Spring 2023

Business and Psychological Aspects of Viable Mental Health Digital Tools

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May 2023

Acknowledgements

I would like to take this opportunity to thank the individuals who have fostered the environment for me to grow and succeed through this Honors Thesis. Thank you to my advisors, Dr. Stacey Dunn and Dr. Serina Al Haddad, who guided me throughout this research journey. Thank you for your adaptability to various changes, willingness to collaborate, insightful feedback, and precise execution of compassionate pressure. Thank you to my committee members, Professor Tres Loch and Dr. John Houston, for facilitating meaningful discussion to further enhance my interdisciplinary research. I extend gratitude to my classmates, cohort members, and friends who have challenged me in the classroom, inspired me to learn more, offered helpful edits, and provided moral support throughout. Lastly, thank you to my mom, dad, and sisters for always being a phone call away to encourage my endeavors and put life in perspective. Without the unwavering support of you all, this thesis would not have been possible.

Abstract

This study aims to understand the industry potential of the mental health mobile tool market and articulate how it intersects with consumer attitudes to determine the viability of digital tools in the mental health space. Themes regarding the prevalence of mental health concerns, the role of technology, and the ethics of integrating technology into mental healthcare can be found throughout the study. Market research was conducted to understand the industry in terms of the Porter's Five Forces framework, recognizing low supplier power, a medium threat of new entry, and a high threat of substitution, competitive rivalry, and buyer power. A survey was conducted to assess consumer attitudes towards digital tools for mental health, which play a significant role in determining the industry's potential to compete with substitutes, gain buyer interest, and stand out against rivals. Utilizing a taxonomy to analyze qualitative results from 201 participants illustrates that key concerns of consumers include privacy, human complexity, validity and danger, and that consumers are most optimistic about the increased accessibility, gained assurance, and ease that digital tools provide. Statistical analyses testing correlations and differences in groups emphasize the importance of recognizing a target audience, tailoring to underrepresented groups, and recognizing the vulnerability of the population at hand when creating a viable mental health mobile tool.

Business and Psychological Aspects of Viable Mental Health Digital Tools

Prevalence of Mental Health Concerns

In a report published by the World Health Organization (2022), it is estimated that approximately 970 million people worldwide live with mental illnesses – with 31% accounting for anxiety disorder and 29% classifying as depressive disorders. Globally, 8% of children aged 5-9 and 14% of adolescents aged 10-19 live with a mental illness. In the US alone, 1 in 6 children (aged 6-17) and 1 in 5 adults experience a mental health illness each year (National Alliance on Mental Illness, 2022). Annual prevalence rates are especially high in certain populations, including 35.8% of non-Hispanic mixed/multiracial individuals and 47.4% of individuals who identify as lesbian, gay, or bisexual (National Alliance on Mental Illness, 2022). These numbers are of concern, as mental health affects long-term quality of life and ability to function in society (Barican et al., 2022). Only 46.2% of US adults with mental illness, 64.5% of adults with serious mental illness, and 50.6% of youth (6-17 years old) received treatment in 2020, 2020, and 2016, respectively, with the average delay between onset of symptoms and treatment lasting an immense 11 years (National Alliance on Mental Illness, 2022).

Concerningly, 36.7% of adolescents aged 12-17 in 2018-2019 had persistent feelings of sadness and hopelessness, and 18.8% had seriously considered attempting suicide (Centers for Disease Control and Prevention, 2022). If these mental health conditions truly go untreated for an average of 11 years, they are often not addressed during the sensitive time of adolescent development and are likely to lead to many negative health and psychosocial future outcomes (Golberstein et al., 2019). A longitudinal study of 1265 children in 2002 indicated that individuals who suffered from depression during adolescence were at significant increased risk of later major depression, anxiety disorders, nicotine and/or alcohol dependence, suicide

attempts, educational underachievement, unemployment, and early parenthood (Fergusson & Woodward, 2002). Supporting adolescents and emerging adults by increasing access to mental health treatment is especially important for the well-being of these individuals as well as society in both the short run and long-term future.

According to the Center for Disease Control and Prevention (CDC), between 2016 and 2019 approximately 9.4% of children aged 3 to 17 had ever been diagnosed with anxiety and 4.4% with depression. This is a drastic increase from the 8.4% of children aged 6 to 17 ever having been diagnosed with depression or anxiety between 2011 and 2012 (Bitsko et al., 2018). This escalation continued, with rates of mental illness increasing substantially during the 2019 Coronavirus Pandemic when individuals were removed from their routines, isolated, and experienced financial stress. As opposed to the estimated 193 million people worldwide with major depressive disorder prior to the pandemic (2,471 cases per 100,000 population), the estimated count escalated to 246 million (3,153 cases per 100,000 population) after the pandemic (World Health Organization, 2022). As major depressive disorders alone increased by 28% in just one year, people were deprived of both socialization and mental health support due to social distancing measures and fear of the virus (World Health Organization, 2022).

As struggles with mental health increase, the need for mental health professionals rises. The World Health Organization's Mental Health Atlas (2021) notes that the prominence of mental health workers (mental health nurses, psychologists, psychiatrists, social workers, and other specialized mental health workers) ranges from fewer than 1.4 mental health workers per 100,000 people in low-income countries to over 62 mental health workers per 100,000 people in high income countries, with a median of 14.9 workers per 100,000 in America (1 mental health worker per 6711 people). Mental health workers' presence in America has fluctuated, decreasing

from a median of 16.2 per 100,000 people in 2014 to 11 in 2017, and raising to 14.9 per 100,000 people in 2020 (World Health Organization, 2021).

This shortage is represented in mental health provider Health Profession Shortage Areas (HPSAs) which are dictated based on the ratio of residents to mental health providers, accounting for the need of the area with consideration to poverty level, age distribution, and prevalence of substance misuse. With about 163 million individuals (approximately 48% of the US population) living in HPSAs as of 2023, this shortage is especially concerning, as a study analyzing the association between suicide rate and HPSAs found that these HPSAs have higher suicide rates, with that association increasing over time from 2010 to 2018 (Kuehn, 2022; Health Resources & Services Administration, 2023; Ku et al., 2021). These statistics emphasize a dire need globally for a higher supply of mental health support – through professionals or elsewise – as the demand is evidently severe and only increasing.

Role of Technology

Amidst this shortage of mental health providers, the use of technology in providing mental health support addresses this barrier of access, as well as combats the hurdle of stigmatization. Technology has the potential to bridge the gap between research and practice, making supportive services accessible on a much wider scale due to the nature of its decreased dependency on providers. Some distinct advantages of this technological opportunity include convenience, flexibility, increased scope, anonymity as opposition to stigma, and lower costs (World Health Organization, 2022). Another advantage pertains specifically to highly stigmatized communities, who have vocalized their increased comfort in approaching therapy through technology that allows them to feel safer due to anonymity that is not an option in typical face-to-face therapy (Garsd, 2020).

One meta-analysis of clinical trials for 22 mobile apps found that, compared to patients in a control group, patients using apps to self-manage depression (user provides input, technology provides feedback – i.e., collaborating to create tools to aid in sleeping, or user inputs medication schedule and app provides medication reminders) and alleviate symptoms experience significantly reduced depressive symptoms (Chandrashekar, 2018). Anxiety was also successfully reduced using targeted apps, with the most effective intervention including a combination of the digital tool alongside face-to-face or internet-based therapy (Chandrashekar, 2018). To further develop this treatment, engineers must work effectively with clinicians to integrate best clinical practices with engaging platforms.

Abd-alrazaq et al. (2019) analyzed the features that 41 specific chatbots provide for improved mental health and concluded that the chatbots are most frequently used to deliver therapy, facilitate training (i.e., social skills), and screen for mental illnesses. Of the chatbots analyzed, 70% were implemented in stand-alone software. This is unfortunate, as stand-alone software – as opposed to web-based chatbots – requires the installation of a specific application and is therefore less accessible and more prone to privacy breaches (Abd-alrazaq et al., 2019). Additionally, the majority of these chatbots (92.5%) generate responses based on decision trees rather than machine learning, and therefore are more restricted than chatbots in other fields. This trait also creates a conversation led by the machine rather than by the user, limiting the responses to the user's more complicated needs. This one-sided, automated conversation also challenges the possibility of a therapeutic relationship, which requires two individual beings as well as their connectedness – and is believed to be a major ingredient for therapeutic change (Rodgers, 1957; Gelso & Hayes, 1998).

Another challenge lies in the generational gaps, as a recent study by Accenture (2020) reports that individuals in Gen Z (born 1997 – 2001) were more than four times more likely than Baby Boomers (born 1946 – 1964) to prefer virtual care to in person care, with 41% of Gen Z preferring virtual or digital experiences with doctors and other medical professionals, as opposed to 9% of Baby boomers – a finding that aligns with the overall trust different generations have in tech companies and that addresses a potential challenge in the industry to providing care for all ages. Gen X (born 1965 – 1980) falls in between the other generations in terms of openness to virtual care over in-person, with 22% preferring the virtual or digital experience (Accenture, 2020). Clearly, further development of these tools is needed to reach their maximum potential. Simultaneous to the revision of technological aspects, developers must consider ethical regulation, data privacy, and credibility concerns that arise with these advancements to best maintain integrity and effectiveness.

Ethics of Mental Health Digital Tools

In our rapidly evolving world, the ability to step back and reflect on the practices of our society – especially emerging technology – is essential. As artificial intelligence (AI) continues to grow, this reflection becomes even more crucial. In the realm of mental health, digitization and automation serves many benefits accompanied by hesitations. Valentine et al. (2021) breaks down the ethical challenges which emerge when using AI to personalize responses that increase user engagement into three categories: lack of explainability, complexities regarding the tradeoff between privacy and personalization as it contributes to the quality of a recommendation, and the control of app usage data.

Explainability refers to the challenge of an automated suggestion regarding mental health, as explaining the reasoning for the suggestion (previously recognized red flags). It is often

sensitive in nature, inappropriate, and counter beneficial. This is further exacerbated as an ethical concern due to the lack of a clinician, and therefore risk of malfunction or inefficacy in logistical processes and outcomes, especially considering that only between 3% and 5% of mental health apps utilize evidence-based approaches (Armontrout et al., 2016; Clay, 2020). One study found that 6 out of 69 mental health apps analyzed, downloaded more than one million times each, displayed an erroneous crisis helpline number – bearing an ethical responsibility much heftier than an error in non-life-critical industries (Martinengo, 2019).

The world of digitized mental healthcare also creates a high-risk tradeoff between privacy and personalization, with the user's mental health privacy being protected in an ambiguous manner. Although the increased personalization drives high engagement, and therefore effectiveness, it comes with the risk of exposing and sharing more personal data (Valentine et al., 2021). Valentine and colleagues (2021) recognized the challenge in controlling the data protected, unsure if protocol should treat data as medical records or content consumption. Privacy and security concerns are prominent, as uniform Health Insurance Portability and Accountability Act ("HIPAA") protection does not necessarily apply to health data shared via mobile applications (Armontrout et al., 2016).

Evidently, a large proportion of individuals in the US needing mental health support are not receiving the care they need, indicating the need for changes to uplift the mental health of the population (Reinert et al., 2021). Although the goal of improving mental health is obvious, the way to do so remains unclear. This paper aims to investigate the potential of technology in fostering this change, specifically through digital applications and chatbots employing machine learning. In continuation of past research on the aptitude and scalability of technology in mental health, this paper delves into the prospective suppliers and consumers of the market to determine

its feasibility. More specifically, we begin with a market analysis to determine the attractiveness of the industry for mental health digital tool creators (suppliers), and then examine the acceptance of the general population (consumers) through analysis of primary research. We conclude with an exploration of the intersection of these two segments (suppliers and consumers) to determine the overall viability of digital mental health tools.

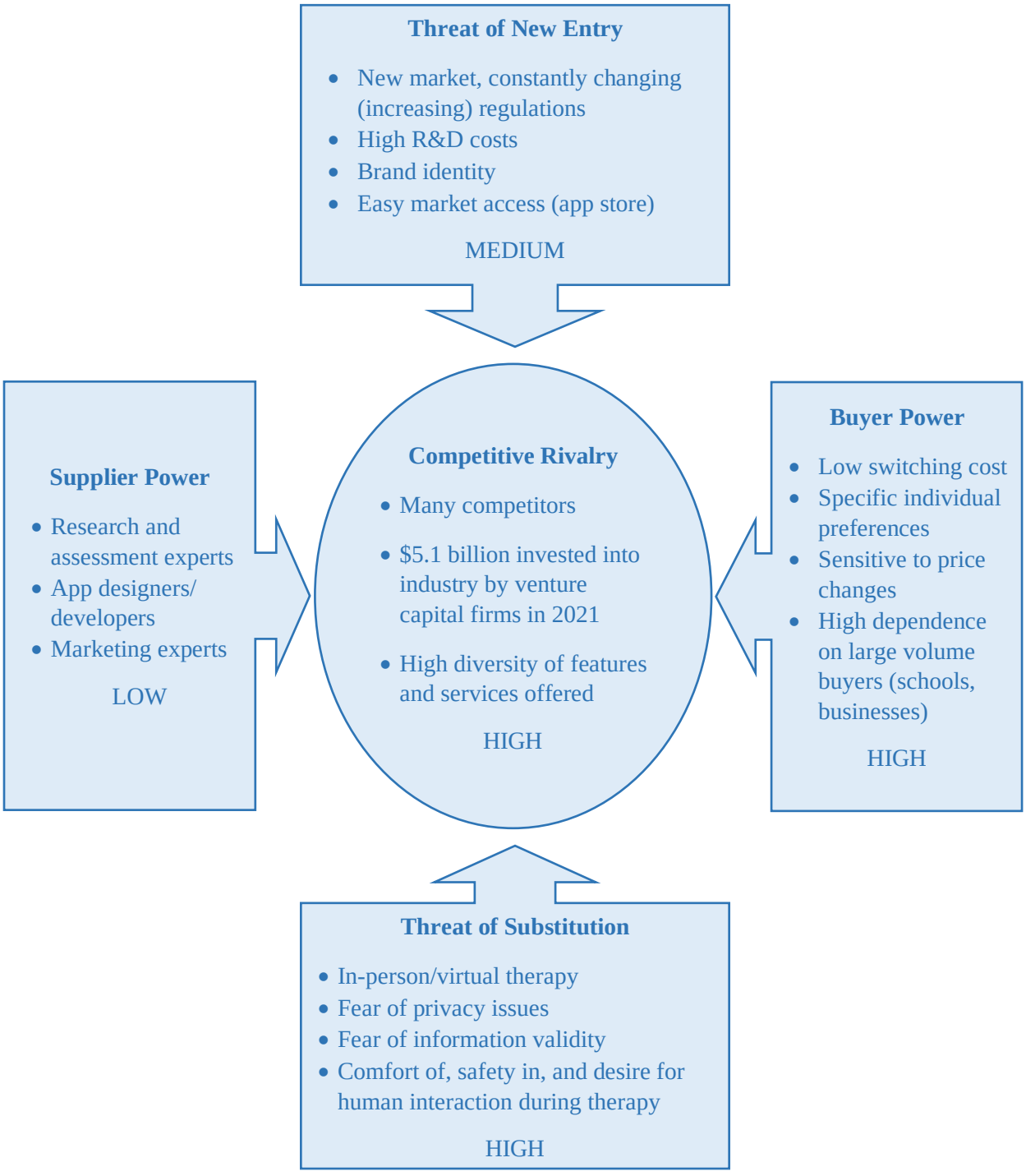
Industry Analysis: Mental Health Digital Tools

This section aims to analyze the mental health digital tool industry by using Porter's Five Forces framework to realize industry barriers to entrance, suppliers, customers, rivals, and substitutes. The digital tools include artificially intelligent (AI) conversational chatbots, as well as mindfulness, medication, and/or specific psychological treatment mobile applications. The tools aim at supporting a broad range of populations, recognizing that they must be both engaging and clinically effective. Strategically, companies in the industry often hire qualified clinical officers as well as technical officers. These calculated positions interact to enhance the mission of the company. Statistical analysis will be conducted to recognize the potential of a company amidst the threats and opportunities in this evolving industry.

This research examines the mental health mobile tool industry's competitiveness, and therefore profitability, through five lenses: the threat of new competitors to the market, the power of suppliers and buyers in bargaining with companies in the market as providers and purchasers, respectively, the threat of substitutes that could provide alternative solutions for the same problems, and the degree of rivalry from other companies proving for the same struggle with a similar strategy. The Porter's Five Forces model displayed in Figure 1 outlines external factors that will impact the success of companies aiming to penetrate the digital mental health tool industry in the upcoming years.

Figure 1

Porter's Five Forces: Mental Health Digital Tool Industry



Note. The diagram above displays the major factors of the five forces which influence the potential of the current mental health digital tool industry, with details elaborated in text.

New Market Entrants

Digital mental health companies entered the mainstream front in 2010, and their market presence greatly propelled during and after the Covid-19 pandemic (Lovett, 2022). Many start-ups received significant funding, as governments and donors realized the importance of tools to aid the increased prevalence of mental health struggles of a population suffering isolation, stress, and despair. This growth is accelerating as users' awareness and acceptance for such tools increases, fueling technological advances and realization by providers of the potential to increase the scope of service, with a compound annual growth rate (CAGR) of 20.3% between 2023 (market value: USD 19.5 billion) and 2030, when it is estimated to reach a market value of USD 71.1 (Gotadki, 2023).

In this rapidly growing market, new entrants are constantly attempting to claim their share. With easy market access through app stores, the challenge comes in performing in-depth research, strategic development, and creative marketing. As Lovett (2023) states, startups that want to succeed must be able to differentiate from their peers and clearly measure the success of their tool's outcomes, facilitating clear communication and accountability regarding Return on Investment (ROI) to stakeholders. Improper assessment and research have low reliability and high risks, although not necessarily immediately obvious to the user – causing a rise of demand for regulations by experts in the field for emerging companies to prove themselves worthy against, following suit of Australia's implementation of National Safety and Quality Digital Mental Health (NSQDMH) Standards in November 2020 (Landi, 2021; Brown et al., 2021).

Supplier Power

Suppliers of mental health digital tools include software (approximately 65-67% of the market revenue share) and services (Gotadki, 2023). Cloud-based software allows integration of

data in real time, a feature much desired by the ever-evolving industry. Although originally the digital tools require intense research and development, once they have been created – especially if that initial creation includes the power of machine learning to improve and constantly update the tool's strategy – little work is necessary by suppliers to maintain it. Therefore, beyond the initial setup, suppliers have minimal influence on the industry. Additionally, because of the abundance of software engineers, there is no shortage in supply of these providers and therefore no strong power of their supply.

Buyer Power

Buyers of mental health digital tools include both large-scale providers (such as employers, schools, mental health institutions, insurers, and community centers) as well as direct individual consumers. As mentioned previously, a large portion of Americans are experiencing mental health challenges (with 20.78% of adults experiencing a mental illness in 2019-2020, over 50 million Americans), and a majority (54.7%) of those not receiving any treatment – in addition to the 59.8% of youth with major depression who are not receiving any mental health treatment (Mental Health America, 2023). This creates a large demand for the industry, with the US population rationing out to an estimated 350 individuals per mental health provider – an infeasible quantity for each provider to ensure quality care of (Mental Health America, 2023).

Because of the available substitution, primarily human mental health providers, the buyers have strong power on the influence of the industry. Acceptance of and engagement with digital mental health tools is essential, and often conflicting with consumers' fears regarding privacy, empathy, and quality care through technology, as described in the following study regarding consumer acceptance of this field. Assuming that there is acceptance of the integration of technology into the mental health field, consumers (especially large providers, such as school

systems or employers) have high power in choosing between the various providers (rivals), with low switching costs – therefore having high power in accountability to ensure high standards of quality and fair pricing withing the industry.

Rivals

The state of mental health in the United States is drastic, as indicated in the introduction – further perpetuated following the COVID-19 pandemic, which disrupted routine and isolated many individuals from their support systems. With demand of buyers, availability of suppliers, high incentives, low barriers to entry, and insufficient alternative options providing mental health support, the potential within the digitalized tool industry is high. Many companies recognized this need and created mental health mobile applications to aid the outnumbered therapists, creating competitive rivalry within the field. It is now estimated that over 20,000 applications (apps) exist to support mental health, including those providing psychoeducation, tools for symptom tracking, chatbots, games, and specific therapy types, such as cognitive behavioral therapy (Neary et al., 2022).

Primary competitors often focus on one population segment, such as adolescents, adults, and seniors, or on one mental health niche, such as depression, generalized anxiety disorder, OCD, and eating disorders to enhance their market position (Gotadki, 2023). Major competitors, each focusing on different segments, include The Mentor Network (US), Brightline, Talkspace, and BeMe. The Mentor Network was established in 1980 with expertise in brain trauma recovery among other specialties and expanded into early childhood and substance abuse mental health services in May 2021. Another competitor with the US is Brightline, which provides virtual behavioral health services – and raised USD 105 million in May 2022 to expand high quality mental health services (Gotadki, 2023). Rising to the competition, rivals have increased

creativity, with Talkspace launching a toolkit for employers to foster mental well-being in their teams in and out of the workspace, and mobile tools like BeMe developing a Teen Advisory Board and using phone features such as mood tracked and daily personalized recommendations to encourage engagement.

Substitutes

There are two primary substitutes to the digital tools in supporting mental health: in-person therapy and virtual therapy. Both options provide support for mental health, with strengths of human empathy and trust – addressing the concerns many individuals have regarding human connection and data privacy in the integration of technology. A key weakness of these substitutions is accessibility, both financially and logistically – which the digitalized tool industry can address. Additionally, digital mental health tools can confront the mental health disparities faced by minoritized groups, tackling issues of lack of representation through integration of diverse research – if done thoroughly: reducing bias (Friis-Healy et al., 2021). Specific research regarding consumers' perception of digitalized tools as opposed to in-person or virtual therapy options can be found in the following section addressing consumer attitude. As mentioned in the section regarding buyer power, individuals needing help far outnumber those who are currently qualified and available to provide it.

Although the proposed Porter's Five Forces model shows that digital mental health tools may seem like the perfect solution to this shortage, the consumer openness towards support through digital media is necessary for its success. To better understand the consumer attitude—which is critical in predicting the growth and potential of the digital mental health industry—205 individuals completed a brief survey (mean time: six minutes and ten seconds, see Appendix A)

regarding their general opinion towards the use of technology to support an individual's mental health. The next section provides details regarding the study and its results.

Introduction: Consumer Attitude

This study examines consumer attitude through conduction of a survey to better understand the viability of the digital mental health industry. Our first set of hypotheses examine how individual differences correlate with varying levels of optimism regarding the potential of digital mental health support. Based on previous studies and literature reviewed, the following hypothesis are explored:

H1 *Younger consumers will have a more positive general opinion of the integration of technology to support mental health than older consumers.*

H2 *Individuals with a more advanced level of computer expertise will report being more comfortable discussing their mental health with a chatbot.*

H3 *Individuals in minority ethnic populations (Asian, Black, Mixed, Other) are more likely than White participants to have a more positive general opinion of the implementation of digital tools in the mental health field.*

H4 *Increase in anxiety score of the consumer will be associated with a more positive opinion regarding the potential of mental health digital tools in fostering increased vulnerability by the consumer due to anonymity.*

H5 *Increase in depression score of the consumer will be associated with greater concern regarding mental health digital tools' lack of validity/helpfulness*.

Next, this study analyzes participants' preferability among different methods of mental health support. Based on past literature regarding perceptions of in-person therapy, virtual therapy, mental health mobile apps, and chatbots, we hypothesize:

H6 *Chatbots will be ranked consistently lower than other methods of mental health support.*

Lastly, this study examines the most frequent concerns and attractive features that individuals present when prompted to self-report and when cued to mark their level of concern/optimism about certain features.

Method

Participants

Participants were recruited through Academic Prolific, an online platform designed to connect researchers with participants for large scale research, screened to ensure participants were over the age of eighteen years old, fluent in English, and residing within the United States. Participants received financial compensation for completing the study. A total of 205 individuals voluntarily and anonymously participated in this study. A total of 4 responses were excluded from the study due to personal requests and unreliable responses, resulting in a total of 201 participants.

Demographics of participants are as follows:

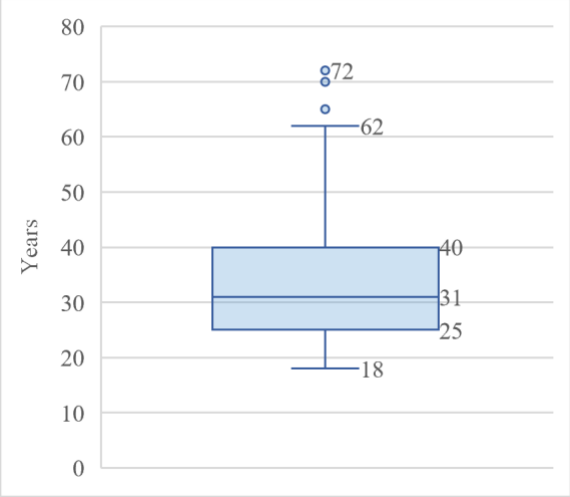
- Race: White (129), Asian (25), Black (20), Mixed (16), Other (9), and undisclosed (2). Participants with “undisclosed” races have chosen to remove their race from their Academic Prolific profile.
- Gender: 96 individuals identify as women (48%), 99 as men (49%), 5 as non-binary (2%), and 1 as gender-fluid (1%)
- Sexual orientation: 140 heterosexual/straight (70%), 28 bisexual (14%), 12 gay/lesbian (6%), 8 queer (4%), 5 asexual (2%), 4 pansexual (2%), 2 not listed (1%), 1 celibate (0.5%), 1 prefer not to disclose (0.5%)

- Ages ranging from 18-72 years and a median age of 31 (*M* = 34.33, *SD* = 12.22, see Figure 2).

Of these participants, 16% didn't know mental-health-focused mobile applications exist. Of participants who did know they exist, 52% had never downloaded any, and 18% had downloaded them and deleted them. Of participants with mental-health-focused mobile apps currently downloaded, 44% don't use them, leaving only 14% of the entire participant population actively using these apps at the time the survey was conducted.

Figure 2

Box Plot of Participants' Ages



Note. Participants' self-disclosed ages range from 18 to 72, with the box ranging from 25 (first quartile) to 40 (third quartile), with an interquartile range of 15 and a median age of 31. Participant's ages are skewed left, with four outliers older than 62 years old.

Materials

In collecting data regarding the demographics of participants, a self-rated computer expertise scale adopted from Schepman and Rodway (2020) was used to recognize the technological familiarity of the participants (see Appendix B). Participants were asked various questions about their demographics, including age, and mental health history. Additionally, participants were asked to compare different forms of mental health support, reporting the challenges and opportunities they recognize as potential consumers of the industry.

In the present study, two distinct scales were used to gather data regarding the current mental health of participants. Both scales were formatted as self-report questionnaires, with participants indicating how often they experienced specific symptoms over the past two weeks. The Patient Health Questionnaire-9 (PHQ-9) is a 9-item depression module from the full PHQ, which calculates a score (0-27) to screen for mild (5-9), moderate (10-14), moderately severe (15-19), and severe depression (20-27) based on nine questions regarding mood, motivation, and physical health (for more information on the PHQ-9, see Appendix C, Kroenke et al., 2001).

The second scale is the 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) (Spitzer et al., 2006), used to screen and access the severity of GAD. Participants rated how often they had been bothered by specific problems (seen in Appendix D) relating to worry, irritability, and fear over the past 2 weeks: “not at all”, “several days”, “more than half the days”, and “nearly half the days” (0-3), totaling to maximum score of 21, with scores for mild (5-9), moderate (10-14), and severe (15-21) anxiety.

Procedure

The study was approved by the Rollins College Institutional Review Board (IRB), taking into account participant risk, informed consent, and selection of participants. This study was

conducted through a self-report questionnaire comprised of questions regarding general opinion of the integration of technology into the mental health industry with respect to participants' demographic details, proficiency using technology, previous mental health support interactions, and mental health histories. The survey was conducted via the Qualtrics online platform and distributed through a digital link in Academic Prolific. Registered surveyors within Academic Prolific were invited to complete the survey, with Academic Prolific screening to ensure that all participants speak English fluently and to balance for sex distribution. After completion of the survey, participants were debriefed through a short message (see Appendix E).

Qualitative responses regarding participants' concerns and optimistic outlooks about the integration of digital tools to support mental health were coded in an inductive fashion, with codes described in the taxonomy seen in Appendix F. Cohen's Kappa was calculated to determine the interobserver agreement of each code based on a randomly selected sample of 30 concerns and 30 attractive features (k = -0.053 - 1, M = 0.778, SD = 0.298). According to Fleiss (1981, as cited in Bakeman & Gottman, 1997), this mean kappa is excellent as it is greater than 0.75.

Results

Results of a two-tailed Pearson's correlation analysis reject the null hypothesis, indicating a significant correlation between age and general opinion regarding the use of digital tools to aid mental health, $r(199) = -.146$, $p < .05$.

A one-tailed Pearson's correlation analysis failed to reject the null hypothesis, therefore failing to supply evidence of a significant increased comfort in discussing mental health with a chatbot by participants with increased level of computer experience, $r(199) = .075$, $p > .05$.

Findings of an independent-sample *t*-test fail to reject the null hypothesis, indicating that there is no significant difference ($t(197) = -0.417$, $p > .05$) between the general outlook regarding the implementation of digital tools in the mental health field of individuals in the ethnic majority (White, $M = 3.43$, $SD = 0.958$) and individuals in the ethnic minority (Asian, black, mixed, other, $M = 3.49$, $SD = 0.959$).

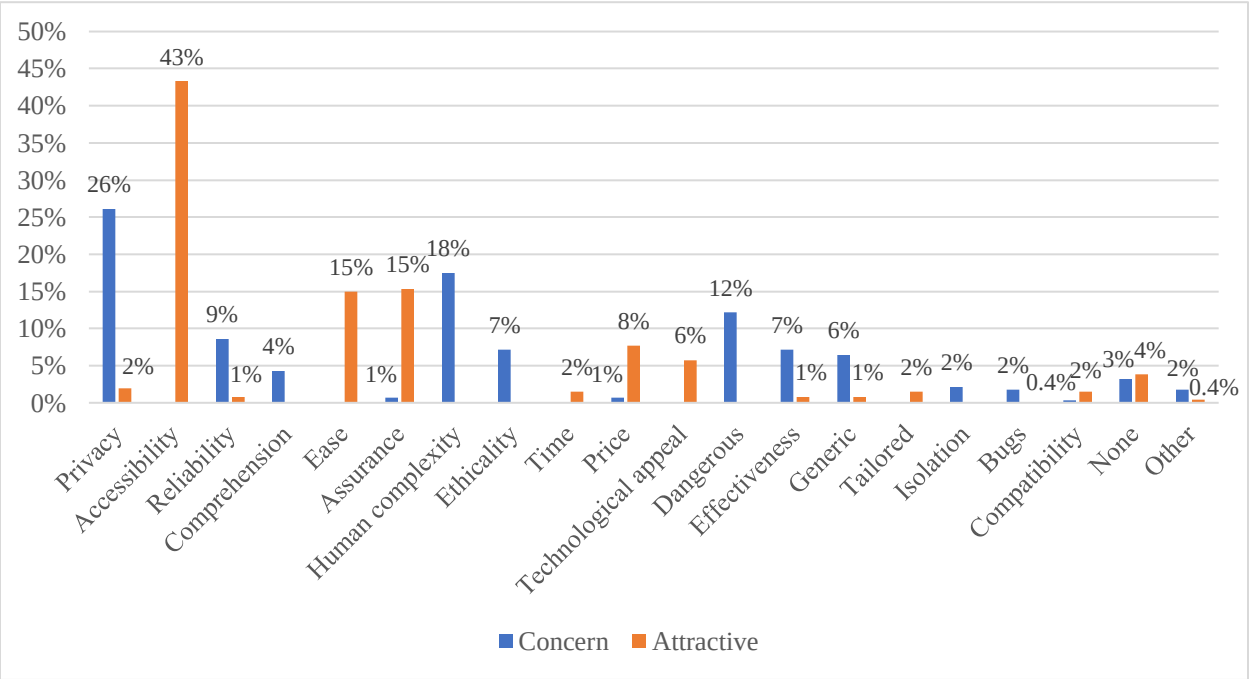
A one-tailed Pearson correlation analysis failed to reject the null hypothesis, indicating no significant correlation between scores on the anxiety screening and their optimism regarding mental health digital tools offering increased vulnerability by user due to anonymity, $r(199) = .099$, $p > .05$.

The null hypothesis regarding a correlation between scores on the depression screening and concerns regarding mental health digital tools' lack of validity/helpfulness was rejected through a one-tailed Pearson correlation. The positive correlation suggests that higher levels of depression were correlated with greater concern regarding validity and helpfulness ($r = .173$, $p < .01$).

In self-reported concerns and optimistic outcomes pertaining to the integration of mobile tools into the mental health industry, participants most often listed privacy as a concern (26% of concerns stated), followed by human complexity (17%), and danger ("dangerous", 12%). Accessibility was the most frequently mentioned attractive feature of the integration of technology (43% of attractive traits stated), followed by assurance (15%) and ease (15%, see Figure 5).

Figure 5

Relative Frequencies of Self-Reported Concerns and Optimistic Outcomes

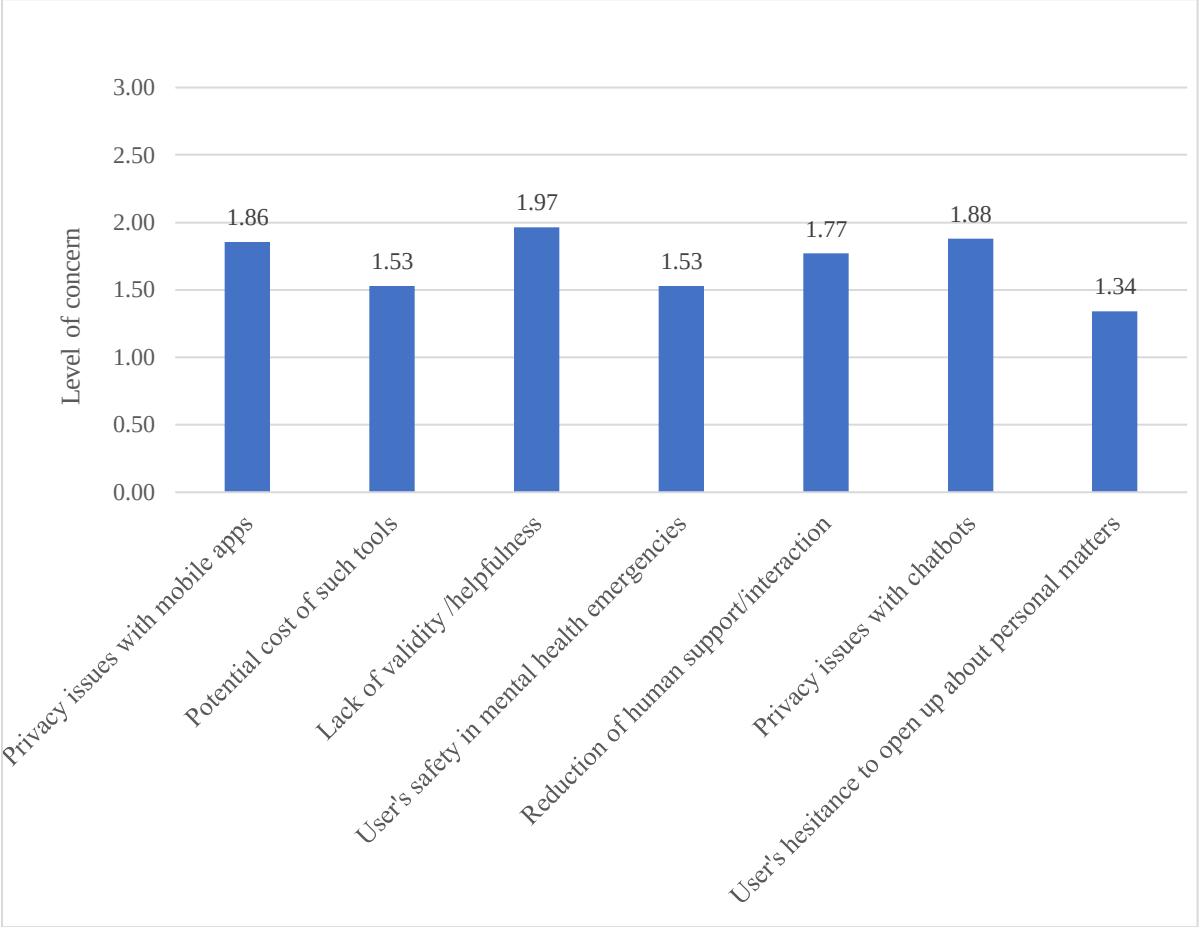


Note. Relative frequency is calculated out of the total number of concerns (279), and total number of attractive traits (261), respectively.

Out of the 7 presenting concerns, in which participants reported concern about mental health digital tools between “Mildly concerned” (1) and “Concerned” (2), the greatest concern was identified as lack of validity/helpfulness (M = 1.97, SD = 1.0), followed by concerns regarding privacy issues with chatbots (M = 1.88, SD = 1.0), as analyzed using weighted averages (see Figure 6).

Figure 6

Level of concern caused by specific aspects of mental health digital tools



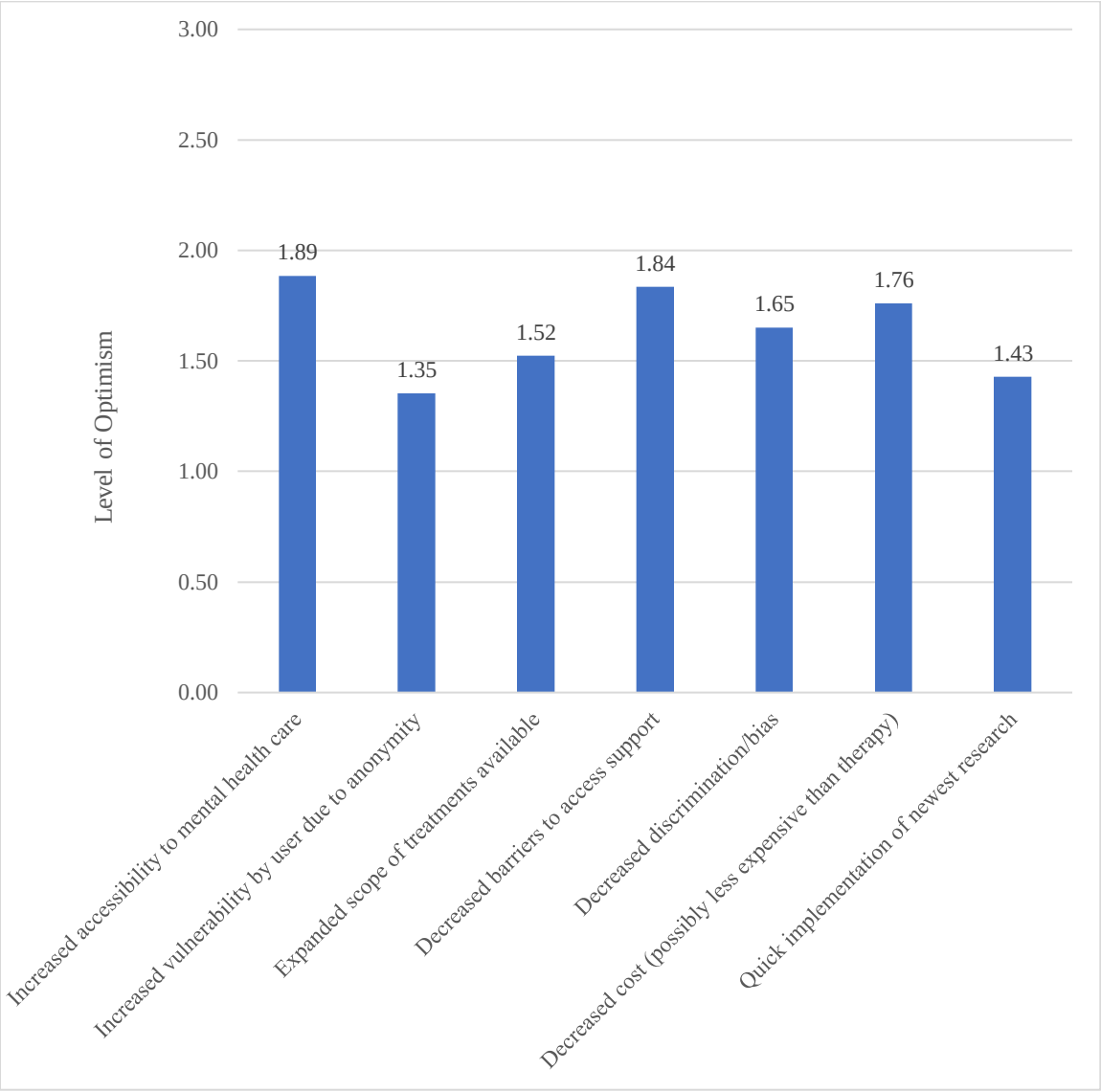
Note. Each score was calculated based on a weighted average of the presenting concern, with responses equating to (values): Not concerned (0), Mildly concerned (1), Concerned (2), Very concerned (3).

Of the 7 stated opportunities of digital mental health tools, individuals reported their optimism between “Mildly optimistic” (1) and “Optimistic” (2), with highest optimism found regarding the potential of increased accessibility to mental health care (M = 1.89, SD = 0.9),

followed by decreased barriers to access support (*M* = 1.84, *SD* = 1.0), as analyzed using weighted averages (see Figure 7).

Figure 7

Level of optimism regarding specific aspects of mental health digital tools



Note. Each score was calculated based on a weighted average of the presenting concern, with responses equating to (values): Not optimistic (0), Mildly optimistic (1), Optimistic (2), Very optimistic (3).

With preferred method of support ranked as 1 through least preferred method ranked as 4, in-person therapist ranked first most frequently (105) as well as ranked last second most frequently (30), following chatbots (135, see Table 4). A Friedman test found that there was a statistically significant difference in preference ranking of in-person therapists (M = 1.90, SD = 1.1), virtual therapists (M = 2.14, SD = 0.9), mental-health-based apps (M = 2.52, SD = *0.9*), and mental-health-based chatbots (M = 3.43, SD = 0.9), $\chi^2(3) = 163.609$, $p < .001$. Post hoc analysis was conducted with a Friedman's two-way analysis of variance by ranks (N = 201, df = 3) to determine significant difference between each pair of methods, determining that all differences are significant other than between in-person and virtual therapy, with $p < 0.050$ indicating significance.

Table 2

Frequency of rank order per mental health support method

	Rank order			
	1	**2**	**3**	**4**
In person therapist	105	41	25	30
Virtual therapist	48	90	49	14
Mobile app	37	44	98	22
Chatbot	11	26	29	135

Note. Participants ranked the method of support 1 – 4, with 1 indicating their most preferred medium and 4 their least favored.

Discussion: Viability of the Digital Mental Health Industry

Consumer Attitude

The purpose of this study was to gain a better understanding of the general population's acceptance (or lack of) towards the integration of digital tools into the mental health realm. The data analyses of the survey conducted were able to address the research questions as follows:

1. *Does a correlation exist between age and general opinion regarding the use of digital tools to aid an individual's mental health?*

Our hypothesis that older consumers will have a more negative (low) general opinion regarding digital mental health tools was supported by this study. This supports previous research regarding a difference in acceptance based on generation of the user. Although statistically significant, age as a factor does not account for much of the variance in opinion regarding the use of digital mental health tools' ability to aid mental health.

2. *Does a correlation exist between an individual's level of computer expertise and their level of comfort discussing their mental health with a chatbot?*

Our hypothesis that individuals with a higher level of computer expertise would feel more comfortable discussing their mental health with a chatbot was not supported by this study, as evidence was not significant in rejecting the null hypothesis that no correlation exists between the two measures. This supports the idea that comfort discussing personal matters with a chatbot is not necessarily due to technological limitations or to concerns recognized by those who know the power of computer systems, but instead may be due to personal characteristics, past experiences, and/or availability bias based on opinionated sources they have heard from.

3. *Are individuals in minority populations (Asian, Black, Mixed, Other) more likely than in White participants to have a more positive general opinion of the implementation of digital tools in the mental health field?*

Our hypothesis that individuals from minority ethnic populations would have a more positive regard towards digital mental health tools than White participants was not supported in this study. Results show no significant difference between the two groups, failing to support previous research suggesting the positive outlook in historically stigmatized communities. This indifference may be due to fear of the potential continuation of discrimination through these digital tools, with programs being suited for majority populations and rejecting the specificities necessary for others.

4. *Does increase in anxiety score correlate with increase in optimism regarding mental health digital tools offering increased vulnerability by user due to anonymity?*

This study failed to reject the null hypothesis, thereby failing to support the hypothesis that a higher anxiety score (using the GAD-7 scale) is associated with more positive opinions regarding the vulnerability that the anonymous nature of digital mental health tools fosters. This is interesting, as many participants reported a foreseen advantage of vulnerability from people who are more embarrassed or shameful when faced by a human, seeing digital tools as an opportunity for those individuals to confide in their emotions – but this test reveals that people who test as more anxious do not necessarily recognize that advantage.

5. *Are higher scores on depression associated with greater concern regarding mental health digital tools' lack of validity/helpfulness?*

Our hypothesis was supported, as individuals who screened to higher depression scores were generally found to be more concerned about the lack of validity and helpfulness of digital

tools in supporting mental health. This correlation is important in understanding a frequent oxymoron in mental health, with a presenting symptom of hopelessness, and the first step towards change being believing that change can occur. When integrating a new forum of support without empirical evidence or past user reviews to reinforce the individual's belief in the potential, this challenge is faced directly.

6. *Are any methods of mental health support (therapy in person, virtual therapy, mental health apps, chatbots) ranked consistently higher or lower than the others?*

Our hypothesis that the chatbot would be consistently ranked lower than other methods of mental support was supported. This overall inferiority of the medium demonstrates that despite the stated points of attraction, this substitute method of mental health support is unfavored. Consumers still prefer other methods of support, therefore challenging the competitive stance of substitutes in the market, as influenced by buyer demand.

7. *Which concern regarding digital mental health tools are individuals most concerned about? Which opportunity are they most optimistic about?*

Before prompting of various possible concerns, participants' self-reports most frequently discussed the issue of privacy, for instance, sharing that they worry about "the possibility of information and data being stored and possibly sold without my permission because mental health is personal." Privacy issues were also the second highest worry out of seven prompted concerns participants were presents with. As aforementioned, mental health data is not as well protected as other medical information, leaving users responsible to trust-blindly or read the fine print when they share their personal experiences. With the rapid growth of this industry and the likely unbalanced priority of privacy between the user (very important) and the provider (not

necessarily essential), it is understandable that individuals are reluctant to trust that these digital tools are secure.

Participants also demonstrated high concerns regarding the human complexity that they feel is essential for the support/er to encompass for the sharer to feel heard. As one participant stated as their primary concern, “lack of personal touch, is an AI tool really going to understand what I'm going through? really?” This worry ties back to the challenge of technology to emulate a therapeutic relationship – or find an alternative approach that doesn’t rely on this human connection. This also relates to the concern that such a tool would be dangerous, with “no real time access to mental health services when urgently needed” and no filter of inappropriate responses. On the alternative side, assurance was frequently reported as a positive trait of digital tools – honing in on the vulnerability that these mobile solutions promote by virtue of the lack of interaction with another human, with participants sharing that “[they] feel less insecure because a non human being is listening to me,” and that “it would be easier to open up and be honest.”

This lack of dependency on a human also allows the increased accessibility that was reported most frequently both through self-reports and within cued prompts. Respondents see the potential of having a supportive tool in their pocket, pointing at the advantage of this being “Available at all times, without an appointment.” By separating from human service, mobile solutions create an additional avenue of support for that large portion of individuals who are not receiving help, due to time constraints, financial obligations, or provider availability.

Applicability to Industry

At the intersection of the industry analysis and the consumer attitudes we can discover the natural degree of potential of digital tools, as well as uncover the necessary points to address in shaping the tool into a viable solution. The industry’s current liveliness, evident by its

increasing estimated value and high quantity of new entrants, and fueled by its easily accessible suppliers, represents the current belief that the industry has potential. This belief is also supported by the current mental health prevalence in the United States, a situation craving focus, responses, and solutions. The primary concern, which will separate a successful digital mental health tool from its rivals and propose it as opposed to substitutes, is whether it can address its buyers in a way that fosters trust, support, and engagement.

To cultivate traction with consumers, it is essential to hear, adapt, and respond to their stances rather than force them to change their beliefs blindly. The survey conducted serves as a starting point to making decisions with the end user in mind. After hearing the voices of 201 participants, we recommend companies consider adapting and responding as follows:

- Based on the low accountability by participant age for variance in opinion regarding the integration of digital tools into mental health support, rather than overselling the age bias and focusing on simplicity and user-friendly features for older populations and implementing additional options for younger, more tech-savvy user, we recommend operating based off variables more highly associated with opinion.
- With no evident correlation between computer expertise and comfort discussing mental health with chatbots, companies looking to create a successful mental health digital tool should have a strategic plan to approach user's hesitations, keeping in mind that it is likely not a logistical block, but rather a hesitancy based on emotions and trust.
- We urge digital tools to use this as an opportunity to counter centuries of discrimination and lack of appropriate resources for marginalized communities. Seize this opportunity to create a tool that is relevant to historically underfunded, under-researched, and underserved populations. Act in a promising way that excites these minority populations

and *does* provide them with a more optimistic outlook of the potential of digital tools, as their past deprivation situates them to now have more to gain.

- The incongruence between *suggested* advantages *for* particular populations (increased vulnerability for people living with anxiety) and *recognized* advantages *from within* those populations (don't recognize that advantage for individuals with anxiety) demonstrates the importance of listening rather than assuming. It is easy to speculate that a feature will be helpful to certain groups, but it is effective to instead engage with those groups and operate based on their initial reactions, trials, and feedback.
- Acknowledge that you are targeting a vulnerable population. People living with mental health difficulties are looking for stability, and integrating a new and untested tool into their lifestyles doesn't promote stability. Mistakes in this field are especially costly, in both the short- and long-term goals of an individual.
    - This also places a unique twist on marketing, stressing the importance of selling each tool for what it is and what it can provide, demonstrating transparency and further cultivating trust.
- Evidently, providing mental health support through a medium without a person comes with challenges regarding lack of therapeutic alliance and response to urgent situations – as well as opportunities of expanded scope and increased comfort/vulnerability with certain consumers. We emphasize the importance of researching this niche set-up extensively to best understand how to provide its full potential, whether through understanding the populations it most effectively serves, as a complimentary practice to other means of support, or analysis of the type of service is best offers. Communication

of such understanding is essential, as buyers walk a tight line between fearing and appreciating this niche environment.

    - We emphasize the importance of considering the ethical implications of providing "connection" with a non-human and acting in accordance.
    - A contingency plan, or connection with other services for dire situations, is advised.

- In response to the frequent and bold privacy concerns, we recommend investing in solid technological security measures, and utilizing a simple and promising way to communicate those efforts with users.

Limitations

Limitations in this study include the vast quantity and varying quality of information available regarding the integration of mental health mobile tools. Many sources are unreliable as they have no empirical support, and many apps also are founded from limited research and therefore create a negative image within the market. Additionally, the unbalanced ethnic diversity of the sample serves as a limitation, especially in analyzing the general outlook of varying ethnic groups. Similarly, although the age range of the sample spreads from 18 years old to 72, 50% of the sample falls between 25 and 40 years old, challenging the notion of understanding the influence of age on survey responses. In the future, such issues should be addressed by ensuring that the surveying site used balances such demographic variables that will be compared in analysis. In terms of analyses, Likert scales are not typically preferable for Pearson's correlation analyses, but the analysis was deemed acceptable for this study due to the large sample size. Lastly, limitation exists in the inter-rater reliability measure – which was limited to 60 samples out of the 400 due to time constraints.

Future research should investigate the nuances of the stated recommendations. To best listen to the potential buyers (consumers), many conversations, surveys, and studies must be conducted. Collaborative research will be especially effective, uniting the potential of reliable software engineers, innovative app designers, experienced clinical psychologists, and principled marketing managers to emerge a viable digital mental health *tool from within* our approaching-unviable reality.

In terms of clinical support, future research should assess and compare the efficacy of different methods of therapeutic treatments through digital tools, and the correlation between consumer's perceptions/trust and the quality/quantity of empirical support of a tool. Additionally, it would be interesting to continue tracking the opinions of various generations to better understand if all generations have opinions that decline with age, or if normalization of digital mental health support will lead to a less significant divide than previous research entails.

Regarding an effective business model, research should be conducted to better understand the relationship between cost and willingness to engage, recognizing the role that insurers play in the market. On a similar note, previous research regarding engagement towards goals (i.e., in physical health) in relation to money paid by user should be analyzed for applicability (i.e., would an individual be more committed and therefore see better results if they are paying a higher price).

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Appendix A

Survey Question

1. How old are you?
2. Which best describes your current gender identity?
    a. *Woman, Man, Transgender woman, Transgender man, non-binary, Not listed*
3. Which best describes your current sexual orientation?
    a. *Asexual, Bisexual, Gay/Lesbian, Heterosexual/Straight, Pansexual, Queer, Prefer not to disclose, Not listed*
4. Which state (within the US) do you currently reside in?
5. What field do you currently work in? (if not working - what do/did you study? If haven't studied - what field are you interested in?) *(Appendix C)*
6. What is your level of education?
    a. *No formal education, so high school (no diploma), High school graduate (diploma or the equivalent), Some college credit (no degree), Associate degree, Bachelor's degree, Master's degree, Professional degree, Doctoral degree*
7. How would you rate your level of computer expertise? *(Appendix B)*
8. Which of the following devices do you own and use regularly? (Check all that apply)
    a. *Smartphone, Tablet (iPad or equivalent), SmartTV, SmartWatch, Laptop*
9. Have you ever attended
    a. In person therapy?
        i. *No, Yes (I've tried it and decided it wasn't for me), Yes (on an as-need basis), Yes (regularly)*
    b. Virtual therapy?

    i. *No, Yes (I've tried it and decided it wasn't for me), Yes (on an as-need basis), Yes (regularly)*

10. Do you have any mental-health-focused mobile applications downloaded?
    a. *No (I didn't know these exist), No (I know they exist but never downloaded any), No (I downloaded some but deleted them), Yes (but I don't use it/them), Yes (and I use it/them)*
11. Please select the answer "c"
    a. *d, b, a, c*
12. Have you ever been diagnosed with any of the following?
    a. *Depression, anxiety, none, not listed*
13. Screening for depression *(Appendix C)*
14. Screening for anxiety *(Appendix D)*
15. Would you consider yourself actively seeking a digital tool to help you improve your mental health?
    a. *Yes, Somewhat, No*
16. Please rank the following treatment tools from 1 through 4 (with 1 being the tool you would be most likely to use if struggling, and 4 least likely) by dragging the list items.
    a. *A therapist (in person), A therapist (virtually), A digital tool (mental-health-based app), A digital tool (chatbot)*
17. On a scale from 1 to 5, 1 being extremely negative and 5 being extremely positive, what is your general opinion regarding the use of digital tools to aid an individual's mental health?
    a. *1 (extremely negative), 2, 3, 4, 5 (extremely positive)*

18. On a scale from 1 to 5, 1 being extremely uncomfortable and 5 being extremely comfortable, how would you feel about discussing your mental health with a chatbot?
    a. *1 (extremely uncomfortable), 2, 3, 4, 5 (extremely comfortable)*
19. What would be your biggest concern regarding the integration of digital tools in mental health treatment?
20. What do you find most attractive in the option of digital tools being used for mental health treatment?
21.

How concerned are you by the following aspects of mental health digital tools:

	Not concerned	Mildly concerned	Concerned	Very concerned
Privacy issues with mobile apps	○	○	○	○
Potential cost of such tools	○	○	○	○
Lack of validity/helpfulness	○	○	○	○
Concern of user's safety in mental health emergencies	○	○	○	○
Reduction of human support/interaction	○	○	○	○
Privacy issues with chatbots	○	○	○	○
User's hesitance to open up about personal matters	○	○	○	○

22.

How optimistic are you that mental health digital tools can offer:

	Not optimistic	Mildly optimistic	Optimistic	Very optimistic
Increased accessibility to mental health care	○	○	○	○
Increased vulnerability by user due to anonymity	○	○	○	○
Expanded scope of treatments available	○	○	○	○
Decreased barriers to access support	○	○	○	○
Decreased discrimination/bias	○	○	○	○
Decreased cost (possibly less expensive than therapy)	○	○	○	○
Quick implementation of newest research	○	○	○	○

Appendix B

Technology Familiarity

How would you rate your level of computer expertise?

- ◯ Hardly ever use the computer and do not feel very competent
- ◯ Slightly below average computer user, infrequently using the computer, using few applications
- ◯ Average computer user, using the internet, standard applications etc.
- ◯ User of specialist applications but not an IT specialist
- ◯ Considerable IT expertise short of full professional qualifications
- ◯ Professionally qualified computer scientist or IT specialist

Appendix C

Patient Health Questionnaire-9

Over the last 2 weeks, how many times have you been bothered by the following problems?

	0	1	2	3+
Little interest or pleasure in doing things	○	○	○	○
Feeling down, depressed or hopeless	○	○	○	○
Trouble falling asleep, staying asleep, or sleeping too much	○	○	○	○
Feeling tired or having little energy	○	○	○	○
Poor appetite or overeating	○	○	○	○
Feeling bad about yourself - or that you're a failure or have let yourself or your family down	○	○	○	○
Trouble concentrating on things, such as reading the newspaper or watching television	○	○	○	○
Moving or speaking so slowly that other people could have noticed. Or, the opposite - being so fidgety or restless that you have been moving around a lot more than usual	○	○	○	○
Thoughts that you would be better off dead or of hurting yourself in some way	○	○	○	○

Appendix D

Generalized Anxiety Disorder-7 Questionnaire

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge?	○	○	○	○
Not being able to stop or control worrying?	○	○	○	○
Worrying too much about different things?	○	○	○	○
Trouble relaxing?	○	○	○	○
Being so restless that it is hard to sit still?	○	○	○	○
Becoming easily annoyed or irritable?	○	○	○	○
Feeling afraid as if something awful might happen?	○	○	○	○

Appendix E

Debriefing Message

We thank you for your time spent taking this survey. Your response has been recorded, and your compensation will be manually approved shortly.

Results from this survey will aid in analyzing the market potential of the mental health digital tools.

If you feel upset after having completed the study or find that some questions or aspects of the study were distressing, talking with a qualified clinician or counselor may help.

If you would like to receive a copy of the final report of this study when it is completed, or have any additional questions, please feel free to contact the researcher: dbejerano@rollins.edu

Appendix F

Self-Reported Concerns and Optimistic Outlooks Taxonomy

Category	Definition
Privacy	Safety/security of data/information remaining confidential, data breech
Accessibility	Access, convenient, available 24/7, from any location, flexible, expanded scope/scale, available in between therapy sessions, on own time
Reliability	Accurate communication of response/diagnosis/treatment, informed, qualified for quality, consistent, credible
Comprehension	Accuracy/potential in understanding information, correctness in interpretation
Ease	Easy, easy to use, ease, ease of use, straightforward usage
Assurance	Anonymity as an advantage, comfort in sharing/opening up/less insecure/reduce anxiety due to anonymity, lack of judgement, not having to interact with an actual person, discreet, trust
Human complexity	Feeling cared for, feeling understood/empathy, "real", feelings, human connection/interaction, uniqueness, trust, with emotion, not mechanic
Ethicality	Incentive of supporting struggle rather than of financial self-interest), acting in a just way, ethicality of sales, manipulation, information/data misuse, biased programs
Time	Impact the duration of time spent addressing the mental health concern, quickness
Price	Fiscal cost for service

Technological appeal	Tracking, Ability to keep note of changes/progress, tool, using phone features (notifications) increased potential of computers, aware of/access to information (knowledge)
Dangerous	Response to critical mental health conditions, dire/urgent situations, dangerous/risky, inappropriate, too much information
Effectiveness	Success in producing desired result/effect, thorough, helpful, adequacy, useful, appropriate
Generic	One size fit all, rather than tailored to individual needs, don't match needs, only what it is programmed for, doesn't address the multilayered-ness of humans
Tailored	Tailored to individual needs, rather than one size fits all, specific, many options, addresses personal needs, match needs, patient-specific, numerous options/alternatives
Isolation	Autonomy in mental health, reduced human interaction, drift away from humans/therapists and instead rely on technology, feeling judged
Bugs	Technological faults, bugs in the program, quickly created rather than thoroughly, syncing issues, problems in training the tools
Compatibility	Pairable, interaction (support, strengthen) other forms of therapy, or instead if other forms have been unsuccessful
None	No concerns/opportunities identified, don't know
Other	Using the tool regularly, dissatisfaction, mismanagement