Published in final edited form as:

Soc Work Ment Health. 2016 ; 14(6): 625–636. doi:10.1080/15332985.2015.1130010.

Building Mobile Apps for Underrepresented Mental Health care Consumers: A Grounded Theory Approach

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Abstract

Cell phone mobile application (“app”) use has risen dramatically within the past several years. Many individuals access apps to address mental health issues. Unlike individuals from privileged backgrounds, individuals from oppressed backgrounds may rely on apps rather than costly mental health treatment. To date, very little research has been published evaluating mental health apps’ effectiveness. This paper focuses on three methods through which grounded theory can facilitate app development and evaluation for people underrepresented in mental health care. Recommendations are made to advance mobile app technology that will help clinicians provide effective treatment, and consumers to realize positive treatment outcomes.

Keywords

mental health; education; prevention

Research has shown that mental health consumers from traditionally oppressed groups are less likely to receive necessary treatment than their middle-class counterparts (Alegria, et al, 2008; Kim Aguado, Chiriboga, Jang, Parmelee, & Allen, 2011) and are less likely to adhere

to treatment protocols once they receive care. Researchers conclude that due to issues including low-paying jobs and jobs without health benefits, family care obligations, and inadequate transportation, many individuals from traditionally oppressed backgrounds drop out of treatment despite the belief that the treatment is beneficial (Brownstein-Evans, Keefe, & Polmanteer, 2014). Moreover, the stigma associated with having a psychiatric diagnosis and receiving mental health care may also result in further challenges to treatment adherence.

One approach that can potentially empower underrepresented mental healthcare consumers is the use of mobile applications (or “apps”). Over the past several years, apps have been developed to address depression, anxiety, substance abuse, and other mental health disorders (Donker, Petrie, Proudfoot, Clarke, Birch, & Christensen, 2013). Apps can serve as reminders of upcoming appointments, prompts to take prescribed medications, and as way to communicate with providers, caregivers, and support systems (Jones, Patel, Saxena, Radcliffe, Al-Marri, & Darzi, 2014). Moreover, mental healthcare consumers likely have specific ideas about how apps can help them, which may differ from the ideas generated by app developers.

This is in no way to say that everyone can afford to purchase apps. In fact, individuals from underrepresented groups are often unable to afford the cost of purchasing smart phones and various mobile apps. In recent years, however, apps have become increasingly more affordable thus enabling them to reach a wider market. Initially, one had to purchase a fairly expensive cell phone that was bought with an expensive plan often associated with only one carrier. With the proliferation of prepaid cell phones allowing flexibility of use from a variety of carriers do not require the user to purchase a long-term plan, increasing the possibility that more people from underrepresented groups can afford the cost of cell phones and apps. The growing numbers of cell phone subscribers and Internet users in the world substantiate the above claims: Based on the World Health Organization (WHO), cell phone subscribers around the world have increased to 6.9 billion in 2014 (WHO 2014) from 2.2 billion in 2005 (IC Insights 2014). The increase in Internet users has followed a similar trend. The Internet Live Stats, as part of the Real Time Statistics Project, indicates that the number of Internet users in the world have risen to 2.9 billion in 2014 from 1.0 billion in 2005 (Internet Live Stats 2015).

Advancing an App Development Research Agenda

Given the lack of research on the effectiveness of mental health apps, grounded theory may be a helpful approach for developers to use while devising and evaluating an app's effectiveness. In turn, grounded theory may help consumers with using the app appropriately, and mental health providers with developing more effective treatment plans.

Using Grounded Theory

Grounded theory is a method of constructing new theory through qualitative data analysis (Martin & Turner, 1986). As researchers review the data, themes and concepts become increasingly apparent, are extracted from the data, and are tagged with codes. As more data are collected and re-reviewed, the codes can be grouped into themes and concepts and then

into categories and explanations, which become the basis for the new theory. Joorabchi, Mesbah, and Kruchtehn (2013) used grounded theory to develop apps. However, their research has been limited to improving “pre-launch testing.” Consequently, while most developers use grounded theory to get a sense of the users’ preferences so that the app may enroll a large number of subscribers, obtaining additional data on the app’s effectiveness as a therapy tool have yet to be collected. Furthermore, baseline data from mental health providers regarding their use of, and how they go about introducing, apps to their patients have not been gathered. Finally, because mental health-related apps are relatively new, little emphasis has been placed on how they can help subscribers on a continuous basis.

In view of these shortcomings, three specific ways through which grounded theory may facilitate app development for underrepresented mental healthcare consumers are suggested. First, app developers should utilize the existing knowledgebase about the social contexts of underrepresented mental healthcare consumers and gather additional information about the consumers’ needs and concerns to design useful app features. The developer’s own research experience, coupled with reviewing the relevant literature, will help accomplish this goal.

Second, a useful app should contain features that continue to engage consumers in treatment. Although developers have recognized the importance of incorporating user feedback before an app is launched, they underemphasize the merits of collecting ongoing feedback after the app is subscribed (Bentley & Barrett, 2012). As a result, apps may be of limited valued. Having continuous engagement is necessary for an app’s utility (Kim, Kim & Wachter, 2013). For mental healthcare consumers, particularly individuals who have paranoid symptoms as part of a severe and persistent mental illness, the fear of being stigmatized for having a mental health diagnosis may prevent them from using an app (Price et al., 2014). Building features that enhance privacy of use, confidentiality of messages sent and received, and recommended treatment will help allay these concerns.

Finally, a developer should carefully plan how to analyze app-use data. Useful data on how users share information, exchange emotional support, and interact with other users, can be collected from an app linked to a backend server. The data can be analyzed with ethnographic coding and other related methods to gain valuable insights about the users’ experience, which in turn can be used in developing future app updates. Moreover, the data can be used to identify psychosocial factors that determine treatment adherence and other treatment-related behaviors that may help therapists to improve services (Luxton, McCann, Bush, Mishkind, & Reger, 2011).

A Problem-solving Framework

To orient the following discussions, a problem-solving framework known as the “W-shaped” model (Scupin, 1997) will be presented. Following the framework is a discussion of how grounded theory can improve the framework when applied to app development. The W-shaped model divides the research into several methodological steps. As shown in Figure 1, the researcher recognizes a problem (at point A), such as conducting a literature review, then begins to explore the problem to identify researchable topics (between points A and B). As the exploration proceeds, the researcher gradually moves to the empirical field to collect

preliminary evidence (point B). The researcher then gathers sufficient data to formulate one or more testable hypotheses (between points C and D) for more rigorous empirical studies.

The ABCD phase of the W-shaped model may be regarded as the “pre-test” stage, after which the researcher moves on to the empirical stage (i.e., EFGH). During the transition between the two stages, the researcher clarifies his/her research agenda at the cognitive level (points D and E), then prepares the test materials (such as an experiment) (points E and F), collects empirical data (points F and G), and analyzes the data (G and H). Finally, he/she reaches the endpoint of the analysis and comes up with interpretations and conclusions (point H).

Although developers have used similar approaches (Bentley & Metcalf, 2009), the emphasis has been on the app’s “pre-launch” stage, which is analogous to the “pre-test” stage (ABCD). Influenced by human-computer interaction studies, developers have used “contextual inquiry” (Dourish, 2006) to explore the app’s contextual background after recognizing a need the app could fill (equivalent to the stage between points A and B in Figure 1). Contextual inquiry enables developers to increase their understanding of the social settings in which expected users will utilize an app. Subsequently, developers use probes such as the users’ diaries, journals, voicemails, photos, and videos to clarify potential users’ utilization of devices (similar to the points between B and C) (Gaver, Dunne, & Pacenti, 1999). Some developers examine log interactions and communications among users to better understand how an app can affect users’ lives (Gilbert, Chun, Cox, & Jung, 2011). Visiting various locations where users access the app, and interviewing potential users may also help developers design useful features during an app’s pre-launch stage (between points C and D in Figure 1). Whereas some developers prematurely terminate the pre-launch phase (point D), due to time pressures from demanding users seeking desirable features (Neil, 2014), other developers extend the pre-launch stage to points E or F, thus gaining additional information of the potential users’ expectations.

Although there are successful cases in the current market that are developed with similar, somewhat hastened procedures (Bentley & Metcalf, 2009), it can be argued that more time should be taken before and after the app is officially launched so as to assure its effectiveness. Specifically, the research steps between points F and H deserve much attention. In these remaining stages, systematic procedures that may help to achieve useful goals are discussed.

Improving the pre-launch

A recurring debate among grounded theory researchers is whether or not the literature review and the researchers’ preconceived notions about the topic are detrimental to the research process. Glaser (2002) believed that researchers should not let preconceived notions influence data interpretation. Conducting literature reviews, Glaser believed, adversely affects a researcher’s ability to discover the theory underlying of the problem. Others point out that researchers seldom enter a study with an “empty head.” They believe a strong knowledge base, coupled with a thorough literature review, enables the researcher to better articulate his/her research problem, ensure that the problem has not been resolved in the

literature, and contextualize the study with information that pertains to the research subjects, thereby increasing theoretical sensitivity (Charmaz & Belgrave, 2002). The literature review helps the developer learn more about how apps can empower mental health consumers from underrepresented groups; how the apps can increase the likelihood that consumers will receive adequate services; and how the consumers' social context such as their interests, the app components they most frequently use, and the apps that promote treatment adherence will enhance utility. Completing a literature review and developing a strong knowledge base, gives the developer a significant advantage in the exploration stage (i.e., the points between A and B) as he/she enters the development process.

Research concludes that African Americans and Asian Americans are less likely than individuals from other racial and ethnic groups to access mental healthcare (Alegria, et al., Kim, Aguado Chiriboga, Jang, Parmelee, & Allen, 2011), and adhere to treatment protocols once they receive care. Likewise, the stigma associated with having a psychiatric diagnosis and receiving mental health treatment may result in further challenges to their treatment adherence (Hastings, Jones, & Martin, 2015). Consequently, an "alert reminder," on the phone's notification panel that reminds consumers about some aspect of their treatment such as taking prescribed medications, may be beneficial. Figure 2 provides a visual description of such an app feature.

It is likely that people in low-income populations will have their cell phone service discontinued. This problem is mitigated by the "text messages only" ("text") function, which remains active for a period of time after the other cell phone services have been disconnected. For this reason, a good app, such as the one illustrated in Figure 2, will include features that enable continuous usage.

More than just one-shot interviews

Instead of relying on one-shot interviews, developers should continuously engage users. (Shapiro-Mathews & Barton, 2013). For example, whenever the consumer turns on the app, the app is able to "observe" the consumer and record his/her activities. Some newer apps have built-in functions to continuously monitor the user's movement and bodily changes as well as moods and even suicide risk. Although promising, few randomized control trials have been undertaken to assist people with mental health conditions. One reason is that unlike medical conditions such as cardiac arrhythmia, which can be monitored by physiological changes in pulse and heartbeat, monitoring mental health conditions are relatively difficult. Consequently, to be useful, the app requires users to be fully engaged and offer ongoing input on their mental/emotional state and on the app's utility (Estrin & Sim, 2010; McCurdie et al. 2012).

A social media platform, defined as a virtual space created by Internet-based tools to enable information exchange and emotional interaction among users, draws on the user's social networks as the engaging mechanism (Leung & Li, 2015). A social media platform, consisting of professionals, mental health consumers and their peers was found to be useful in a mobile app for depression within an Asian American community (Lee, Juon, Martinez, Hsu, Robinson, Bawa, & Ma, 2009). Having a social media platform installed in mobile

phones, enables users to participate in virtual networks with a much stronger capacity to share information and even emotions than was possible with older cell phones. This feature in particular helps people with depression to avoid isolation and increase social interaction, which are critical indicators of treatment progress. Some cell phones allow users to take pictures and videos, which geographically locate users and their friends, which in turn can be forwarded to websites, and can even monitor bodily conditions and environmental changes. With these capabilities, users are able to enrich their sharing with a social media platform (Bentley & Barrett, 2012). These new technical possibilities encourage interactions between mental healthcare consumers and their peer groups, which can transform the social media platform into a cohesive social network.

Typically, social media platforms rely on the interactions of their users. Although a user does not need to be physically present to participate in a social media platform, an online community needs to have active discussions and information exchanges to be effective (Leung & Pasupathy, 2011). The interactions may or may not generate interesting and useful content and hence may fail to produce useful knowledge. In cases where useful data are collected, the developer—who provides the infrastructure of a virtual community for patient users—can then make necessary changes that offer useful stimuli to encourage interactions among mental healthcare consumers and caregivers who also subscribe to the app.

One possible strategy is to foster interactions by “pushing” appropriate content to users on a regular basis. Information tailored to a user’s needs and interests is particularly effective in changing beliefs, attitudes, and behaviors (Cohen, Caburnay, Luke, Rodgers, Cameron, & Kreuter, 2008). For example, a pilot study of underrepresented mental healthcare consumers focused on getting professional psychological advice. The developer may push this advice to the social media platform inside the app to foster interactions. This information may be presented with pictures, videos, or other entertaining materials to continuously engage users. Figure 3 provides further detail of how this app may look.

Method for post-launch analysis

Grounded theory researchers seek to discover patterns from the data they collect by comparing many different events in the app users’ lives. The comparisons enable the developer to identify events of similar and different natures pertaining to the same and different individuals over time. The researchers can then build concepts and theories about the underlying root causes and possible solutions of the social problems they are investigating.

Additionally, apps allow the researcher to store and use data obtained from the apps. Storing mental healthcare consumers’ interaction data allows researchers to record the consumers’ language and later examine if the language (and other data) reflects any of the consumers’ concerns within specific contexts. In one pilot study, interviewees were asked about their perceptions of mobile apps used for health purposes. Their responses indicate that a “good app will allow me to connect with family members” (Leung & Li, 2015). This response can be followed-up on by further asking what they meant by “good.” Their perception of how

“good” changes over time and how the changing perception shapes behavior can be examined.

Related techniques such as an “affinity analysis” may be used to supplement the data analysis (Cohen, Caburnay, Luke, Rodgers, Cameron, & Kreuter, 2008). For instance, an affinity analysis gathers all the data that pertain to the issues or needs the user addresses. The developer and her/his team ask for input from the users and record the input on sticky notes. The team then pastes the sticky notes onto a wall and groups the notes in meaningful ways. The research team then selects two to three groups representing the most needed features.

The analysis can also be made available to the mental health professionals and other caregivers for reviewing and/or adjusting treatment plans. For example, an app may contain features to allow a depressed patient to express his/her mood by selecting a “mood icon” on a daily basis. The consumer can share his/her mood with friends and caregivers by using the “mood icon” or a text message.

Similarly, a well-designed app is able to record how the structure of a mental health consumer’s social network changes over time, and even how these changes are associated with mental health outcomes (Luxton, McCann, Bush, Mishkind, & Reger, 2011). With this in mind, depressed individuals with strong networks can be anticipated to experience positive mental health outcomes more frequently. More specifically, apps provide a convenient way for individuals with depressive symptoms to engage with and receive emotional support and useful information from their social networks. Developers can examine whether the proposed app outperforms conventional ways of networking among targeted participants. Figure 4 provides more visual information for how to bring about this possible change.

Future Directions and Conclusions

Although many apps are available for people living with various mental health disorders, and the research on app use has been growing, few randomized control trials have been published that validate their effectiveness. Among the issues that need to be evaluated are the potential pitfalls that apps may not be able to address. For instance, people who have mental illnesses frequently need help developing social skills that will enable them to engage with others in their communities. Although apps can help people develop cyber relationships, developing skills for face-to-face interactions may be difficult with some apps. Likewise, individuals seeking mental health care may avoid certain topics, such as the ability to self-assert one’s wishes, which may be associated with their diagnosis. In these instances, many apps may reinforce maladaptive or unproductive behaviors that may still be better addressed during face-to-face sessions. Attention to user preferences that are part of marketing apps may end up reinforcing symptoms that should be addressed. Still, using grounded theory can be helpful to mental healthcare consumers progressing in treatment, providers looking to gain a more thorough understanding of the consumers’ mental health needs, and developers hoping to widen the appeal and use of additional apps.

As of 2013, there were more than 1 million apps developed by Apple's AppStore, Android Market, Windows Marketplace, and Blackberry AppWorld combined (Joorabchi, Mesbah, & Krechten, 2013). Given the growth in the app marketplace, estimates suggest that by the end of 2015 over 70% of all handset devices will be smartphones with the capability of running mobile apps (Joorabchi, Mesbah, & Krechten, 2013). Strong potential remains for apps that can improve the mental health care for many individuals with mental health concerns. Shedding light on how apps can be improved for people with mental health concerns shows potential as an adjunct approach to traditional treatment approaches.

References

- Alegria M, Chatterji P, Wells K, Cao Z, Chen C, Takeuchi D, Jackson J, Meng X. Disparity in depression treatment among racial and ethnic minority populations in the United States. *Psychiatric Services*. 2008; 59(11):1264–1272. [PubMed: 18971402]
- Bentley, F., Barrett, E. Building mobile experiences. Cambridge, MA: The MIT Press; 2012.
- Bentley F, Metcalf CJ. The use of mobile social presence. *IEEE Pervasive Computing*. 2009; (4):35–41.
- Brownstein-Evans, C., Keefe, RH., Rouland-Polmanteer, RS. Social work practices in screening, diagnosing, and providing services to new mothers with postpartum depression; Paper presented at the 47th annual meeting of the New York State Social Work Education Association; Saratoga Springs, NY. 2014.
- Charmaz, K., Belgrave, L. Qualitative interviewing and grounded theory analysis. In: Gubrium, JF, Holstein, JA, Marvasti, AB., McKinney, KD., editors. *The SAGE handbook of interview research: The complexity of the craft*. 2nd. Thousand Oaks, CA: Sage; 2002. p. 347-367.
- Cohen EL, Caburnay CA, Luke DA, Rodgers S, Cameron GT, Kreuter MW. Cancer coverage in general audience and Black newspapers. *Health Communication*. 2008; 23(5):427–435. [PubMed: 18850390]
- Donker T, Petrie K, Proudfoot J, Clarke J, Birch MR, Christensen H. Smartphones for Smarter Delivery of Mental Health Programs: A Systematic Review. *Journal of Medical Internet Research*. 2013; 15(11):e247. <http://doi.org/10.2196/jmir.2791>. [PubMed: 24240579]
- Dourish, P. Proceedings of the SIGCHI conference on Human Factors in computing systems. ACM; 2006 Apr. Implications for design; p. 541-550.
- Estrin D, Sim I. Open mHealth architecture: an engine for health care innovation. *Science (Washington)*. 2010; 330(6005):759–760. [PubMed: 21051617]
- Gilbert, P., Chun, BG., Cox, LP., Jung, J. Proceedings of the second international workshop on Mobile cloud computing and services. ACM; 2011 Jun. Vision: automated security validation of mobile apps at app markets; p. 21-26.
- Glaser B. Conceptualization: On theory and theorizing using Grounded Theory. *International Journal of Qualitative Research*. 2002; 1(2):23–38.
- Gotlib, IH., Hammen, CL., editors. *Handbook of depression*. 3rd. New York, NY: The Guilford Press; 2014.
- Hastings, JF., Jones, LV., Martin, PP. *African Americans and depression: Signs, awareness, treatments, and interventions*. Lanham, MD: Rowman & Littlefield; 2015.
- IC Insight. Worldwide Cellphone Subscriptions Forecast to Exceed Worldwide Population. 2014. 2015. <http://www.icinsights.com/news/bulletins/Worldwide-Cellphone-Subscriptions-Forecast-To-Exceed-Worldwide-Population-In-2015/>
- Internet Live Stats. Internet Users. 2015. <http://www.internetlivestats.com/internet-users/#trend>
- Jones SP, Patel V, Saxena S, Radcliffe N, Al-Marri SA, Darzi A. How Google's 'ten things we know to be true' could guide the development of mental health mobile apps. *Health Affairs*. 2014; 33(9): 1603–1611. [PubMed: 25201665]

- Joorabchi, ME., Mesbah, A., Kruchten, P. Empirical Software Engineering and Measurement, Symposium conducted at the meeting of ACM/IEEE International on IEEE. Baltimore, MD: 2013 Oct. Real challenges in mobile app development.
- Kim G, Aguado Loi CX, Chiriboga DA, Jang Y, Parmelee P, Allen RS. Limited English proficiency as a barrier to mental health service use: A study of Latino and Asian immigrants with psychiatric disorders. *Journal of Psychiatric Research*. 2011; 45:104–110. DOI: 10.1016/j.jpsychires.2010.04.031 [PubMed: 20537658]
- Kim YH, Kim DJ, Wachter K. A study of mobile user engagement (MoEN): Engagement motivations, perceived value, satisfaction, and continued engagement intention. *Decision Support Systems*. 2013; 56:361–370.
- Lee S, Juon HS, Martinez G, Hsu CE, Robinson ES, Bawa J, Ma GX. Model minority at risk: Expressed needs of mental health by Asian American young adults. *Journal of Community Health*. 2009; 34(2):144–152. [PubMed: 18931893]
- Leung R, Li J. Using social media to address Asian immigrants' mental health needs: A systematic literature review. *Journal of Nature and Science*. 2015; 1(4):e66.
- Leung RC, Pasupathy KS. The economics of social computing: some preliminary findings on healthcare organizations. *Journal of Computational Science*. 2011; 2(3):253–261.
- Luxton DD, McCann RA, Bush NE, Mishkind MC, Reger GM. mHealth for mental health: Integrating smartphone technology in behavioral healthcare. *Professional Psychology: Research and Practice*. 2011; 42(6):505.
- Martin PY, Turner BA. Grounded Theory and organizational research. *The Journal of Applied Behavioural Science*. 1986; 22(2):141.
- McCurdie T, Taneva S, Casselman M, Yeung M, McDaniel C, Ho W, Cafazzo J. mHealth consumer apps: the case for user-centered design. *Biomedical Instrumentation & Technology*. 2012; 46(s2):49–56. [PubMed: 22239360]
- Neil, T. *Mobile Design Pattern Gallery: UI Patterns for Smartphone Apps*. Sebastopol, CA: O'Reilly Media, Inc; 2014.
- Pratt LA, Brody DJ. Depression in the US household population, 2009–2012. *NCHS Data Brief*. 2014; (172):1–8.
- Price M, Yuen EK, Goetter EM, Herbert JD, Forman EM, Acierno R, Ruggiero KJ. mHealth: a mechanism to deliver more accessible, more effective mental health care. *Clinical psychology & psychotherapy*. 2014; 21(5):427–436. [PubMed: 23918764]
- Scupin R. The KJ method: A technique for analyzing data derived from Japanese ethnology. *Human Organization*. 1997; 56(2):233–237.
- Shapiro-Mathews E, Barton AJ. Using the patient engagement framework to develop an institutional mobile health strategy. *Clinical Nurse Specialist*. 2013; 27(5):221–223. [PubMed: 23942098]
- World Health Organization. Electromagnetic fields and public health: mobile phones. 2014. <http://www.who.int/mediacentre/factsheets/fs193/en/>

Figure 1.
W-shaped problem-solving framework.

Figure 2.
An app reminder.

Figure 3.
Engaging Users.

Figure 4.
Social Networks of App Users.