrimination from cultures outside of

their own. Therefore, understanding individual, interpersonal, community, and societal

factors can help HCI researchers develop design processes for providing mental health

literacy through digital platforms to combat stigma.

Students requested therapy on an "as-needed" basis instead of seeking therapy at regular intervals (e.g., weekly). Such support is ideal when human support is augmented with machine intelligence. Automated mental health tools can guide them through evidence-based self-support skills, help them reflect on the context of their problems, suggest when they might need help from a professional counselor, and provide them with informational support to find one. This approach can guide the user as they move back and forth between self-help and professional support.

However, there are real-world constraints to implementing and integrating such a solution with existing mental health systems on campuses (Thielking, 2017). *Ad-hoc* therapy from professionals is accessible through telehealth options (e.g., (Free Care and Therapy, 2021; Online Therapy, 2021)). Students may experience financial barriers in accessing these online resources, particularly in the United States, where this work was conducted, and access depends on insurance. Understanding the feasibility of integrating university mental health and counseling services with mobile tools requires a broader understanding of the human and digital ecosystems into which such tools might be introduced. Between truly automated digital support and on-demand professional engagement, there may be an important middle ground: technologically supported and mediated peer support.

Peers who know how to successfully navigate the mental health system or have some training as peer counselors can act as a bridge between self-help and professional support. For example, some universities have peer educator programs for well-being (University of Washington, 2021), but even peer programs struggle to scale to the level of need present on campuses. The study findings suggest that machine-

enabled personalization and prompting may enable improved, sustainable, and scalable

peer support, such as that seen in other domains (Bonar et al., 2021; Jaganath et al.,

2012). As AI technology advances, opportunities for analyzing health information to

provide recommended treatment plans will become more popular. However, I believe

there needs to be specific training on what each component within one's health data

means as it relates to the individual as a whole and not biased assumptions.

Algorithmic approaches can tackle many customization challenges, but they

require a huge amount of personal data collection, such as tracking usage patterns

within the app or on the phone more broadly, geo-location, and even personal content

of messages, phone calls, and voice recordings (e.g., MoodRhythm (Matthews et al.,

2016)). Researchers and designers should engage in discussions and practices around

the protection and use of such sensitive personal data, only some of which is protected

in the US by rules governing health data (Office of Civil Rights, 2013) or educational

data in the case of university students (US Department of Education, 2021). For

European students (European Union, 2018) or those living in states in the US with their

own privacy laws (e.g., California (State of California Department of Justice, 2018) and

Massachusetts (Tufts Technology Services, 2021)), these trade-offs may become even

more complex for designers to understand and meaningfully engage with. Privacy and

ethics around such data use become even more consequential when these systems are

scaled beyond research studies.

Providing options for anonymity and regulations surrounding online peer support

groups can help, but institutions need to be mindful about staffing human moderators,

either peer leaders or professionals, to maintain a safe online space (Seering et al.,

2019). Beyond the opportunities and challenges associated with data collection for personalization, students may inherently struggle with the need for support from other people and the commensurate need to share personal and private information with those people. Based on the empirical understanding from this study, we list recommendations for designers to consider when creating digital evidence-based mental health interventions for students (Table 4.2).

Table 4.2: Design takeaways for student mental health

Self-Help	Professional Support	Peer Support
Provide students with app notification reminders that reflect their current mental health journey and/or mental state. Try to minimize generic reminders as much as possible.	Display journey road map of what information is needed to obtain professional counseling service (e.g., insurance information, location).	Match students who have the same goals, similar experiences, and or shared identity in an anonymous online peer forum.
Design for engagement by using AI capabilities to allow for greater personalization of information and goal completion (e.g., recommender system).	Design for supportive practices when desired professional support is not available.	Address privacy concerns of students when making connections outside the app.
Address concerns of privacy and personal data use of students for such personalization.	Provide students with agency in transitioning back and forth between self-help and professional support.	

4.5 Summary

The goal of this study was to understand how university students use and perceive existing technical and non-technical resources and envision support for their mental well-being. I present findings from a series of participatory design sessions with

20 university students to aid in the design of a Cognitively-Based Compassion Training mobile application intended for the mental health of undergraduate and graduate-level students.

In this chapter, I answer the research questions: How do racial-ethnic minority communities envision the design of digital mental health support? And what opportunities exist for designing digital mental health support to promote and improve emotional and social well-being for racial-ethnic minority communities? Analysis of both student statements and artifacts from these design sessions indicates that any technical support for this population should provide healthy reminders, connect them with peers and counselors, personalize content and aesthetics on the app, and support informational and instrumental life skills. By designing with students, I translate these concerns into design implications and broader considerations for the trade-offs one might encounter in different design solutions to support this group. I find that technological solutions must work alongside existing resources to integrate self and automated help with help from peers and professionals. These interventions should support a variety of transitional life skills not traditionally thought of as "mental health" concerns and navigate the tension between disclosures and privacy or confidentiality in a highly stigmatized context. This is of great importance for REM students based on their different cultural backgrounds and how the lack of specific life skills may have not been equated to mental health stressors.

Chapter 5. Analysis of Distance-Based Mental Health Support for Underrepresented University Students

In this chapter, I explore the experiences of Black and Latinx students navigating on-campus mental health resources and current digital mental health support presented by university counseling websites. An overview of the study methods and data analysis follows an introduction that explains the motivation behind this research. I present findings from a survey study that convey how Black and Latinx undergraduate and graduate students perceive the effectiveness of on-campus counseling services and provide insight into tech solutions that can possibly close the accessibility gap. I also present findings from a content analysis of campus counseling center websites from the top 20 Predominately White Institutions (PWI), Hispanic Serving Institutions (HSI), and Historically Black Colleges and Universities (HBCU) as ranked by US News and World Report in August 2020. The goal of the content analysis was to evaluate how current university systems are providing inclusive mental health resources to their students.

Following, I discuss design considerations for using technical support within and surrounding counseling centers on university campuses for researchers, faculty, and university staff seeking to improve access for students. Specifically, I detail how we should be incorporating culturally responsive design into digital support for REM students by using the NIHMD research framework to address specific challenges within health determinants that can impact engagement. The main contributions of this work are: 1) identifying specific mental health resources Black and Latinx university students seek on their respective campuses; and 2) design implications for creating more

efficient and effective systems for on-campus counseling services. This work addresses the following dissertation research questions:

> **RQ1:** How do intersectionality and social determinants of health affect how racial-ethnic minority communities seek and engage with digital mental health solutions?

> **RQ3:** How can designing for cultural responsiveness contribute to the engagement of digital mental health technology for racial-ethnic minorities?

This work was published in the extended abstracts of the 2021 CHI Conference on Human Factors in Computing Systems 2021 (Williams et al., 2021) and in the proceedings of Advances in Human Factors and System Interactions 2021 (Williams et al., 2021).

5.1 Motivation

Black and Latinx university students who require mental health support often encounter significant challenges in succeeding in higher education. These challenges stem from stigma within their communities (Leath and Chavous, 2018; Masuda, Anderson, and Edmonds, 2012; Morey, 2018; Corrigan, 2004; Corrigan, Druss, and Pelick, 2014), biases in mental health care assessment and treatment (Snowden, 2003; Williams and Washington, 2018), and difficulties with accessing on-campus mental health resources. Recent research indicates that therapy and counseling can provide substantial benefits to these communities by navigating through trauma and anxiety, given the significant oppression they have faced (Oswalt et al., 2020; Singh, 2020). With Black and Latinx communities experiencing the long-lasting effects of systemic racism in America (Churchwell et al., 2020; Berry, Londoño Tobón, and Njoroge, 2021),

university students who belong to these respective communities are searching for a positive and supportive environment (Williams and Washington, 2018; Webb, Burns, and Collins, 2008) to address their mental health challenges.

University campuses can become another added resource for Black and Latinx students when they leave home to pursue higher education (Boettcher et al., 2022). Within their respective institutions, they should feel supported and have easy access to resources that will help them through various cultural barriers. These resources should feel inclusive, accessible, and empowering (Iacovino and James, 2016). Services universities provide can better meet the needs of these students if school-wide systems are made more accessible, more culturally aware, and sensitive, and further encourage these groups of students to visit specific on-campus resources that meet their needs. Without such resources, Black and Latinx students are at a substantial disadvantage (Chang et al., 2020).

5.2 Methods

I first conducted an exploratory survey to gather insights on the perspective on on-campus mental health services. After considering the results of the survey, I began to wonder about the current ways students can access services at their university counseling centers. This prompted me to conduct a content analysis of 60 counseling websites from prominent U.S. colleges and universities (US News, 2020). In this section, I describe each phase of this project.

5.2.1 Exploratory Survey

The exploratory survey study was conducted to gather insights into how Black and Latinx students navigate existing on-campus counseling resources and elicit

student input on how technology might be used to improve access to these resources. The survey was sent electronically by the Office of Access and Inclusion at the University of California Irvine and Howard University (Appendix B). A total of 36 university students (25 undergraduate and 11 graduate) who self-identified as Black and Latinx participated in the survey study. All participants were currently enrolled in an undergraduate or graduate degree program at the time of the survey study. The survey was anonymous and did not contain any identifying information (i.e., name, school, major). The survey was hosted on the Qualtrics survey platform with a total of 20 questions in both long and short-answer formats.

I conducted a thematic analysis of two short-answer survey responses. The qualitative analysis process was in two coding cycles. The first-cycle coding (Saldana, 2013) involved an inductive approach in which descriptive and *in-vivo* codes (words of participants) were derived from participant responses. An inductive approach is the development of themes that come directly from the raw data. I did not go with a deductive approach, the use of a theory to develop themes from the data, because this survey was exploratory research to get insight into students' experiences and preferences instead of testing a theory. The inductive approach allowed us to derive a comprehensive understanding of students' experiences and preferences.

Second-cycle coding (Saldana, 2013) focused on identifying thematic patterns in the data and ways in which participants' responses converged and diverged thematically. This approach allowed for the refinement of the themes and categories defined in the first-cycle. The two coding cycles enhanced the validity of the qualitative study findings. Qualtrics software platform used for the survey creation and distribution

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was also used for descriptive statistical analysis of multiple-choice questions. Measures of central tendency, frequency distribution, and percentiles were the descriptive statistics captured in this study.

5.2.2 Content Analysis

I conducted a content analysis of 60 U.S. college and university counseling center websites. Sites analyzed included the 20 top ranked Predominantly White Institutions, Hispanic Serving Institutions, and Historically Black Colleges and Universities (as ranked by US News and World Report in August 2020) for 60 websites. I performed a Google search on "college/university name" + counseling center to find the counseling website of each specific school and then navigated to the highest-level web page for the counseling center. Figure 5.1 and 5.2 is an example of my search process for the University of California-Irvine's counseling center.

Figure 5.1: Google search process for university counseling centers
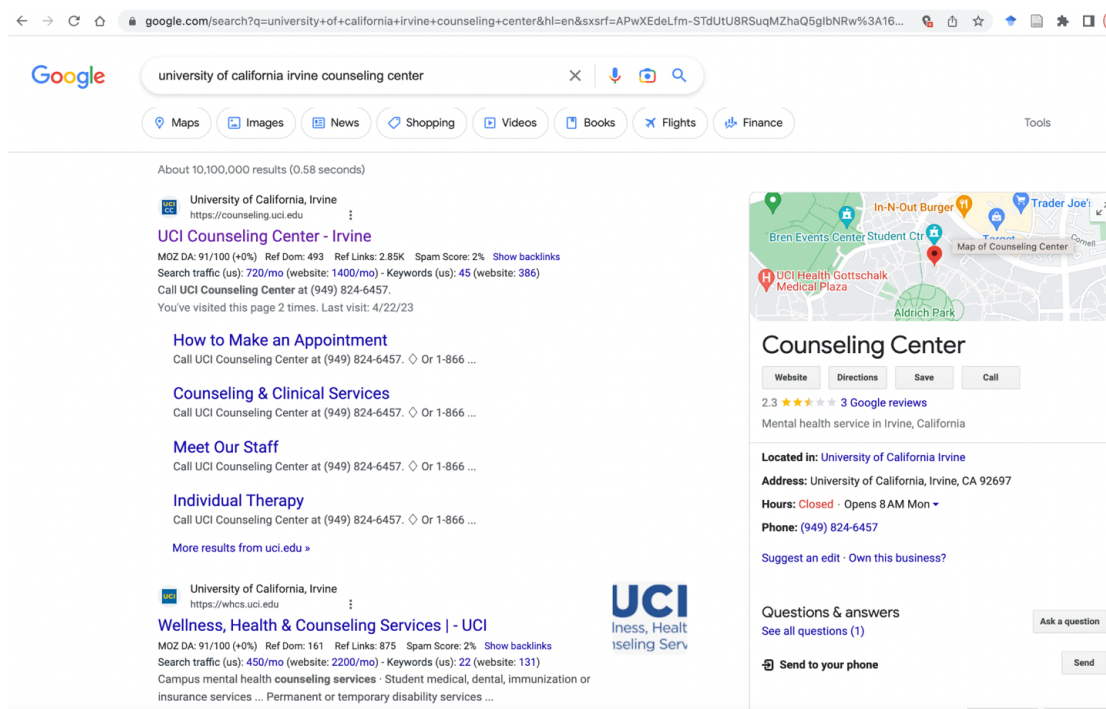
Figure 5.2: Example of the highest-level webpage for a university counseling center website

I identified the initial units and categories of analysis based on a combination of my knowledge of mental health resources, such as previous my research study (Williams and Washington, 2018) and literature reviews (Maura and Weisman de Mamani, 2017; Parcesepe and Cabassa, 2013) in addition to the thematic categories identified through coding the student survey responses. I created an initial codebook of 18 codes where I and two other researchers used it to code a subset of 6 sites. The research team then met to compare our results, discuss the coding process, and identify codes that needed to be clarified, expanded, collapsed, added, or deleted. Based on that discussion, we arrived at the final operational definitions for 16 codes (Appendix A). We then coded an additional six university counseling websites and re-coded the first six, which was a total of 12 (20% of the total sites to be coded) with an

inter-rater reliability of .86 (93.06% agreement). Finally, each researcher independently coded an additional 16 sites to reach a total of 60 sites.

5.3 Results

Similar to previous research detailing the experiences of university students' mental health (Lattie et al., 2020), survey respondents described barriers to accessing mental health care, such as access to resources and tools to help them cope. The findings did not show any difference between the type of school the students attended and their mental health care preferences. Students emphasized wanting to utilize peer support groups and local community resources and wishing for more efficient access to on-campus resources by scheduling appointments and finding counselors that best suited their needs. Notably, this project began with the intent to engage heavily in mobile mental health support. However, these findings clearly indicate the need to redesign and develop improved fundamental technical infrastructure around mental health on college campuses. In this section, I highlight areas of improving access, holistic approach, community and peer support, and culturally responsive options.

5.3.1 Improving Access

Easy access to appropriate mental health services on campus is essential to helping students seek out and utilize the services intended for them. The notion of access was present in the data in two distinct ways, which I describe as improving navigational access (the ability to clearly navigate resources) and situational access (the ability to access resources by a variety of methods to suit the needs of a variety of situations).

In terms of improving navigational access, survey participants uniformly expressed difficulty finding resources and had limited knowledge of what resources and services were available to them on campus. Students expressed strong preferences for wanting better access to services on campus. For example, one participant identified wanting *"easier access to mental health professionals,"* referring specifically to the difficulty of making contact with a counselor. Other students reported wanting easier access to resources. This lack of navigational access was also evident to the researchers as they coded the 60 counseling center websites. Many resources were difficult to find because they were housed in non-intuitive sections (e.g., diversity-related resources were mostly housed under group therapy) or required clicking through multiple pages, tabs, and/or links to locate. Taken together, these findings suggest that mental health resources and services are often not presented in an intuitive fashion, which is a significant shortcoming when the students attempting to navigate them may already be experiencing high levels of stress or mental distress.

Given the stigma surrounding seeking help with mental health for Black and Latinx students (Corrigan, Druss, and Pelick, 2014; Leath and Chavous, 2018), it may be a challenge for these students to inquire about services in person due to the fear of being seen and labeled by fellow peers (Eisenberg et al., 2009). Therefore, it was not surprising that study participants also expressed a strong desire for what I call situational access, or access to a variety of means of accessing different mental health resources that were suited to their current situation or needs. For example, suggestions included online appointment scheduling, an event calendar for online group discussions, and anonymous chat box discussions.

The need for situational access was also reflected in the content analysis. Even though COVID-19 has pushed more U.S. colleges and universities to offer telehealth services than ever before (Blaisdell, 2021), our analysis revealed that even post-pandemic, many institutions were lacking in online resources. Of the 60 sites reviewed, ten offered scheduled counseling via phone, five offered counseling via video, 34 offered both, and 11 offered no remote options or were unclear in their offerings. Immediate counseling was offered via phone or video at 39 schools, with two of those supplementing with chat-based immediate intervention. Given these limited options, particularly during remote educational terms, the limits of access for students are substantial.

However, it is worth noting that expanded telehealth options alone are not a solution to the issue of increased access. Students living in dorms or shared apartments frequently struggle to find a quiet space in which they can also talk about privacy concerns. Even making the phone call to book an appointment can potentially be a challenge, but only 12 sites offered online appointment booking, and only 23 offered an online health assessment prior to booking an appointment. Even those schools that advertised immediate chat sessions with counselors had no easily discernible way to access these chats. This lack of both navigational and situational access presents significant opportunities for technology to relieve the burden of students seeking services by providing an easily navigable, intuitive, and user-focused interface, and a broader range of resources that can be accessed discreetly, independently, and remotely. Finally, it is unclear whether these universities will maintain what telehealth offerings and external online resources they do offer following the pandemic.

5.3.2 A Holistic Approach to Mental Health

University students are often under high amounts of stress, due to busy schedules and heavy workloads (Yangdon et al., 2021). Managing these demands while maintaining mental health can be challenging (Corona et al., 2017; Hunt and Eisenberg, 2010; Oswalt et al., 2020). Our findings demonstrate that of the multiple resources presented to students on campus (e.g., psychiatric services, individual counseling, etc.), students were most interested in having more resources focused on addressing their healthcare needs holistically. Wellness, for example, was a central focus of concern for students. For example, student survey respondents requested *"healthy tips to deal with different types of mental health issues", "mood tracking,"* and *"healthy exercises for mental health improvement, meditation/calming practices."* These approaches were well-represented in counseling center websites, with 53 out of 60 (88%) offering some form of wellness-related resources to their students, and 41 (68%) were coded as having a wellness ethos (as opposed to a more traditional medical model (Klerman,1977) pervading the entire site.

Students were specific in their descriptions of the types of resources that they believed could contribute to their overall well-being, such as *"Memes, something to make you laugh; a step-by-step process of how to meditate and evaluate ourselves and mental state."* They also requested wellness-focused *"Therapy sessions, anonymous chats, reminders to do small self-care tasks."* The websites themselves offered a variety of resources focusing on the whole student, such as study skills and time management workshops, yoga and meditation classes, and wellness apps, to name just a few.

While our analysis revealed great interest in self-care and self-evaluation options to support students' mental health, many sites offered such self-care resources;

however, one challenge for both the students hoping to consume these resources and the counseling centers offering them is the limited efficacy study of such mHealth resources. Along these lines, universities sometimes limit their own recommendations by offering a disclaimer that distances themselves from the external wellness and self-help resources that are included on the website. University students, already feeling stressed and a bit lost, are unlikely to be able to discern on their own the efficacy of any particular approach outside of professional care, and indeed, one respondent decried *"not another app."*

5.3.3 Community and Peer Support

Having a sense of community and belonging in an environment away from home plays a crucial role in a university student's experience (Hoffman et al., 2002; Okeeffe, 2013; Strayhorn, 2018), even more so for minoritized students (Dortch and Patel, 2017; Hausmann, Schofield, and Woods, 2007; Strayhorn, 2009). When mental health challenges arise, students often want to be a part of a community that will help them cope and work through issues and that can commiserate and share similar experiences (Uwah, McMahon, and Furlow, 2008). University students find these communities in on-campus clubs and organizations, as well as in the broader community, such as local churches and meet-up groups. Participants expressed a desire for local community resources and counselors that were external to campus, such as *"How to find local black counselors and professionals, resources for local groups, self-care tips, hotline numbers, 24/7 communication line."* Notably, in this quote, the respondent describes not only the types of resources needed but also hints at the need for cultural competency by

explicitly calling out the need for *"black counselors and professionals" - a* topic I take up in the next section.

In contrast to students' expressed desire for community-based forms of support, our content analysis revealed that only 39 of the 60 sites analyzed provided such resources. Additionally, even when provided, none of these resources connected directly to online offerings from those groups, provided mapping directly to them, or included any other integrated services students have come to expect from a modern customer-centric web experience.

Students also expressed wanting to have fellowship and the opportunity to engage in conversations with peers who are experiencing similar issues as them. Specifically, they asked for things like *"Peer-to-peer conversations, alumni network, resources"* and *"A community of people that are dealing with similar issues."* In addition, students provided a variety of options for peer support, including *"A chat box for anonymous discussions,"* event calendars, and distance-based peer mentoring. While our content analysis revealed that many institutions provided training and support for peer counseling services, none appeared to incorporate alumni as resources. In addition, it is worth noting that on the counseling websites, peer support was sometimes positioned as an outward-facing activity. For example, one university website framed peer support as referring a friend to the counseling center.

> Please let us know if you are worried about a friend. We are also available to consult with faculty and staff about concerns they may have about their students. Give our office a call or reach out to our Campus Awareness Response and Education (CARE) Team.

Another site positioned peer support as a limited resource that students should

approach with caution.

> Involve yourself only as far as you are willing to go. At times, in an attempt to reach or help a troubled friend, you may become more involved than time or skill permits. It is important to know the boundaries and limitations of your intervention.

However, these notions of peer support, while important, are not well-aligned

with the fellowship and community-focused notions of peer support that students in the

study expressed wanting. In addition, it is important to note that same-race peer support

is preferred (Leath et al., 2022; Watkins and McGowan, 2022). Some institutions

addressed this need for community and shared experience through group counseling

and the creation of discussion groups focused on shared student backgrounds and

identities (26 of 60). Nonetheless, there are clear discrepancies between what students

in our study expressed a desire for, and what these institutions offer in terms of

community and peer support.

5.4 Culturally Responsive Mental Health Options

Culturally responsive mental health resources minimize inequalities in mental

health outcomes and access to services (Ruiz-Casarez, 2014; Tondora et al., 2010).

Resources and activities culturally related to these students help them build a sense of

belonging and a broader community (Museus, Yi, Saelua, 2017; Pappamihiel and

Moreno, 2011). Students care about the identities held by their counselors and

expressed wanting to learn and/or know more about them before scheduling an

appointment. Student survey respondents expressed wanting to have access to

counselors who they can relate to in culture and identity (i.e., ethnicity, gender, and

sexual orientation). Alternatively, student survey respondents expressed wanting access to counselors to whom they can relate. To illustrate, one participant explained that they would like to see which therapists on their campus identify themselves as a person of color, queer, or both, while another expressed a desire specifically for access to Black mental health professionals. Similarly, a different student asked for photos of nearby professionals wanting, *"names and a number of nearby professionals with pictures."*

Despite students' clear preferences for finding mental health professionals with whom they feel some form of connection or affiliation, our content analysis revealed that finding this information and making these connections was not well-supported. 18 sites (30%) had no biographical information for counselors at all. For others, the information was often difficult to find. Specifically, they were often text-only (i.e., no photos), contained minimal information, and/or only included a name and professional degree. There were, however, some clear exceptions, where biographical information were more expansive and included the names, photos, and specializations of the mental health professionals. The results indicate students preference for transparency of the counselor's identity and specialty.

5.4 Discussion

Students within a university community often seek support through traditional one-on-one counseling sessions or group therapy sessions (Cornish et al., 2017). However, due to the COVID-19 pandemic, universities had to shift their services strictly online, leaving university students to navigate their counseling centers virtually. The built environment for distance-based university support is achieved through scheduling appointments via phone or online booking and telehealth services. Study findings in

Chapter 5 revealed that 12 of the 60 websites of universities evaluated provided an option to only schedule an appointment with the counselor via phone. This is a challenge for university students, especially those who have moved back home with their families during the pandemic stay-at-home orders, where cultural stigma may hinder them from seeking mental health services. The lack of an online discreet and private booking system posed a barrier to access for REM University students seeking help during the pandemic (Williams et al., 2021).

By understanding the inner workings of the built ecosystem of the university counseling center, this sheds light on the need for a comprehensive look through a service design lens. I suggest universities develop an improved digital infrastructure that can hold the capacity of the university student body, allowing students to schedule appointments online while adhering to HIPAA privacy laws. Future work calls for streamlining touchpoints for students, counselors, and administrators.

University students also seek a sense of belonging within their college community, especially REM University students, who struggle in predominantly white institutions where their culture is not the majority (Silver, 2020). Cultural-specific spaces and organizations, such as the Black Student Union or the Latinx Resource Center provide a safe space for some of the mental health stressors they experience at the university level, such as microaggressions, discrimination, and overall systemic injustices that took place in society during the Covid-19 pandemic. Based on the findings shown in Study 3, students expressed the need for community and peer support, not just within the university campuses but also in the outside local community. Students also made multiple references to needing culture and identity specific support.

Culturally responsive mental health resources are needed to engage and address the specific challenges faced by these students. Being that many of these community resources were on hold during the pandemic, online spaces were built in the form of webinars or teleconferencing spaces to connect. Therefore, I suggest HCI researchers partner with university counseling stakeholders to support the creation of culturally responsive virtual support environments where students feel safe. Creating culturally responsive virtual support environments at universities requires the involvement of university students and faculty. These partnerships can facilitate the design and development of digital mental health solutions that improve the accessibility and effectiveness of mental health services for REM students.

5.5 Summary

The goal of this study was to understand the experiences of Black and Latinx students navigating on-campus mental health resources, detail their current resources to brainstorm potential technical support systems, and evaluate the current systems. I present findings from a survey study with 36 Black and Latinx university students that detail how they perceive the effectiveness of on-campus counseling services and provide insight into tech solutions that can possibly close the accessibility gap. I also present findings from a content analysis of 60 campus counseling center websites.

In this chapter, I answer the research questions: How do intersectionality and social determinants of health affect how racial-ethnic minority communities seek and engage with digital mental health solutions? And how can designing for cultural responsiveness contribute to the engagement of digital mental health technology for racial-ethnic minorities? Findings from the survey study show that students struggle

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with navigating on-campus mental health resources and do not want another technical

solution to solve the problem but instead want the existing systems fixed. Both

students and universities are interested in improving access, an increased focus on

wellness, peer-community support, and culturally responsive mental health options.

However, by not looking coherently and comprehensively across both the organization

and the technologies that support them, most offerings fall short.

Chapter 6. Mental Health Apps for Culturally Responsive Support: A Quantitative Analysis

In Chapter 6, I present a quantitative study on the evaluation of mental health applications for cultural responsiveness. I begin this chapter with the motivation behind this work, which stems from the previous study presented in Chapter 5. I follow up by detailing the search and analysis of mental health applications. The results of this study are presented in two sections: content and access. Next, I discuss the role intersectionality and access play in the mental health of REMs and cross-reference the evidence found in the evaluation. I close by summarizing the study and referencing the NIHMD research framework to emphasize design considerations for designing mental health applications for REM populations.

6.1 Motivation

Mental health applications have grown in popularity in recent years, owing in part to the Covid-19 pandemic, with an emphasis on the need for mental health support during a difficult period (Clay, 2021; Hwang et al., 2021). From 2019 to 2021, the market for mental health applications increased by 54.6% with a revenue forecast of 17.5 billion. Even more so recently, mental health applications became a popular trend in the startup sector, as well as in academic and health arenas, all striving to contribute to the development of digital mental health solutions (Auxier et al., 2021).

Not only has there been a push for expanded mental health access through mobile applications, but there has also been a push for developing solutions specific to minority communities (Friis-Healy, 2021), in light of systematic inequalities being pointed out as a pandemic in and of itself (Kim, Donnelly, and Ran, 2021). There is substantial research on providing culturally competent mental health treatment for in-

person services (Nardi, Waite, and Killian, 2012) but little research on how to make digital mental health treatments and services culturally relevant. Currently, researchers are still investigating how to do so (Ramos et al., 2021) by reviewing previous research and frameworks.

This study builds on the previous research study presented in Chapter 5 by analyzing mental health applications provided as additional resources on university counseling center websites. I wanted to evaluate mental health applications promoted to university students to see if they provide culturally responsive resources outside of on-campus counseling services. The study has shown that mental health apps available in the market, particularly those marketed to university students, are inadequate in meeting the needs of culturally diverse populations. Furthermore, this study highlights a range of barriers to accessing these applications, including the use of operating system requirements on dated smartphone models, additional expenses required to use advanced features on the applications, limited multilingual support, and reading literacy skills necessary to comprehend the content of the applications. The main contributions of this work are 1) noting the presence of cultural responsiveness within mental health application content and access and 2) design implications for embedding cultural responsiveness into the development of mental health applications. This work addresses the following research questions:

RQ3: How can designing for cultural responsiveness contribute to the engagement of digital mental health technology for racial-ethnic minorities?

RQ4: What opportunities exist for designing digital mental health support to promote and improve emotional and social well-being for racial-ethnic minority communities?

6.2 Methods

In this section, I detail the search and selection process employed for evaluating the mental health applications featured in this study. Additionally, I provide an overview of my data analysis process, including how the culturally responsive codes were initially created and used to evaluate the mobile applications.

6.2.1 App Search and Selection

I collected information from the US News and World Report's highly regarded list of the 60 top-ranked Predominately White Institutions (PWIs), Historically Black Colleges and Universities (HBCUs), and Hispanic Serving Institutions (HSIs) as the basis for data collection (full list shown in the Appendix). To obtain information about the promotion of mental health applications as supplemental resources for students, I navigated to the "additional resources" webpage on the university counseling websites of these institutions. This approach to data collection was chosen based on previous research, which demonstrated that most of the university counseling center websites had a dedicated page for additional mental health resources, including mobile applications, available for student usage. Figure 6.1 is an example of my search navigation on the University of California-Irvine's counseling website for mental health resources.

Figure 6.1: Example of search navigation for the counseling website of the University of California, Irvine
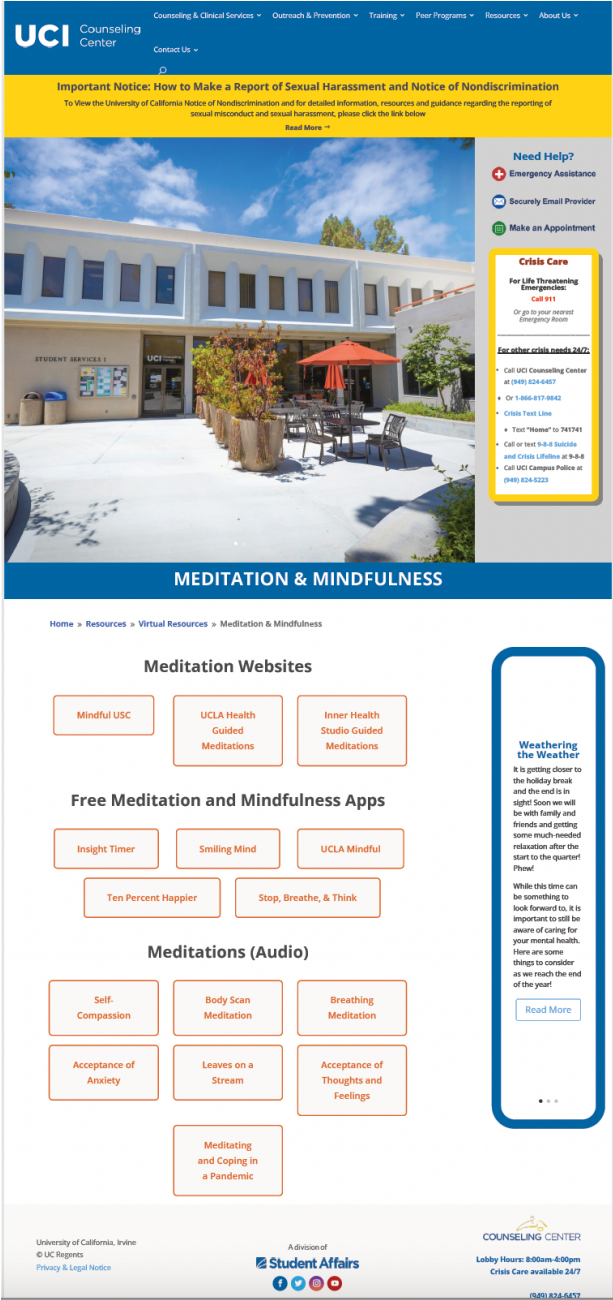
The search was conducted between September and October 2022. First, I identified all of the mental health applications listed as available resources on the university counseling website. I then screened the mental health applications based on

the inclusion and exclusion criteria. Mental health applications were excluded if they 1) focused solely on exercise, productivity, or substance and alcohol abuse 2) were no longer available in the app store, 3) needed a code to access 4) were solely for research purposes, or 5) only for android users targeted. The search initially identified a total of 91 unique mental health applications combined across all schools. Of the 91 applications,10 was excluded because the applications were not providing resources directly related to anxiety, depression, stress, and mindfulness. 21 was eventually removed from the sample because they were no longer in the iTunes store at the time of downloading. The final sample consisted of 60 mental health applications, which were downloaded to an iPhone and analyzed. Figure 6.2 shows the selection process of the evaluated applications.

Figure 6.2: Flowchart showing selection process of applications
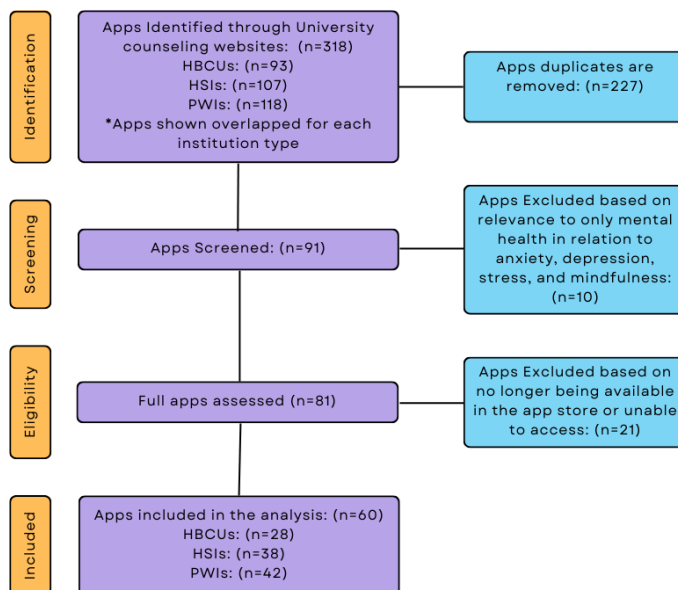
6.2.2 Data Analysis

Each application was coded for cultural responsiveness based on categories I identified through literature reviews and study findings presented in Chapter 3 to evaluate the cultural responsiveness of current digital mental health applications. I used the Framework for Reporting Adaptations and Modifications Enhanced (FRAME) and Bernal and Sáez-Santiago's model for Culturally and Linguistically Diverse (CALD). FRAME calls for a part of their framework to assess the intent or goal of the modification (e.g., improve fit, cultural adaptations, reduce costs, etc.) and the contextual factors that influenced the decision. Bernal and Sáez-Santiago's model for Culturally and Linguistically Diverse (CALD) calls for "culturally centering" a given intervention with 8 elements: language, persons, metaphors, content, concepts, goals, methods, and context (Bernal and Saez-Santiago, 2006). My previous research study, in Chapter 5, has a major key finding of cultural responsiveness is needed when providing remote mental health services and resources. In addition, I used a systematic review paper of evaluation frameworks (Ramos et al., 2021) for considering diversity, equity, and inclusion in mental health applications, which cross-referenced codes I created from the two frameworks and the data from my previous research studies. I, along with two undergraduate researchers, coded all 60 applications with an interrater reliability agreement of 94%. To determine the Flesch-Kincaid Readability Score, written content was collected from each application's initial page after the sign-in, assessment, or dashboard homepage. The content was then inputted into Microsoft Word, which generated the score using the Flesch-Kincaid calculation feature.

Table 6.1: Codes gathered from literature and frameworks

FRAME	Systematic Review	CALD	Study 3 (Chapter 5)
Race/ Ethnicity	Cost	Language	Diverse Representation
Gender Identity	System Requirements	Persons	Language
Sexual Orientation	Internet Connectivity	Context	Cost
Cognitive Capacity	Language		
Physical Capacity	Literacy		
Literacy	Content for people with disabilities		
First/Spoken Languages	Diverse Visual Representations		

Table 6.2: Codebook used for content analysis of mental health applications

Label	Definition	Code
LGBTQ	Written content or audio that provides informational support for the mental health of individuals a part of the LGBTQ+ community	Yes or No
Physical Disability	Written content or audio that provides informational support for the mental health of individuals with learning disabilities	Yes or No
Learning Disability	Written content or audio that provides informational support for the mental health of individuals with physical disabilities	Yes or No
Ethnic Identity	Written content or audio that provides informational support for the mental health of individuals from diverse ethnic identities	Yes or No
Religious Identity	Written content or audio that provides informational support for the mental health of individuals practicing a religious or spiritual faith	Yes or No
Virtual Community	Existence of a virtual community for users to connect and interact within the application platform	Yes or No

Voice	Existence of voice-based features with more than one narrated voice	Yes or No
BIPOC Focused	Mental health application solely dedicated to individuals from Black, Indigenous, and People of Color communities	Yes or No
Website Available	Existence of a web-based version of the mental health application	Yes or No
Cost	A free or paid cost associated with using the application	Free or Paid
Operating System	Current operating system software that supports the mental health application	Operating System Type
Language	Existence of the language(s) the application is available in	Language(s)
Content Reading Level	The highest reading level based on written content provided in the application from the first initial screen outside of onboarding and assessments.	Flesch-Kincaid Readability Score

6.3 Results

In this section, I first provide findings on the extent to which culturally responsive codes were presented in the content of the mental health applications evaluated. I then describe access to these applications based on operating system capabilities, cost, language support, and reading level. I close by presenting mental health applications displayed by school type (HBCUs, HSIs, and PWIs).

6.3.1 Content

The cultural responsiveness codes examined in this study do not constitute an exhaustive list of the culturally responsive variables that should be considered when designing digital mental health applications for REMs. Further research should be done with users to gather insight into whether there are other culturally responsive variables that are important to REM seeking digital mental health support that are currently not

shown in the literature. Nevertheless, these codes have been comprehensively derived from the existing literature, as evidenced by previous studies conducted by (Bernal and Saez-Santiago, 2006; Ramos et al., 2021; Stirman et al., 2013; Stirman, Baumann, and Miller, 2019; Williams et al., 2021).

Among the applications analyzed, 16 (27%) of them provided support for the mental health of the LGBTQ community through written and audio content that addressed the challenges faced by this group. Only 3 (5%) applications offered support for individuals with learning disabilities, in contrast to 6 (10%) applications that addressed the mental health needs of individuals with physical disabilities. Additionally, 12 (20%) applications included content that focused on various topics related to the mental health of individuals belonging to a REM group. Furthermore, 15 (25%) applications provided content catering to individuals practicing a religion or spirituality.

In terms of platform features, 16 (27%) of the applications included a virtual community within their platform in the form of anonymous forums where users could share personal stories and encourage one another. There were 20 (33%) applications that featured multiple distinct voices narrating audio content and/or meditations. However, none of the applications were specifically focused on the mental health needs of Black, Indigenous, and People of Color (BIPOC) populations. Notably, two applications were initially identified during the screening process but were no longer available for use in the app store at the time of the study.

These findings reveal that the extent to which digital mental health applications cater to the mental health needs of different marginalized populations varies, with some applications offering more support for certain intersectional groups, such as the LGBTQ

community, while others lack a specific focus on the disability community. Further

research and development of culturally responsive digital mental health applications for

REMs is warranted to address these gaps and promote equitable access to mental

health support. Figure 6.3 shows the number of applications that had each culturally

responsive code represented.

Figure 6.3: Apps with Culturally Responsive Codes
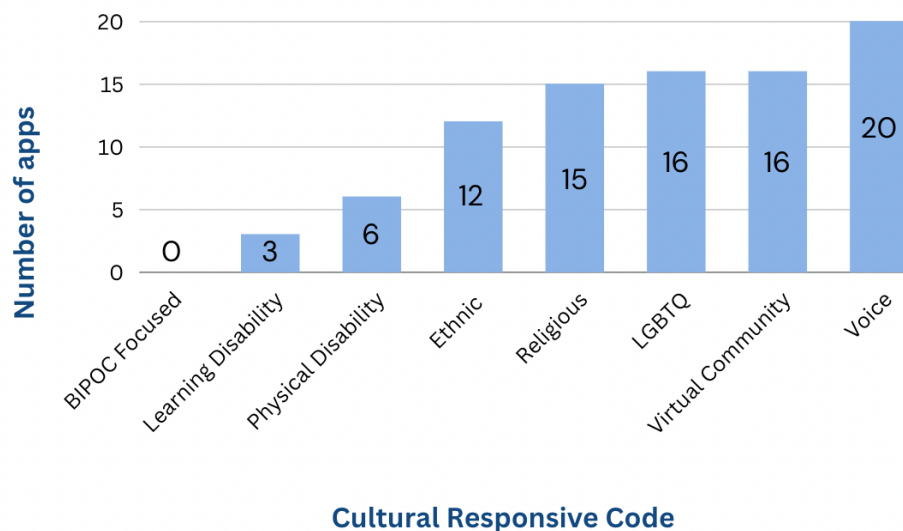
6.3.2 Access

Access is a hindrance to mental health resources. This section provides findings

on the various technical capabilities, socio-economic factors, and cultural factors that

impede access.

6.3.2.1 Operating System and Cost

Google and Apple release updates for their operating systems yearly (Android

and iOS, respectively) to offer the latest capabilities to smartphone users. While Android

is the dominant operating system globally (Garfinkle, 2022), iOS is more commonly used in the United States. As of the time of writing this dissertation, iOS 16 is the latest operating system for iPhones, while Android 14 is the most current operating system for Android phones. 19 (32%) applications require iOS 14.0 or later, whereas 14 (23%) applications require Android OS 6.0 or later.

All of the mental health applications included in this study are listed as free on the app store, with 17 (28%) offering free trials before requiring a paid subscription for continued use. Certain free applications may also offer locked content that can be unlocked through in-app purchases. The price range for in-app purchases and subscription purchases varies from $0.99 to $249. Cost is a significant challenge for university students, specifically underserved students with low-socioeconomic backgrounds (Emmanuel, 2023).

The information provided regarding the latest updates in operating systems for Android and iOS devices, as well as the prevalence of free and paid mental health applications on app stores, has implications for designing for access that I further discuss in the discussion section.

6.3.2.2 Language and Reading Level

Multilingual support in mental health applications plays a crucial role in enhancing scalability and increasing access to diverse populations, enabling them to benefit from these resources. However, an important limitation in this regard is that a large number of applications, specifically 38 (63%) evaluated, only offer support in English. 14 (23%) applications provide multilingual support in five or more languages. Among the languages offered, English, Spanish, and French were the most provided.

Even though the applications evaluated were found on university websites in the United States, where English is the national language, the lack of multilingual support is still a barrier, with 25 million Americans considered Limited English Proficient (Hooper et al., 2015). The language barrier between patients and mental health providers has been well documented in the literature (Brisset et al., 2014; Ohtani et al., 2015), with this barrier now extending to mental health applications.

While mental health applications have the potential to improve accessibility compared to in-person interventions, as stated in previous research (Bucci, Schwannauer, and Berry, 2019; Torous et al., 2020), many of the evaluated applications fall short in this regard. An important aspect of accessibility is the reading level of the information provided in these applications, specifically as it relates to underserved groups that may not have a high literacy level. The average reading level of all 60 evaluated applications was found to be 9.1, which corresponds to a 9th-grade reading level. According to previous studies, the average reading level for a college freshman in the United States is a 7th-grade reading level (Olney et al., 2017; West, 2015).

Accessible health information is paramount in addressing mental health disparities and ensuring that individuals from diverse backgrounds can equally access and benefit from mental health resources (Skierkowski et al., 2019). However, previous studies (Eltorai et al., 2014; Rooney et al., 2021) have demonstrated that the readability of mental health information frequently exceeds the recommended reading level standards of 6th to 8th grade. This standard reading level may not be helpful for the average American, but it is the average reading level for an American university student (Olney et al., 2017; West, 2015). This indicates a need for further investigation into the

establishment of readability standards and guidelines for mental health resources to

ensure that they are accessible to individuals with varying levels of literacy. While

language and literacy levels may not pose a significant challenge to university students

studying in the United States, given that they are required to undergo English language

proficiency tests and other academic assessments to gain admission, it is still an

immense barrier for many individuals at large.

6.3.3 Mental Health Applications by Varying Institutions

A total of 28 applications were presented across 20 HBCUs. Half of the HBCUs

10 (50%) did not display any mental health applications on their counseling websites.

Among the 28 mental health applications, 12 (43%) lacked any culturally responsive

codes. Furthermore, six (21%) applications featured four or more culturally responsive

codes. HSIs collectively presented a total of 38 applications, with six (30%) schools not

displaying any mental health applications. Among the 38 applications, 17 (45%) did not

contain any culturally responsive codes. Similarly, PWIs collectively presented 42

applications, with six (30%) schools not displaying mental health applications on their

counseling websites. Moreover, 19 (40%) applications at PWIs did not incorporate any

culturally responsive codes. Both HSIs and PWIs presented a comparable number of

mental health applications (8 each) that featured four or more culturally responsive

codes. Figure 6.4 shows the number of culturally responsive codes from mental health

applications displayed by school type.

Figure 6.4: Culturally Responsive Codes by School Type
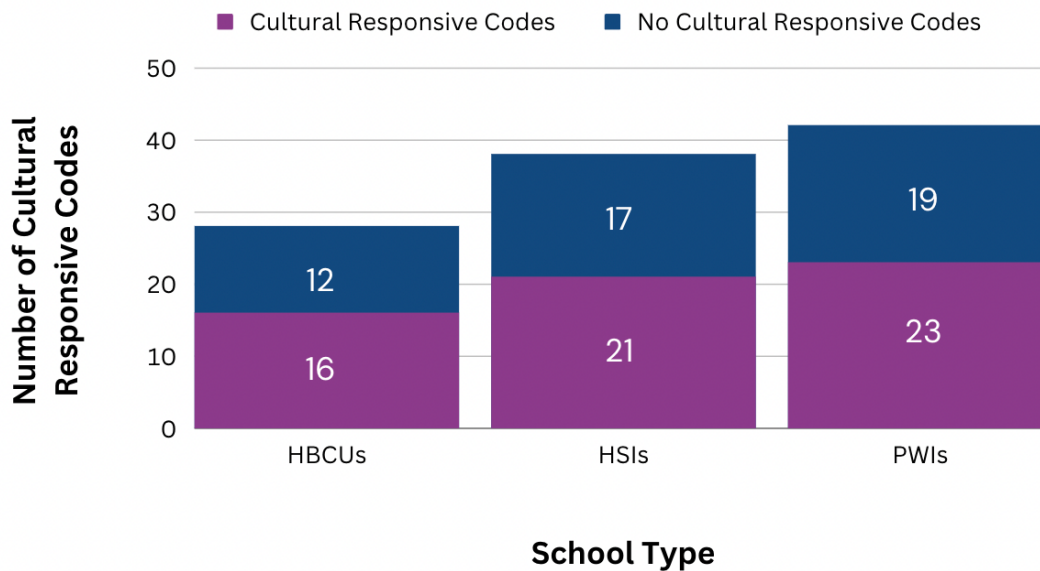
6.4 Discussion

REMs are not a monolith. Indeed, various intersecting identities, including nationality, gender, sexual orientation, and disability status, can significantly shape one's life experiences and impact their mental health (Galán et al., 2021; la Roi, Meyer, and Frost, 2019). For instance, individuals who identify as both Black, male, and autistic may encounter formidable obstacles when navigating society (*Obstacles Black Autistic Individuals Face — American Autism Association*, 2021), as they must contend with the pernicious effects of racial bias and discrimination. This individual will be reminded of the potential incidents such as the tragic 2012 shooting of Stephon Watts, a Black autistic teenager (Hurst, 2015), and the 2016 shooting of a caregiver protecting a Black autistic male in North Miami (Fieldstadt, 2019), which serve as poignant examples of the grave consequences that can arise when these identities intersect. Such incidents have significant repercussions, not only for the individuals involved but also for their loved

ones who offer them support. In this regard, the concept of vicarious racism is highly

relevant, as it highlights the profound impact of racism on those who bear witness to it.

The cultural responsiveness of mental health applications has recently come

under scrutiny (Ramos et al., 2021; Ramos and Chavira, 2022) and reveals significant

gaps in their ability to address the needs of individuals with disabilities effectively. Of

particular concern were the physical and learning disabilities codes, which were found

to be among the least culturally responsive codes. Specifically, in the context of physical

disabilities, the applications primarily referred to pain resulting from a physical disability.

While chronic pain is a real and debilitating condition, it represents only one facet of the

lived experiences of individuals with physical disabilities. It is essential to recognize that

individuals with physical disabilities have diverse and multifaceted experiences, such as

difficulties with mobility and pain (Antle, 2004) that can impact accessing education,

employment, and transportation (Bezyak et al., 2020). They may also encounter

discrimination, prejudice, and negative stereotypes that can exacerbate feelings of

isolation and marginalization (Dovidio, Pagotto, and Hebl, 2011; Rohwerder, 2018).

Physical disabilities often accompany negative stereotypes and stigma that can

profoundly impact an individual's sense of self and social standing (Green, 2007; Nosek

et al., 2003). Thus, it is critical that mental health applications provide comprehensive

support to students with physical disabilities, which includes addressing the trauma that

stems from their experiences of marginalization. Such support can foster a sense of

confidence and empowerment (Mejias, Gill, and Shpigelman, 2014), enabling students

to cope with or overcome some of the barriers they face.

The limited attention given to learning disabilities in the context of mental health support reflects a larger trend of a lack of recognition of invisible disabilities. Invisible disabilities are defined as disabilities that are not immediately apparent to an observer yet can have significant impacts on daily activities and quality of life, ranging from mild challenges to severe limitations (Invisible Disabilities® Association). Examples of invisible disabilities include cognitive and mental health disorders. The lack of support given to people with invisible disabilities can further perpetuate the stigma and misperceptions surrounding them. By failing to acknowledge the reality of invisible disabilities, society inadvertently reinforces the notion that these disabilities are not real or insignificant. Specifically, students struggle with obtaining the necessary testing accommodations from their school's disability services (Marshak et al., 2010). Not acknowledging learning disabilities, can create a cycle of stress and marginalization for those who live with invisible disabilities, as they are forced to grapple with the stigma and skepticism that surround their experiences (Rohwerder, 2018).

Mental health support services should take a more inclusive approach to addressing the needs of individuals with invisible disabilities, recognizing the complex interplay between physical, cognitive, and emotional factors that can impact their lives. By acknowledging the reality of these disabilities through more written and audio content in mental health applications, health researchers and designers can help break down barriers and empower individuals with invisible disabilities.

Within the context of this study, access refers to the offering of services that can be used by the vast majority of people digitally. Individuals from underserved areas may confront structural challenges such as a lack of technology resources, restricted internet

access, and language limitations. Aside from these systemic issues, the rapid development of mental health applications may be contributing to the access issue. For example, the presence of free trials and locked content in some mental health applications suggests that developers may need to carefully reconsider their pricing and monetization strategies to provide wider access to underserved populations. While offering free trials can allow users to test an application before purchasing a subscription or continuing to engage long-term, developers should ensure that the transition from a free trial to a paid subscription is transparent and clearly communicated within the application description in the app store before downloading. While evaluating these applications, 17 had the label "free" but were not descriptive of in-app purchases to unlock content features. This gives developers an opportunity to consider reduced pricing for individuals and create alternative business models. This could help reduce financial constraints and improve access.

Ultimately, improving access to mental health resources requires a multifaceted approach that addresses systemic issues while also considering the role of technology companies in creating accessible and affordable mental health applications. By prioritizing accessibility in the development and pricing of mental health applications, developers can play a crucial role in improving access to mental health resources for all individuals, regardless of their socioeconomic status or background.

Multilingual support is of paramount importance in the provision of access to mental health services, as it plays a critical role in facilitating accurate communication of health information and enhancing the comfortability of students addressing their challenges in American universities. In particular, students who have limited proficiency

in the dominant language of a host country, such as those who have moved to the United States, may experience discomfort or stigma when communicating in a language that is not their primary language. This discomfort may be exacerbated by the stigma associated with not knowing the English language, resulting in a lack of use of mental health applications and exacerbating the existing access divide.

To bridge this divide, founders of mental health applications should strive to design apps that are culturally responsive and inclusive of diverse cultural backgrounds. Incorporating culturally relevant content, as well as considering language preferences and literacy levels, can help increase access to mental health applications for users who may otherwise struggle to access mental health resources. Furthermore, ensuring that the application is accessible to users with varying levels of digital literacy or technological access is crucial for promoting equity and inclusivity. By recognizing the unique needs of individuals from diverse linguistic and cultural backgrounds and designing apps that are culturally responsive and inclusive, developers can play a critical role in improving access to mental health resources and promoting mental health equity.

6.5 Summary

In this chapter, I presented a quantitative study on the evaluation of mental health applications promoted to university students in the United States for cultural responsiveness. Mental health applications became increasingly popular within the last decade to alleviate the shortage of counselors and access to mental health support, which also resulted in the trend of mental health startups (Auxier et al., 2021). Currently,

the mental health applications on the market in the United States lack cultural responsiveness for REM university students.

Findings show that overall mental health applications on the market, specifically those promoted to university students, lack cultural responsiveness. This study also identified various challenges to accessing these applications, such as operating system requirements for applications not being available on older smartphone models, additional costs to use full features on applications, lack of multilingual support, and slightly high levels of reading comprehension necessary to comprehend the application's contents.

Technology startups operating within the mental health domain should prioritize collaboration with health practitioners and design researchers. Doing so will ensure that the mental health applications developed provide culturally responsive content in multiple forms, such as written, audio, and imagery, that is supportive of individuals with intersecting identities. Furthermore, it is critical to focus on improving accessibility by offering multilingual support and providing access to the full range of platform features when they are mentioned as free in the app store. Implementing these strategies can effectively bridge the gap in mental health support services, particularly for marginalized and underrepresented communities, and promote more equitable outcomes in mental health.

Chapter 7. Discussion

Cultural responsiveness should be incorporated into the design of technology-enabled mental health solutions to provide interventions for increased mental health support access and engagement for racial-ethnic minorities (REMs). Experts have used several technical solutions to address the barriers to access and inclusion for mental health services, such as mobile applications (Mohr et al., 2017; Schroeder et al., 2018), internet-based solutions (Lara et al., 2014; Nygren et al., 2018), and video software (Hadler et al., 2021; Langarizadeh et al., 2017). However, there has been little development in incorporating cultural responsiveness into these solutions (Narayan et al., 2023). Across four studies, I have identified four key themes that identify the need for culturally responsive digital mental health interventions for REMs and why this is necessary: 1) health-seeking behaviors; 2) means of access through technology; 3) implementation in real-world settings; and 4) implications for culturally responsive design. Taken together, these studies present a comprehensive view of the needs, challenges, and opportunities for designing digital mental health solutions for REMs in varied communities. Findings also show how designing culturally responsive digital mental health technology for real-world contexts can be complex and multifaceted. These studies emphasize the importance of developing technology to address the mental health needs of REMs with a better understanding of cultural responsiveness.

The National Institute of Minority Health and Health Disparities (NIMHD) Research Framework assists researchers in conceptualizing how social determinants of health impacts the mental health of REMs in order to provide appropriate services and interventions. However, the NIHMD Research Framework does not provide researchers

with methods to operationalize this framework to design mental health technology that is suitable for REMs. My thesis helps to bridge the gap between the NIHMD Research Framework and the design process across two domains of influence: 1) physical/built environment; and 2) sociocultural environment. Trust, community, and engagement were focus areas within the physical/built and socio-cultural environments that should be operationalized for the design process of culturally responsive digital mental health technology. These focus areas, while not an exhaustive list, encompass the key factors that emerge from the findings of my dissertation.

7.1 The Need for Cultural Responsiveness in Digital Mental Health

Collectively, my studies displayed areas that reflect a lack of attention to cultural responsiveness when designing digital mental health technology. There will be less potential for increased engagement in technology-enabled interventions for REM groups if the health-seeking behaviors of REMs, disproportionate means of access through technology, lack of implementation in real-world settings, and implications for culturally responsive design are not addressed. In the absence of a cultural responsiveness lens, it is possible to overlook the cultural influences, attitudes, and generational traumas that impact an individual's health-seeking behaviors. The variability in technological access and digital literacy among the global majority has been observed to have implications for the exclusion of certain communities benefiting from new means of accessing mental health care (Saeed and Masters, 2021; Spanakis et al., 2022). Interventions with new technical approaches may not be adopted or be as successful in highly vulnerable communities if socioeconomic and cultural circumstances are not fully considered and understood in the early developmental stages. Additionally, there is a lost potential for

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REM involvement with digital mental health tools when intersectionality and linguistic needs are not taken into account. To meet the various needs and realities of the REMs for achieving improved access to digital mental health care, cultural responsiveness is necessary.

7.1.1 Health-seeking Behaviors of Racial-ethnic Minorities

Previous research has shown that negative experiences in healthcare can impact health-seeking behavior (Hewins-Maroney, Schumaker, and Williams, 2005; Javed et al., 2021). Some REM groups have a mistrust of the healthcare system (Boulware et al., 2016; Kennedy, Mathis, and Woods, 2007; Scharff et al., 2010) or come from a cultural background that values resilience (Chan, Piehler, and Ho, 2021; Ho et al., 2021; Lusk and Chavez-Baray, 2017; Helling and Chandler, 2021) and perpetuates mental health stigma (Ciftci, Jones, and Corrigan, 2013; Benuto et al., 2019; Kakuma et al., 2010; Kudva et al., 2020). Through the design workshops and survey insights from REM university students in Chapters 4 and 5, I have found that students seek more communal and peer support. Researchers found that the predominant ancillary support of peer roles has an influence on students' interest in digital mental health tools (Lattie et al., 2020). However, designing for peer support in digital mental health solutions is still advancing and calls for improvement (Fortuna et al., 2020).

The need for communal and peer support results from REM's mistrust of the healthcare system (Shiyanbola et al., 2022; Siler et al., 2021). Recognizing the impact of historical events on REMs' mistrust of healthcare providers is imperative for researchers and designers to adopt a trauma-informed approach (Chen et al., 2022; Kelly, Lauren, and Nguyen, 2021) and exercise cultural sensitivity when promoting

digital health interventions. In Chapter 3, I found that for vulnerable communities, a lack

of trust hinders engagement with community-based, evidence-based interventions

despite their potential benefits. Families are hesitant to disclose personal information to

home visitors when it is required for monitoring the child's well-being. Families in

vulnerable communities need rapport before seeking and engaging with "non-traditional"

resources. On the other hand, young adults have specific needs for health-seeking.

Chapters 4 and 5 present their specific mental health needs, such as culturally

responsive resources, accessible evidence-based health information, and professional

support. Students also discussed using popular mental health applications such as

Calm, Headspace, and BetterHelp; however, some applications on the market may not

be evidence-based or have unethical practices.

Notable figures in the public eye have engaged in the endorsement of mental

health applications, only to subsequently rescind their support due to the presence of

injurious advertising. For example, US gymnast Simone Biles ended her endorsement

partnership with Cerebral after the company received a subpoena from federal

investigators over its prescribing practices of controlled substances, including the

amphetamine Adderall and other stimulants used to treat attention-deficit hyperactivity

disorder, or ADHD (Blum, 2022; Helmore, 2022). The company, BetterHelp, uses

influencer marketing to promote its teletherapy platform, in which these influencers

make commissions off the number of clicks and sales of the mental health application.

According to the Federal Trade Commission (FTC), BetterHelp did not uphold its

privacy obligations by disclosing the Internet Protocol (IP) and email addresses of

approximately 5.6 million former visitors to Snapchat and Pinterest to target them with

BetterHelp ads. Additionally, the company disclosed the email addresses of over 70,000 visitors, including people who had looked into Pride Counseling and Faith Counseling, to an online advertising company. The FTC has compelled the company to pay $7.8 million to consumers to settle allegations of revealing consumers' sensitive data to third parties (Vedova and Fair, 2023).

These are just a few examples of the harms that technology companies are further exacerbating for the mental health of individuals who are seeking support. These instances specifically deter REMs from seeking mental health services and can potentially trigger instances of previous medical mistrust (Ramos and Chavira, 2022). By targeting the factors that contribute to health-seeking, researchers can prevent potential harm and develop more effective strategies to increase engagement with digital platforms.

7.1.2 Means of Access Through Technology

Digital mental health technology has gained popularity due to its cost-saving benefits (Comer, 2015; Whaibeh, Mahmoud, and Naal, 2020) and the increasing demand for mental health support (Edbrooke-Childs and Deighton, 2020). It is being used as a means of access due to the inaccessibility of in-person treatment (Ralston, Andrews, and Hope, 2019) and the limited capacity of mental health professionals (Butryn et al., 2017). Further, the COVID-19 pandemic increased awareness of the alarmingly disproportionate access to adequate health care. Despite a significant increase of 80% in video consultations during the first two months of the pandemic, minority groups accounted for only a small portion of these (Nouri et al., 2020). Limited

access to WIFI, data plans, and difficulty navigating the installation of applications resulted in low usage among minority populations (Perrin and Atske, 2021).

Chapter 3 highlights how systemic inequities, such as financial constraints and limited digital infrastructure, can lead to multiple access barriers faced by REMs living in low-income communities. These access barriers not only affect the well-being and development of young children but also impact the work processes of home-based community workers who deliver the digital intervention. As seen in other research on implementing technical solutions for digital mental health in low-resourced environments, findings show there is a risk of digital exclusion for individuals living under those circumstances (Saeed and Masters, 2021; Spanakis et al., 2022).

Frequently, language and literacy barriers impede a second layer of access. Despite the growing popularity of digital mental health tools, previous research has shown that its usability can be affected by a variety of factors, including age, language, digital literacy, and health literacy (Berkman et al., 2011; Schueller et al., 2019). Young adults are generally considered more adept at using technology to access digital mental health support tools than older adults (Lattie et al., 2020; Tennant et al., 2015). However, not all young adults possess the necessary digital literacy skills to effectively engage with such tools (Khanlou, 2021). For example, low-income young adults with severe mental disorders may have limited access to technology and limited digital literacy skills, affecting their ability to access digital interventions (Spanakis et al., 2022). This calls for designing for health literacy among diverse groups of varying generations. Previous research has explored designing for health literacy through the use of text messages (Poorman et al., 2014; Prayaga and Prayaga, 2020) and game interventions

(Dadaczynski et al., 2021; Parisod et al., 2017). But I suggest researchers consider how to include mental health literacy on digital platforms in ways that cannot be easily dismissed, such as commonly used notifications and tool tips.

Financial constraints, language barriers, and a lack of health knowledge are barriers to digital access. Despite the potential cost-effectiveness of digital mental health applications, there is still little evidence supporting its affordability among underserved groups (Gega et al., 2022). As such, there is a pressing need for research that delves into the accessibility of these applications for university students from REM backgrounds as well as individuals living in low-income communities. It is crucial that we do not repeat the mistakes of the past by once again excluding historically marginalized groups from technological advancements, as discussed in the next section.

7.1.3 From Research to Implementation

One of the primary challenges that digital mental health solutions continue to face is the lack of translation from research to real-world implementation (Anderson-Lewis et al., 2018). Research shows that these tools often result in low engagement (Baumel et al., 2019; Flett et al., 2019; Pratap et al., 2020; Torous et al., 2017; Torous et al., 2018), which is an underlying issue resulting from the lack of real-world implementation. Chapters 3-5 of this dissertation aim at implementing an evidence-based mental health tool for real-world context as it relates to a specific REM population studied. Findings from these studies show the challenges and opportunities for research to real-world implementation of digital mental health technology in low-income rural and urban communities, university ecosystems, and those adjacent.

To address the issues of inclusion and the research-to-practice gap, implementation science provides a promising approach. Implementation science is a field of research that seeks to promote the effective adoption and sustained use of evidence-based interventions, programs, and policies in real-world settings (Bauer et al., 2015; Handley, Gorukanti, and Cattamanchi, 2016). To implement mental health applications with underserved communities, researchers should apply the principles of implementation science, starting with a comprehensive understanding of the specific challenges of feasibility, acceptability, and sustainability in providing culturally responsive mental health solutions. This involves tailoring strategies to the specific needs of the environmental setting and the digital mental health solution being implemented, as well as developing partnerships with community-based organizations and leaders.

Environmental contexts have a substantial impact on the feasibility and sustainability of a technical solution, as discussed in Chapter 3. Additionally, with institutions of higher education, the campus culture heavily impacts acceptability and whether the tech solution would be widely used privately or in conjunction with a counselor or group therapy program (Lattie et al., 2019). The context of use may also provide various levels of acceptability. Therefore, the implementation process should involve collaboration among stakeholders, including community organizations, institutions, healthcare providers, patients, and technology developers, to overcome these challenges. It is essential to develop an immediate plan during the initial implementation phase to ensure the sustainability of digital mental health tools. For example, in Chapter 3, the identification of potential sustainability challenges associated

with completing well-being assessments through a WhatsApp chatbot allowed

researchers to address those challenges early on and develop an effective tool that will

be sustainable in an environment with low digital infrastructure.

To further address the challenges of implementing mental health applications in

underserved communities, implementation science researchers have developed models

for cultural adaptations (Cabassa and Baumann, 2013; McIlduff et al., 2020), aimed at

reducing racial and ethnic disparities in mental health care. There are also efforts to

integrate implementation science with community mental health care to disseminate

evidence-based knowledge and resources among community health leaders (Atkins et

al., 2016; Brookman-Frazee et al., 2022). This approach provides underserved

communities with access to the resources and knowledge they need to support

individuals who may not have the opportunity to participate in research studies

conducted in clinical settings.

The translation of research to implementation for culturally responsive mental

health technologies should require consistent collaboration between health

practitioners, design researchers, and developers to ensure the tailoring of specific

needs for REMs drawn from both my research and previous literature (Ramos et al.,

2021; Williams et al., 2021). Findings show that interdisciplinary collaboration between

these fields can enhance the design and development of these technologies. Digital

mental health researchers are calling for implementation strategies (Connolly et al.,

2021; Graham et al., 2020; LaMonica et al., 2019) and collaborating with the HCI field to

address this problem as well (Lyon et al., 2023). By using the principles of

implementation science, such as engaging with stakeholders and iterative design and

evaluation, the development of evidence-based interventions for REMs can show increased engagement outcomes (McLoughlin and Martinez, 2022). In the section that follows, I will discuss specific iterative design considerations.

7.1.4 Implications for Culturally Responsive Design

Health researchers have forged collaborative partnerships with HCI researchers and computer scientists to design and implement digital mental health solutions (Ben-Zeev et al., 2015; Poole, 2013). While health researchers possess considerable knowledge regarding the efficacy of mental health treatments, they may be less well-versed in the nuances of user interface design and feature development necessary to ensure user engagement and promote long-term usage of digital mental health solutions. Studies presented in this dissertation represent a collaborative effort involving an HCI researcher (myself), developmental psychologists (Chapter 3), health researchers, clinicians (Chapter 4), and computer scientists (Chapters 4 and 5) to transform evidence-based assessments and interventions into technical tools capable of reaching REM groups. What is missing from this collaborative work is the process of designing these digital solutions for cultural responsiveness in order to determine their effectiveness in increasing engagement for REMs.

The approach of culturally responsive design involves a deep understanding of cultural and linguistic diversity and the development of solutions that are sensitive to these nuances. Customization of multilingual support, imagery, and rhetoric that is appropriate for specific cultural norms is necessary to ensure that digital mental health solutions resonate with the target population and are well-received. In Chapter 3, I found there was a great need for the initial WhatsApp chatbot to include local languages

other than English (Zulu, Xhosa, Afrikaans). As seen in Chapter 4, REM university students who are part of the international student population or who have different cultural norms than the dominant culture where their university is located may experience mental health stressors as a result of adjusting to a new environment while still transitioning into adulthood. In Chapter 5, Black and Latinx students expressed wanting to find out background information on counselors to determine which would best identify with their cultural background, gender identity, and sexual orientation. These findings suggest that there is a significant need for improvement in the design of digital mental health interventions to address complex emotional experiences and intersecting identities for REM groups.

Currently, there is not a substantial amount of research on the real-world implementation of accessible design principles for digital mental health solutions (Marwaha and Kvedar, 2021). To advance this area, design researchers must conduct studies that detail the design process for developing such solutions for diverse populations with varying levels of age, language proficiency, digital literacy, and health literacy. These studies should be designed in a manner that allows for replication and validation of the findings across different contexts and populations. Such research is necessary to ensure that digital mental health solutions are accessible and effective for all individuals. Community-based participatory research represents a critical avenue for health researchers seeking to collaborate with community stakeholders to ensure that digital mental health solutions are co-created and implemented in a manner consistent with the needs and values of local communities (Ginossar and Nelson, 2010; Israel et al., 2010). It is crucial that these communities receive the tools and resources they need

to feel empowered and capable of sustaining digital mental health solutions after the partnership with the institution has ended.

7.2 Engaging in Culturally Responsive Design using the NIHMD Research Framework

The ability to provide effective digital mental health solutions for REM groups is associated with the many social factors that influence mental health outcomes (Broom et al., 2015; Ramos and Chavira, 2022). The NIHMD Research Framework allows for the conceptualization of social determinants of health (National Institute on Minority Health and Health Disparities, 2017) that can provide insights into how to design culturally responsive digital mental health technology for real-world implementation. Conceptualizing culturally responsive design in mental health technology through understanding the levels of influence in the NIHMD Research Framework provides HCI researchers with the concrete factors that should be included in research and design processes. However, the framework does not operationalize the varying levels of influence for designing culturally responsive digital mental health solutions for real-world contexts. I aim to bridge the gap between the NIHMD Research Framework and the process of designing culturally responsive digital mental health technology by demonstrating how the framework aids in the identification of problem areas that require attention throughout the design process and how to then use this information to provide practical design solutions.

Figures 7.1 and 7.2 show the levels of influence that were highlighted for each study within the physical/built environment and sociocultural environment domains of influence.

Figure 7.1: NIHMD Research Framework and its Connections to the Dissertation Studies in the Physical/Built Environment Domain of Influence
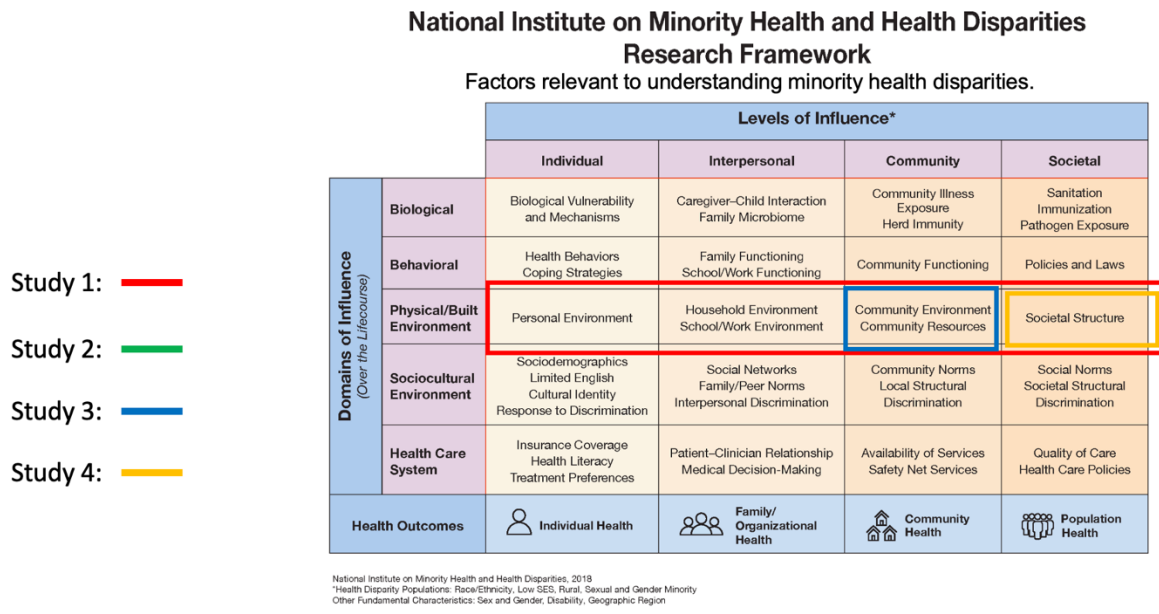
The physical and built environment domain of influence were prominent in the findings of studies presented in Chapters 3, 5, and 6. Chapter 3 focuses on the individual, interpersonal, community, and societal levels of influence, in which the personal and household environment presents unique challenges for home-based community ECD work (Orgill, 2010), with families experiencing limited internet access, overcrowded households, and a lack of healthy food, clean water, and electricity (Nxumalo, Goudge, and Thomas, 2013; Sibanyoni and Tabit, 2017). Chapter 5 highlights the ways students within a university community often seek support through traditional one-on-one counseling sessions or group therapy sessions (Cornish et al., 2017). Chapter 6 presents the societal structure of universities, also known as social institutions (Miller, 2003), that offer a vast array of mental health resources along with other resources via campus counseling center websites for their students.

Figure 7.2: NIHMD Research Framework and its Connections to the Dissertation Studies in the Socio-cultural Environment Domain of Influence
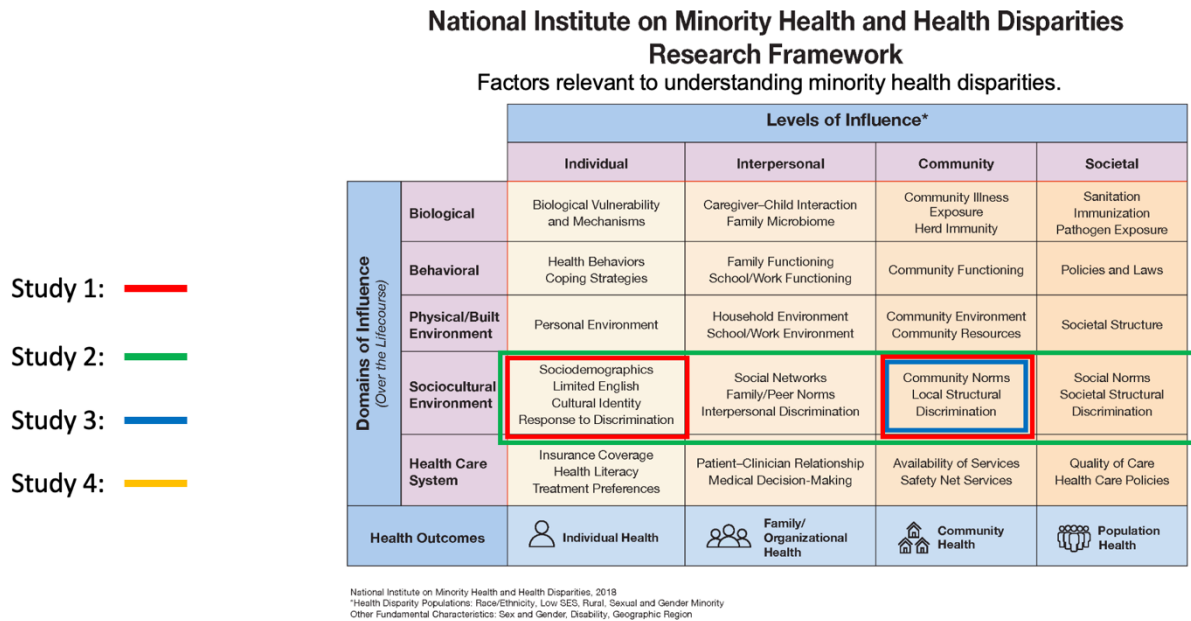
The socio-cultural environment domain of influence was prominent in the findings of studies presented in Chapters 3, 4, and 5. Chapter 3 focuses on the individual and community factors that influence both ECD work and WhatsApp chatbot adoption, such as limited English proficiency, employment status, and community violence. Individual, interpersonal, community, and societal factors affecting students are discussed in Chapter 4, including religious and spiritual beliefs and practices, cultural identity, and mental health stigma. Chapter 5 shows the need for community and peer support among students, both on university campuses and in the surrounding community.

7.2.1 Implementing Design for Trust

Cultural norms, historical traumas, and ethical considerations are various contributing factors to trust for REMs seeking and engaging in mental health care Lindinger-Sternart, 2015; López-Cevallos, Harvey, and Warren, 2014). Mental health technology was adopted during the Covid-19 pandemic, such as telehealth services to attend appointments (Langarizadeh et al., 2017) while at home with family or

roommates. This could be uncomfortable, depending on the cultural norms of the household environment. Mobile mental health applications have been developed with the intention of enabling individuals to receive on-demand assistance anywhere. When designing mental health technology for on-demand and in-home use, it is essential to consider how the personal and household environment may impose limitations on the target population from the perspective of all potential users.

Cultural norms between family generations and instances of conflict between family members may hinder the establishment of trust within the household environment. In Chapter 3, I found that trustworthy relationships in community-based programs that deliver evidence-based mental health interventions are necessary to cultivate long-term before disseminating new interventions for effective intervention delivery. Active participation and cooperation of families in the early-childhood development program are challenged when rapport and trust are minimal or non-existent with HVs. Families are fearful of their personal household circumstances getting out into the community, making them susceptible to potential rumors and embarrassment. In addition, they fear being reported to child services or sharing personal information with government agencies, both of which have the potential to create friction within the family.

University students are increasingly gravitating toward digital mental health applications as a resource for their mental health challenges; however, they have several ethical and privacy concerns. Students in Chapter 4 stated the need for evidence-based support to make sure they were receiving helpful information that was

scientific and not harmful. In addition, students want anonymity in peer-to-peer forum interactions and confidentiality of personal data collected by the app.

Operationalizing the NIHMD research framework for trust in the design process of culturally responsive digital mental health technology necessitates standardizing transparent data privacy forms and developing proper data infrastructure that ensures user privacy and the protection of personal identification. Even though this may seem obvious in today's technological age, ethics and privacy transparency tend to be lost in hidden user touchpoints due to the rapid development of new technologies and methods of providing mental health services (Norman and Stappers, 2015).

To ensure that users are aware of the privacy policies within mental health applications, these policies should be presented in a manner that requires their active participation and comprehension. In general, privacy policies are often regarded as a passing exercise to fulfill regulatory requirements. However, developers must shift their approach to make privacy considerations more intentional rather than an afterthought. Specifically, after registering for a service, privacy information should be presented in the form of short modules to facilitate attention and comprehension before users provide any personal information.

One of the major challenges for REMs is their reluctance to seek mental health services due to concerns about potential institutional harm or family shame (López-Cevallos, Harvey, and Warren, 2014; Scharff et al., 2010). The issues of privacy and security are particularly salient for marginalized communities due to their historical mistrust of institutions and the unethical practices of technology companies that sell user privacy data to third parties (Vedova & Fair, 2023). When designing innovative

mental health solutions in collaboration with multiple institutional partners, researchers must strategically establish the appropriate data infrastructure for the intended population environment. Only relevant data that is required for the intervention should be gathered in order to reduce the amount of unnecessary data that can be misused. Who has access to which data and in what capacities must be strategically identified. Additionally, storage solutions should be selected with scalability and transferability in mind. For instance, universities that develop new technologies must choose a storage solution that the targeted organizations can maintain. Considerations should include cost, technical capabilities, and program growth.

The effects of designing for trust extend beyond the individual level to the entire community. Designing for trust can lead to broader community adoption and participation through shared values and a positive reputation. Failure to design digital mental health solutions with proper infrastructure to address privacy and security concerns can leave these communities vulnerable and exacerbate existing mental health disparities, some of which are addressed in the following section.

7.2.2 Implementing Design for Community

REMs have cultivated community support systems throughout various generations to supplement the systemic injustices of institutional support. Family, peers, and community-based programs are at the core of those systems (Alitz et al., 2018; Siler et al., 2021; Tello and Lonn, 2017). There is a great deal of community-based research and intervention delivery for digital mental health technology (Buck et al., 2022; Gulliver et al., 2019) and, increasingly, for vulnerable communities (Harerimana, Forchuk, and O'Regan, 2019; Porche et al., 2022), which necessitates deliberate and

strategic effort. However, there are still challenges with doing this work due to the lack of operationalizing research frameworks for real-world contexts.

In Chapter 3, I discovered that technical tools cannot thrive in any environment, regardless of the availability of devices and an individual's technical capabilities. Low-income communities that face violence, poverty, and low digital infrastructure make this challenging. However, individuals living in complex environments should not have the result of not benefiting from technical solutions, but rather researchers working with them to come up with novel ones that operate better in that context. Considering the challenges present in the community environment, researchers can identify the gap in access to resources, opportunities, and education that may otherwise be limited.

Community programs to increase health and well-being access and awareness have been frequently established in vulnerable communities (Corburn et al., 2020; Flett, Khan, and Su, 2019). Volunteer peer support advocates and paid community health workers serve as additional valuable resources for these programs. Nonetheless, community health workers and peer advocates require a higher level of support so that they are psychologically fit for success in their field. When developing technical tools for a community, such as those presented in Chapter 3 and proposed in Chapters 4 and 5, HCI researchers should understand how society plays a role in the supporting agents of the tool just as much as its intended users.

University students that are first-generation Americans look for mental health support from outside family members (peers) due to the generational differences in sentiments surrounding mental health within their culture, as they are told to be resilient and strong rather than seeking out professional mental health support (Chan, Piehler,

and Ho, 2021). University students also seek a sense of belonging within their college community, especially REM University students, who struggle in predominantly white institutions where their culture is not the majority (Silver, 2020). Cultural-specific spaces and organizations, such as the Black Student Union or the Latinx Resource Center, provide a safe space for some of the mental health stressors they experience at the university level (Patton et al., 2019), such as microaggressions, discrimination, and overall systemic injustices that took place in society during the Covid-19 pandemic. In Chapter 5, students expressed the need for community and peer support, not just within the university campuses but also in the outside local community. Students also made multiple references to needing culture and identity-specific support; however, the majority of current mental health applications on the market do not provide this type of support. Findings in Chapter 6 show that out of 60 mental health applications evaluated, none were BIPOC focused, 20% had ethnic-identity-related content, and 27% had LGBTQ-related content.

Being that many of these community resources were on hold during the pandemic, online spaces were built in the form of webinars or teleconferencing spaces to connect. Chapter 5 revealed that 12 of the 60 websites of universities evaluated provided an option to only schedule an appointment with the counselor via phone. This is a challenge for university students, especially those who have moved back home with their families during the pandemic stay-at-home orders, where cultural stigma may hinder them from seeking mental health services. The lack of a discreet online private booking system posed a barrier to access for REM University students seeking help

during the pandemic. To engage and address the unique challenges faced by these students, culturally responsive mental health resources are necessary.

Operationalizing design for community support is important for sustaining the type of support that has been proven effective for REMs: community support systems and programs. Developing a formalized process for peer and professional collaboration and the implementation of virtual support includes assessing the exact needs of the specific population with regard to specific cultural values, stigmas, and religious or spiritual factors. This helps identify the proper professionals and peer specialists who are training in those areas and/or have lived experiences. Furthermore, researchers must consider how to assist peer support advocates and community health workers in preserving their own health and well-being. Knowledge sharing and preventing siloed work environments can contribute to them feeling supported. In Chapter 3, the home visitors found the support of their co-workers was needed to be prepared to work with families each week. This demonstrates the need to foster a sense of community to provide workers with the support and guidance they need to avoid burnout and persevere in their line of work.

There are varying levels of virtual support, such as telehealth services, mobile applications, chatbots, internet-based solutions, podcasts, articles, and forums. The level of virtual support required should be based on the age demographic, socioeconomic status, and literacy levels of the intended audience. In deploying new mental health technologies, the fact that a solution is novel and has a promising potential for benefits should not be the main determining factor, as is often the case. In a previous research study, I highlighted the challenges and opportunities for the design

and development of a mobile application system and wearable technologies to track and provide maternal healthcare information for low-income Hispanic mothers, and I found that choosing the appropriate wearable device for their specific population was crucial to the success of tracking and health behavior change (Williams et al., 2020). This necessitates matching the required technical capabilities with the needs and constraints of the study population.

Designing for community support enables REMs to maintain access to support systems that provide them with the resources and assistance they require when institutions and corporations leave them vulnerable (Vedova and Fair, 2023). Doing so helps foster engagement and potentially improve health-seeking behaviors. In the following section, I discuss other varying factors that should be considered when designing digital mental health technology for the engagement of REMs.

7.2.3 Implementing Design for Engagement

Auditing mental health technology for cultural responsiveness and integrating culture and identity-specific content can help operationalize designing for engagement. Throughout multiple studies of this dissertation, findings show the need for culturally responsive resources and services for REMs to engage with and seek mental health services. At the individual level, cultural factors such as religious and spiritual beliefs and practices, as well as cultural identity, can significantly impact mental health-seeking behaviors and engagement among REMs. Findings from Chapter 4 show students are apprehensive about disclosing their mental health challenges with their families owing to the stigma they may face. In Chapter 5, Black and Latinx students explicitly want access to local "Black mental health professionals" and information on the cultural and gender

identity of campus counselors. Various social demographic factors, such as limited

English proficiency, educational attainment, and employment status, contribute to the

increased need for inclusion in digital mental health services. Chapter 3 findings present

the disparities low-income families face in South Africa due to financial constraints,

unemployment, and living in unsafe housing conditions.

To accommodate diverse populations, digital mental health tools should provide

multilingual support for the various languages spoken in a geographical area.

Unfortunately, a significant portion (63%) of mental health applications evaluated in the

United States application market in Chapter 6 were only available in English, suggesting

a lack of inclusivity. While some may argue that English is the preferred language in the

United States, it is important to recognize that the country is home to numerous cultures

and languages that can benefit from engaging with the app in a language other than

English. HCI researchers have explored the use of conversational agents to provide

multilingual support in technical tools (Danielescu and Christian, 2018; Trang and

Shcherbakov, 2021), which still needs to be further tested to ensure accuracy and limit

ethical challenges.

Individual cultural factors, such as cultural identification, religious and spiritual

beliefs, and practices, are critical considerations when developing a health and well-

being tool. REMs have a variety of intersecting identities that make them susceptible to

stereotypes, microaggressions, and hate speech, resulting in poorer mental health

outcomes (Lewis et al., 2018). Oftentimes, certain identities are excluded from mental

health content, leaving individuals feeling as though they have nowhere to turn for

assistance. Chapter 6 findings show that extremely few applications included mental

health content for physical (6) and learning disabilities (3). Individuals living with disabilities are more vulnerable to mental health challenges due to stigma, stereotyping, and being left out of society (Emerson et al., 2021; Han et al., 2022). There is a missed opportunity to provide individuals with disabilities with digital mental health support that is appropriate for their needs.

Due to the lack of cultural responsiveness in the 60 U.S.-marketed mental health applications evaluated in Chapter 6, it is necessary to regularly audit platforms for cultural responsiveness, as demonstrated in the chapter. It is essential to accurately represent cultures, religions, and identities to avoid triggering any trauma or misrepresenting their culture. This also emphasizes the importance of conducting community-based research and understanding the cultural norms and practices of REM communities to avoid replicating biases and assumptions in technology.

7.3 Summary

Digital mental health technology will continue to advance and be marketed to diverse populations in order to increase access to mental health resources due to the overwhelming lack of counselors needed to serve those in need. The rapid advancement of these technologies in recent years has caused the field to quickly design, develop, and test them on populations that are easily accessible to researchers and organizations. This results in REMs being excluded from the work that helps continue the advancement of these technologies and limits their access to these new technologies. The cultural responsiveness of digital mental health technologies, such as privacy concerns, culture and identity-based resources, and multilingual support, was overlooked due to the lack of inclusion of REMs in this work. Addressing the

components of how researchers can operationalize the NIHMD Research Framework can promote the design of evidence-based, culturally responsive digital mental health interventions that can improve REM populations' health-seeking and engagement.

Chapter 8. Conclusion

The process of designing cultural responsiveness into technology-enabled mental health solutions requires careful consideration and significant work in understanding the intersectional factors and social determinants of health that influence mental health access and utilization among REM communities. This dissertation aims to explore the design and evaluation of cultural responsiveness in digital mental health solutions for REMs. Through four different studies, I characterize how social determinants of health affect how REMs seek and engage with digital mental health solutions, empirically demonstrated how designing alongside individuals within REM groups shapes ideation and design outcomes, and emphasized the deeper work that health researchers, design researchers, and technology developers must undertake to create accessible, scalable, and inclusive digital mental health solutions.

Chapter 3 describes the challenges of real-world contexts that would factor in when designing a technical tool for well-being in low-income communities and under-resourced environments. Chapter 4 focuses on understanding how university students use and perceive existing technical and non-technical resources and envisioning support for their mental well-being. Chapter 5 presents the wants and needs of Black and Latinx students seeking mental health services on their respective university campuses, coupled with an analysis of campus offerings in which culturally responsive resources were a significant need. Chapter 6 conveys the extent to which mental health applications in the U.S. market are culturally responsive. These findings contribute to the challenges of designing and implementing culturally responsive digital mental health solutions for REMs: 1) health-seeking behaviors; 2) means of access through

technology; 3) implementation in real-world settings; and 4) implications for culturally responsive design.

I answer the following research questions to make contributions by providing empirical data on the need for cultural responsiveness in digital mental health solutions through the perspectives of multiple REM communities and insights that can improve design solutions when researchers include REMs in the design process.

RQ1: How do intersectionality and social determinants of health affect how racial-ethnic minority communities seek and engage with digital mental health solutions?

I use the NIHMD Research Framework to pinpoint how social determinants of health impact each REM group studied as it relates to the design and implementation of a digital mental health technology intended specifically for that demographic. Intersectionality is salient amongst the university student demographic where there are students identifying with multiple identities (e.g., first-generation, belonging to a specific ethnic group, American, or LGBTQ), in which they seek out mental health resources that are specific to their identities. University students are apprehensive about engaging with services if the information they seek is not readily available. REMs from socioeconomically disadvantaged backgrounds have limited access to quality mental health services and trust concerns due to the historical discrimination and prejudice of healthcare institutions and corporations. This results in a gravitation toward peer and community support and distrust of digital mental health applications or programs that appear to be similar to government institutions. Environmental (e.g., limited digital infrastructure, lack of access, household environment) and community (e.g., stigma,

trust, violence) complexities create a significant barrier to the use and engagement of digital mental health interventions for REMs.

RQ2: *How do racial-ethnic minority communities envision the design of digital mental health support?*

REM communities studied envision digital mental health support to include culturally responsive mental health options such as multilingual support, culture and identity-specific resources, peer support, transparent health and privacy communication, healthy reminders, and evidence-based life skill support. Adaptation to the intervention itself may not be necessary, but incorporating cultural responsiveness into the design of the technology as a means to mental health access is essential for the engagement of REMs. In addition, another layer of support for alternative solutions outside of technical-based support is envisioned specifically for communities with challenged access to technology.

RQ3: *How can designing for cultural responsiveness contribute to the engagement of digital mental health technology for racial-ethnic minorities?*

Designing for cultural responsiveness can help racial-ethnic minorities engage with digital mental health technologies, which can help increase positive health-seeking behaviors, access through technology, and long-term usage in real-world settings. Increased trust in community-based evidence-based interventions and ethical privacy practices for digital mental health applications has the opportunity to increase engagement. Providing multiple access points for low-income communities to challenge systemic inequities can help those in vulnerable communities gain increased access to

technical well-being solutions. Furthermore, universities can provide more culturally responsive virtual mental health support for REM university students to potentially increase engagement. Findings show the need for more research to real-world implementation of digital mental health technology in low-income rural and urban communities, university ecosystems, and those adjacent to them to assess its feasibility and sustainability.

RQ4: What opportunities exist for designing digital mental health support to promote and improve emotional and social well-being for racial-ethnic minority communities? Trust, community, and engagement were identified as key areas of focus within the physical/built and socio-cultural environments that should be operationalized during the design process of culturally responsive digital mental health technology. I use the NIHMD Research Framework to operationalize how to incorporate designing for trust, community, and engagement in digital mental health solutions.

Trust:

- Standardizing transparent data privacy forms and developing proper data infrastructure that ensures user privacy and the protection of personal identification.
- Establishing appropriate data infrastructure for the intended population environment.

Community:

- Developing a formalized process for peer and professional collaboration and the implementation of virtual support includes assessing the exact needs of the

specific population with regard to specific cultural values, stigmas, and religious or spiritual factors.

- Matching the required technical capabilities with the needs and constraints of the study population.

Engagement:

- Auditing mental health technology for cultural responsiveness.

- Integrating culture and identity-specific content can help operationalize designing for engagement.

Future research directions for this work involve community-based research with diverse REMs having intersecting identities to collaboratively design more effective digital mental health solutions. Additionally, secondary quantitative data collected via the All of Us Research program could be used to gather substantial health data and address mental health disparities and social determinants of health. Such an approach could lead to a more comprehensive understanding of the nuanced challenges and issues faced by diverse communities, complemented by qualitative participatory design research. Taken together, these studies present a comprehensive view of the needs, challenges, and opportunities for designing digital mental health solutions for REMs in varied communities. When looking at these studies collectively, the findings show how designing these solutions can be complex and multifaceted. These studies emphasize the need for a deeper understanding of real-world contexts for implementing digital mental health interventions and culturally responsive resources to address the needs of diverse cultural backgrounds and identities.

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Appendix A
Survey Questions: Analysis of Distance-Based Mental Health Support for Underrepresented University Students

1. What is your classification?
    a. Undergraduate student
    b. Graduate student
2. Which of the following classifies your college or university?
    a. Historically Black College or University
    b. Hispanic Serving Institution
    c. Predominantly White College or University
3. Do you know if any of your peers on campus experience mental health challenges?
    a. Yes
    b. No
    c. Maybe
4. Do you personally experience mental health challenges?
    a. Yes
    b. No
    c. Maybe
5. Have you ever helped a peer talk through any challenges that might cause them to be anxious or frustrated?
    a. Yes
    b. No
    c. Maybe
6. Does talking about your problems to your friends make you feel like a burden to your friend group?
    a. Yes
    b. No
    c. Maybe
7. What are certain things that your friends do to make you feel supported?
8. Do you know where to go on your college campus if you are in need of assistance because of a mental health problem?
    a. Yes
    b. No
    c. Maybe
9. Do you have easy access to counseling services on your campus?
    a. Yes
    b. No
    c. Unsure. I never used it.
10. Do you feel that the counselors on your campus are effective?
    a. Yes
    b. No
11. Have you ever felt like a counselor or therapist could not relate to your situation due to cultural differences?

      a. Yes

      b. No

      c. Never experienced

12. Have you ever felt like a counselor or therapist could not relate to your situation due to age differences?

      a. Yes

      b. No

      c. Never experienced

13. How often do you seek counseling from a close friend vs a trained professional?

      a. Very Often

      b. Often

      c. Not Often

14. Would you be comfortable talking to a group of your peers (even if you don't know them) about any issues you may be having?

      a. Yes

      b. No

      c. Maybe

15. Which one of these activities do you partake in to express your feelings?

      a. FINSTA (Fake Instagram)

      b. Journaling

      c. Vlogging ((YouTube, Tik Tok, SnapChat, Instagram)

      d. None

16. How do you assess that your mental health is improving after experiencing a challenging time?

17. If there were an app for mental health on college campuses, catered specifically to minority students, what do you think the app should offer?

18. Is there an app that your student health center already provides?

      a. Yes

      b. No

      c. Unsure

19. If yes, what about it do you like?

20. Would you prefer a web-based tool rather than an app?

      a. Yes

      b. No

      c. Maybe

Appendix B: Codebook for Chapter 5's Content Analysis

Wellness Resources: Resources focused explicitly on wellness (e.g., meditation apps, breathing apps, nutrition, study habits/productivity, as well as advertisements for workshops and other resources that might be accessed later).

Online appointment booking: Students allowed to book appointments online.

Appointment booking by phone: Students allowed to book appointments over the phone.

Individual counseling services: One-on-one counseling services offered.

Group counseling services: Group counseling services offered.

Community Resources: References to any resources that are external to the university that could provide an opportunity for students to engage with a broader or more culturally responsive community or group (e.g., churches, local wellness resources, Black counselors if not available on campus, etc.).

Counselor bio: Information about counselors (Y for at least two of: name, specialty, photo, or other textual description; N otherwise).

Online assessment: Online triage assessments, can be provided internally or linked out.

Contact & hours of service: Location, phone number, and hours of service

Immediate appointments: Can be marked in-person, video, phone, chat or no
(e.g., Y: IP;) (Y: V;) (Y: C;) (Y: P)

Scheduled appointments: Can be marked in-person, video, phone, chat or no
(e.g., Y: IP;) (Y: V;) (Y: C;) (Y: P)

Expectations: Information on what to expect during your visit/appointment. Codes are Y or N

Diversity Statements: Explicit statements of support for BLM and/or racial and ethnic diversity, inclusivity and equity. Codes are Y or N

Diversity Initiatives: Counseling initiatives for students of color (e.g., therapy groups for students from diverse racial and ethnic backgrounds). These events and groups must be advertised or listed by the counseling center's website and run by the university, but they do not have to be run by the counseling center. Codes are Y or N

Website Ethos: Medical orientations reference medical orientations to mental health, including but not limited to textual references to nurses, medication, triage, hospitalizations, pictures of medical facilities and uniformed medical personnel. NOTE: The *medical model's* school of thought is that *mental disorders* are believed to be the product of physiological factors.
M for Medical; W for Wellness

Website Structure: Menu and/or banner identifies as one or multiple of the following: (use subcodes to note type of layered website: L: M for layered medical, L: W for layered wellness, L: SA for student affairs, L: U for university website or T for Top-level (T: W for top-level wellness, etc.)

Appendix C: List of Schools Used for Content Analysis in Chapter 6

Historically Black Colleges and Universities (HBCUs)

- Spelman College
- Howard University
- Tuskegee University
- Morehouse College
- Xavier University
- Florida A&M University
- Delaware State University
- Claflin University
- North Carolina A&T University
- Fisk University
- Morgan State University
- Tougaloo College
- Dillard University
- North Carolina Central
- University of Maryland Eastern Shore
- University of the District of Columbia
- Bowie State University
- Jackson State University
- Norfolk State University

Hispanic Serving Institutions (HSIs)

- University of California, Irvine
- University of California, Santa Barbara
- University of Central Florida
- Florida International
- Texas Tech
- California State Long Beach
- The University of Arizona
- San Diego State University
- New Mexico Tech
- Santa Barbara
- John Jay College
- University of Illinois Chicago
- University of Houston
- NOVA Southeastern University
- Hallmark University
- Lake Tahoe Community College
- Rutgers University
- Allan Hancock College
- University of California Riverside
- West Texas A&M University

Predominately White Institutions (PWIs)
- Princeton University
- Massachusetts Institute of Technology
- Harvard University
- Stanford University
- Yale University
- University of Chicago
- John Hopkins University
- University of Pennsylvania
- California Institute of Technology
- Duke University
- Northwestern University
- Dartmouth College
- Brown University
- Vanderbilt University
- Rice University
- Washington University of St. Louis
- Cornell University
- Columbia University
- The University of Notre Dame
- University of California, Berkeley