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An mHealth approach to extend a brief intervention for adolescent alcohol use and suicidal behavior: Qualitative analyses of adolescent and parent feedback

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Abstract

Mobile health (mHealth) tools that supplement inpatient psychiatric care can maintain and enhance intervention effects following hospitalization. Adolescents hospitalized following a suicidal event represent a vulnerable population who could greatly benefit from such an mHealth intervention. In specific, suicidal adolescents who drink alcohol are in need of robust interventions that address the bidirectional relationship between alcohol use and suicidal thoughts and behaviors, because it puts them at especially high risk for suicide upon discharge. The purpose of this study was to conduct qualitative interviews to gather feedback to improve a brief alcohol intervention provided to suicidal adolescents during psychiatric hospitalization, and to develop a mHealth tool to extend care after discharge. Participants, eight adolescents and their parents, identified the need for a smartphone application to deliver intervention content to adolescents and parents during the post-hospitalization period. Adolescents sought support in meeting alcohol- and mood-related goals, while parents desired general resources as well as tips for conversations with their adolescent about mood and alcohol use.

Keywords

mHealth; intervention; alcohol; suicide; adolescents; technology acceptance

Introduction

Suicide is the second leading cause of death for adolescents and young adults ages 15–24, accounting for more than one in ten deaths among adolescents (Kann, McManus, & Harris et al., 2018). As suicide rates continue to rise, there is a critical need for innovative solutions (de la Torre, Castillo, Arambarri, López-Coronado, & Franco, 2017; Torous et al., 2018). mHealth tools can serve as mechanisms through which clinicians can deliver more accessible and effective care via mobile phones (Price et al., 2014). For example, smartphone applications have garnered support as an innovative means to extend mental health treatment for suicidal adolescents by bringing the intervention into their home environment (e.g.; Bevan Jones et al., 2018; Torous et al., 2018) because they are ubiquitous among teens and deliver material to them in their preferred modality. Adolescents have high rates of both use and ownership of smartphones, yet this modality remains understudied within clinical research (Wu, Torous, & Harper, 2016). Moreover, these approaches have yet to be tested as a means of improving suicide prevention and intervention (de la Torre et al., 2017) or depression (Wu et al., 2016) among youth.

The Role of Alcohol in Suicide Intervention Development

When developing interventions for suicidal adolescents, it is important to address alcohol use, as it is a substantial risk factor for suicidal thoughts and behaviors (Esposito-Smythers & Spirito, 2004; Goldston, 2004). Indeed, previous research has suggested that alcohol-induced disinhibition can both increase suicide ideation as well as the odds of acting on suicidal thoughts (Sher, 2006). In addition, recent longitudinal research suggests that recurring suicide ideation can eventually result in subsequent alcohol use (Marshall-Lévesque et al., 2017), supporting the self-medication hypothesis (Khantzian, 1997). Taken together, research supports a bidirectional model between alcohol and suicide-related thoughts and behaviors (Bagge & Sher, 2008), emphasizing that in those with comorbid suicidality and alcohol use, these problems can exacerbate one another and should be addressed in an integrated manner (Esposito-Smythers, Spirito, Kahler, Hunt, & Monti, 2011).

Brief Alcohol Interventions for Suicidal Adolescents in Inpatient Treatment

Despite existing evidence for the relationship between alcohol and suicidal behavior, psychiatric inpatient units most often place a primary focus on suicide risk with less attention to adolescent alcohol use as a risk factor for suicide (Rowan, 2001). Psychiatric hospital stays for adolescents are short, placing pressure on clinicians to deliver brief treatment approaches and aftercare planning (Goldston et al., 2003). Consequently, the hazardous bidirectional relationship of alcohol and suicide has been a low priority for researchers, as O'Brien et al. (2018) conducted the only study, to our knowledge, of an alcohol intervention specifically designed for use in inpatient treatment settings with suicidal adolescents. This study tested an integrated protocol to address the functional relationship between alcohol use and suicidal thoughts and behaviors, based on the concepts and techniques of Motivational Interviewing. Motivational Interviewing (MI; Miller & Rollnick, 2013) is a client-centered approach that encourages the client to voice their own arguments for change and has shown success within a limited time period. With a strong focus on

autonomy, MI is particularly well suited for adolescents (Naar-King, 2011). Findings from O'Brien et al. (2018) study demonstrated intervention feasibility and acceptability, underscoring the potential of integrating substance use and mental health treatment during inpatient psychiatric hospitalization.

Adolescent and Young Adult mHealth Interventions for Alcohol Use

Interventions that include an mHealth component have been shown to be feasible and acceptable, and in many cases, effective at reducing or preventing alcohol use among adolescents and/or young adults in a variety of settings, including at home following an emergency department evaluation (Suffoletto et al., 2014) and after discharge from an inpatient psychiatric hospitalization (Agyapong, McLoughlin, & Farren, 2013). A meta-analysis of mHealth interventions for adolescents and young adults [age 12–29] with alcohol and tobacco use concluded that text messaging interventions are a favorable mode of treatment delivery for this age group (Mason, Ola, Zaharakis, & Zhang, 2015). Of the 14 studies reviewed, effect sizes yielded a summary effect size of 0.25, indicating a positive effect of text messaging interventions to reduce substance use (Mason et al., 2015). For instance, results from a study of young adults seen in an emergency department (N=765; age 18–25) indicated that a text messaging alcohol intervention produced small amounts of reduction in both binge drinking and the number of drinks consumed per day among participants diagnosed with an alcohol use disorder (Suffoletto et al., 2014). One study conducted of an MI-based alcohol text messaging intervention with college students (N=18; age 18–23) revealed an increase in ability to change their drinking, as well as trend level significant increases in their intent to reduce their alcohol use, compared to college students with problem alcohol use who did not receive the intervention (Mason, Benotsch, Way, Kim, & Snipes, 2014).

Although there mHealth interventions show promise for young people, very few of these studies have focused on substance use specifically among adolescents. The majority of the studies of mHealth interventions have focused on college-age young adults, who may have different developmental needs. For example, while many college students live on their own, adolescents are mostly living with their parents, offering the opportunity to leverage parent support (via mHealth) within the intervention. In addition, clinical samples are at particularly high risk for alcohol and other drug use (Zeshan et al., 2016), putting them in need of robust interventions that address the bidirectional relationship between alcohol use and suicidal thoughts and behaviors (Bagge & Sher, 2008).

The Need for mHealth Boosters Following Adolescent Psychiatric Hospitalization

Most efforts to address mental health and/or substance use issues among adolescents in inpatient settings have focused on the time period *during* hospitalization; however, these vulnerable youth often face significant challenges in the days and weeks following discharge. Research has demonstrated that having attempted suicide in the past is a major risk factor for future suicide attempts, as well as potential death by suicide (Bridge, Goldstein, & Brent, 2006; Goldston et al., 2003; Shaffer, 1996; Zahl, 2004). In particular, during this post-discharge time period, the risk for suicide, repeat suicide attempts, and readmission is especially high (Knesper, 2010), making continuity of care for suicidal

adolescents critical. Important transitions to outpatient care are often not made (Bridge, Marcus, & Olfson, 2012), leaving adolescents without the structure and help they need following discharge. Cost, transportation, and stigma are also significant barriers to having families return to the hospital for post-discharge follow-up care. As such, O'Brien et al. (2018) highlighted the need to extend the effects of their in-person intervention through the high risk period of post-hospitalization using an mHealth booster.

“Bridging strategies” appear to be feasible and can increase the odds of young people being linked with outpatient follow-up treatment (Boyer, McAlpine, Pottick, & Olfson, 2000). Approximately 78% of adolescents and 90% of adults report owning their own cell phone, with no significant differences across race or income (Brenner, 2013), suggesting cell phone technology as a potentially feasible way to bridge the inpatient care suicidal adolescents receive with their long term treatment outside the hospital. Building on strong evidence of accessibility, additional benefits of using mHealth to enhance treatment protocols include continued engagement, increased dosage of therapeutic content, fidelity to intervention content, and the ability to deliver personally-tailored content to encourage participants to pursue therapeutic goals (Erhardt, & Dorian, 2013; Luxton, June, & Kinn; Pramana, Parmanto, Kendall, & Silk, 2014). Such interventions can also be highly tailored and personalized, increasing acceptability and effectiveness (Ondersma, Chase, Svikis, & Schuster, 2005). For example, a recent study of college students found text messaging to be a feasible and acceptable way to identify time periods at risk for drinking (e.g., during celebratory occasions or attending a sporting event) and deliver an mHealth intervention related to alcohol reduction (Moore et al., 2013). In sum, vulnerable adolescents in the period following psychiatric hospitalization may benefit from mHealth technologies that reinforce the treatment they received during inpatient care and respond to the increased need for support when they return home from the hospital.

Consideration of mHealth Interventions Using the Technology Acceptance Model

The Technology Acceptance Model posits that perceived usefulness and ease of use dictate user acceptability by impacting the intention to use, and consequently, the likelihood of use (Davis, 1989). Since its development, this model has served as the foundation for numerous studies in technology development and its constructs are considered central in understanding user acceptability (Venkatesh, Morris, Davis, & Davis, 2003). Thus, it has direct application as a theoretical framework for developing mHealth interventions.

Perceived usefulness speaks to the degree to which an individual believes using a particular system (e.g., mHealth technology) will improve their condition. In the case of our intervention, the adolescent must believe the mHealth technology would help them to decrease alcohol consumption and suicide-related thoughts and behaviors in order for them to engage in the intervention. Similarly, parents must believe the mHealth technology would help them to support their adolescent in these changes in order for them to use the tool. Consequently, a high level of belief in its utility is often the first contribution to a positive relationship with the intervention. Belief in utility aligns with the core concepts and intention of MI, as the degree to which an individual believes something to be useful may depend on whether or not they *want* to make a change. The purpose of our intervention was

to help adolescents understand the link between their alcohol use and suicidal thoughts and attempts in order to increase their motivation for change, and to help parents understand the ways they can support their adolescents in the change process. By translating these motivations and strategies for change they developed during the in-person session into a mHealth booster of content they would receive after hospital discharge, it would be more likely that adolescents and parents would use it because of the belief in its usefulness fostered during the in-person session.

Paired with usefulness is the perceived ease of use, which addresses the anticipated level of effort that will be required to engage with the intervention. Perceived usefulness is associated with perceived ease of use and in some cases may mutually influence each other (Davis, 1989). For our mHealth intervention, this mechanism of change encompasses the degree to which adolescents and parents expect that using it will be as effortless as possible, which then drives subsequent adoption (Davis, 1989; Zapata, Fernández-Alemán, Idri, & Toval, 2015). In contrast, if the prospective user anticipates that using the app will consume significant physical and mental effort, this will serve as a deterrent to its adoption (Davis, 1989).

In preparation for the development and testing of technology-based interventions, previous research has used qualitative interviews to examine user perspectives of how effective and meaningful a technology system would be (Taiminen & Saraniemi, 2018). This process is important, especially because ease of use has been found to be a major potential barrier among mHealth use (Zapata et al., 2015). For example, participants with limited technology experience have struggled to incorporate mHealth applications, such as older adults and children, and adaptations are recommended, including adjusting font size and tailoring language to correspond with the target audience (Zapata et al., 2015). Moreover, a systematic review of the literature of mHealth interventions designed to treat persons with alcohol use disorders showed that the most effective interventions consisted of a strong evidence base, theoretical grounding, and comprehensive approach (Quanbeck, Chih, Isham, & Gustafson, 2014). Guided by the Technology Acceptance Model, interviews with potential users are needed prior to development to understand and improve perceived usefulness and ease of use, which will ultimately affect utilization of the mHealth technology (Davis, 1989).

Purpose of Study

To improve a brief alcohol intervention provided to suicidal adolescents during psychiatric hospitalization and to develop an mHealth tool to extend care after discharge, we conducted qualitative interviews with adolescents (and their parents) who had previously received our in-person brief intervention (O'Brien et al., 2018). Through these interviews, we sought to understand families' perspectives, as user input is essential in the development of technology-based interventions (Jones et al., 2018) and is a core component of the Technology Acceptance Model. Accordingly, our primary aim was to refine our proposed design of the mHealth booster of the intervention and assess perceived usefulness and ease of use by obtaining feedback on proposed content, interface, and functionality via in-depth interviews with eight adolescents and their parents.

Methods

Sample and Recruitment

Adolescents ($M_{\text{age}} = 16.50$ [13–18]) and parents ($M_{\text{age}} = 53.50$ [45–68]) were recruited from the inpatient psychiatric unit of an urban general hospital in the northeast United States (see Table 1 for demographic information). Adolescents were eligible if they were between the ages of 13 and 18, were hospitalized for a suicide plan or attempt, reported they had consumed alcohol in the month prior to admission, and received the in-person intervention during their psychiatric hospitalization. We excluded participants from the study if they presented with active psychosis or did not speak English. We obtained informed assent and consent from both the adolescent and their parent. The hospital's Institutional Review Board (IRB) reviewed and approved all study procedures.

Integrated Alcohol and Suicide Intervention for Suicidal Teens (iASIST)

The integrated Alcohol and Suicide Intervention for Suicidal Teens (iASIST; O'Brien et al., 2018) consists of one 60- to 90-minute individual session with the adolescent followed by one 20- to 30-minute family session. The individual session is grounded in Motivational Interviewing (MI), but is structured, includes the use of assessment feedback, and is highly personalized. The interventionist begins the session asking about the pros and cons of the adolescent's alcohol use, including how their alcohol use relates to their suicidal thoughts and attempts. Next, the interventionist elicits the adolescent's motivation to change their alcohol use (which often relates to their consideration of how their alcohol use fits in with other goals they have set for themselves), and their self-efficacy in their ability to cut down or stop drinking. Provided the adolescent is interested in change, the interventionist then discusses strategies for decreasing or stopping drinking, concluding with the creation of a change plan. Subsequently, a family session in which the adolescent takes the lead in sharing with the parent(s) the most salient issues from the individual session, often choosing the change plan they have developed. The interventionist also provides psychoeducation about the utility of parental monitoring and parent-adolescent communication, and how these approaches can be useful in decreasing alcohol use and suicidal thoughts and behaviors (For further detail on the intervention and a case example, see (O'Brien, Aguinaldo, White, Sellers, & Spirito, 2018). The initial prototype for the mHealth booster and interview guide for the participant data collection were developed by two of the authors (KO, JB).

Data Collection

Adolescents ($n = 8$) and parents ($n = 8$) were interviewed separately to seek feedback about their experience with the in-person intervention and to elicit input regarding the mHealth booster. Interviews were held in a private room on the inpatient psychiatry unit and were conducted by licensed clinical social workers. A semi-structured script with questions and prompts guided the qualitative interview, with one set of questions for the adolescent and one for their parent. We first discussed the functions of the in-person intervention, including what elements they found particularly helpful and how we could improve our approach. To assess ease of use at a broad level, we then addressed experiences with and preferences for technology modalities (e.g., phone calls, mobile applications, text messaging) within the context of receiving help for mental health issues. We then introduced a general outline of

our proposed mHealth intervention. Within this context, we asked participants how they would want the content from the in-person intervention presented within the mHealth booster framework such that it would optimize ease of use and perceived usefulness. Next, we discussed booster content frequency and whether or not that should change over time to further accommodate intervention use. Then we asked for general thoughts or comments on how or why a mHealth booster might be useful in helping adolescents to change their mood and/or alcohol use. We ended the interview by asking if there was anything else we were not capturing in our booster design and if they had any additional questions or comments. Adolescent interviews ranged from 20–56 minutes (M=41) and parent interviews ranged from 17–61 minutes (M=34). All participants were compensated with a \$25 gift card.

Data Analysis

All interviews were audio-recorded and transcribed for analysis. Authors (KO, JB) read a subset of two transcripts to generate the codebook. We derived deductive codes from the interview research agenda questions and inductive codes from topics participants raised in the interviews. Framed by the Technology Acceptance Model, the goal was to identify overarching themes related to app usefulness and anticipated ease of use (Davis, 1989). Raters (KO, JB) used the codebook to code the remaining transcripts and then had a group meeting to resolve discrepancies and agree upon the final codes for each transcript. All transcripts were double-coded, and data were analyzed with Dedoose software (SocioCultural Research Consultants, LLC., 2016). The research team wrote memos (i.e., reflective notes about what the researcher is learning from the data to track written notes and identify patterns) for each of the main categories and included participant quotes to help illustrate each identified theme.

Results

Feedback on In-Person Component of iASIST to Inform mHealth Booster Content

Adolescent Participants.—Participants generally enjoyed discussing their pros/cons of alcohol use, stating that it was useful to see their behaviors from a broader perspective (see Appendix A.1). Adolescents also enjoyed identifying and discussing their future goals, indicating that it helped remind them about other areas in their life that are important to them: *“I liked this one, cuz it just showed how there’s other important things in your life that are more important, than like alcohol and drugs.”* The majority of adolescents reported benefiting from the change plan component, as it helped develop greater awareness around their reasons for change. As further support, the majority of adolescents chose to share their change plan with their parents during the family session. Overall, none of the adolescents reported they disliked the family session, and three of them noted it was an aspect of the intervention they particularly liked.

Adolescents were less unanimous, however, about their experiences with sections on (1) the relationship between alcohol use and suicidal thoughts and behaviors and (2) how their alcohol use compared to others their age. For example, some adolescents did not think their alcohol use had anything to do with their suicidal thoughts and behaviors, while others did identify a clear connection. With peer comparisons, some youth had not realized how much

more they had been drinking compared to the national average, but others felt the statistics were not applicable to their high school and felt the data did not reflect their context. One participant commented that it was not specific to “*the area I live in, the school I go to, so the data itself didn’t really resonate with me.*” Acceptability of the section on interest and confidence in changing appeared to depend on level of confidence (i.e., those who had lower self-rated confidence expressed apprehension about its usefulness).

Parent Participants.—Parents generally found the family session helpful, citing it as an additional opportunity to talk with their adolescent about important events leading to their hospitalization and a time to discuss factors contributing to their adolescent’s wellbeing (see Appendix B.1). Parents also reported that this session helped start a dialogue within their family, highlighted the need for continuing to work on parent-adolescent communication, and reinforced the importance of parent-adolescent communication about alcohol post-hospital discharge that had not seemed meaningful at the time. One mother stated:

“The idea that we can have a conversation about alcohol based on the tools that you provide or the discussion points that you had were helpful... Within a month [after the hospital] we started thinking, okay, let’s talk about alcohol. You’re gonna go out. We had [our adolescent]’s prom. There was a party after that and we had the discussion about what was allowed, what was not allowed, what he needed to be able to do.”

Feedback on mHealth Modalities

Adolescent Participants.—The majority of adolescents believed that receiving a booster of intervention content through their smartphones would be useful for their continuity of care as well as an easy mode for information retrieval (See Appendix A.2).” The smartphone modality appeared especially feasible, captured well by one participant, “*Definitely, my number one use of communication, regardless of any sort of emergency or anything, is my phone.*” Most participants indicated willingness to log into an app periodically, though they preferred that the app allowed them to remain logged in, for ease of functionality. All participants desired reminders to visit the app, via text messages or push notifications. Most adolescents had used their phones in the past for mental health- or substance use-related help. Adolescents also reported using their phone to text or call with friends, partners, therapists, pastors, or family for support with mental health or substance use issues.

Parent Participants.—Parents were open to receiving booster contact through a range of modalities (See Appendix B.2), with text messaging being the most popular. Indeed, parents already had experience using texting to get help for their adolescent, or to assist their adolescent to get help directly. Several parents preferred an app because they felt it had greater capabilities, although some expressed concern about using an app because they did not consider themselves to be “*tech-savvy.*” Overall, parents viewed an app as “*another tool in the toolbox,*” with one parent’s quote capturing exactly how it could be useful:

“I think having this app being used by both sides as this buffer in between, having other ways for parents to voice their concern for their kids without their kids taking it in a sort of way that they’re just being nagged. I think that will probably lessen

some tension between the relationships of some parents and their teens that are going through this. In that way, I think it'll be helpful, to open the lines of communication."

Some parents also suggested email as a preferred method, especially when receiving a list of resources, though few parents endorsed that they had used a computer for accessing this type of information in the past.

Feedback on mHealth Booster Content and Functionality

Adolescent Participants.—Adolescents had a range of ideas for the material that should be included in the app (See Appendix A.3), including a calendar that would allow tracking of mood scores and drinking on a daily or weekly basis. Adolescents also wanted the goals they identified during the in-person intervention to be incorporated into the app, such as a commitment to reduce or stop drinking alcohol. Participants had several suggestions for text message content, including tips about how to have healthy relationships, coping strategies for managing anxiety (e.g., guided meditation, breathing exercises), general mental wellbeing resources, and motivational messages. In addition, adolescents advocated for the inclusion of a method for interacting with peers anonymously for support. As one adolescent described:

"Something to show that you're not alone or you're not going through it alone. Because even though I was at the hospital and had all these people come visit me and my family was so worried and everything, I went from being surrounded by people who were trained to help me to not at all and surrounded also by people who were going through the same problems or very similar to not at all at home. So a reminder of—that you're not alone and—Can see—or not see other people who are trying to do the same thing, but find a way to give each other motivation or something."

Adolescents' opinions about involving others in the booster (e.g., parents, treatment team) varied widely, especially related to parent involvement and notification. Some adolescents wanted their parents to receive a notification if they reported low mood, whereas others only wanted their parents notified in an emergency. In general, adolescent participants were not interested in GPS tracking and location-based messaging (i.e., when they approach high-risk locations), with one participant calling it "*creepy*."

Parent Participants.—Parents also suggested many ideas for booster content (See Appendix B.3). Specifically, parents were interested in text messages that would provide resources, reminders to discuss alcohol use with their adolescent, and inspirational quotes. The majority of parents were especially interested in how the app could monitor and alert them if their adolescent had a safety concern. For example, if their teen reported a low mood rating or excessive alcohol use, parents desired a notification. Parents stressed the importance of this function as a way to help keep their adolescent safe and wanted a notification, "*not to spy on her...to take care of her, make sure she's healthy, she's not hurting herself.*"

Parents expressed interest in receiving text messages about medication reminders, checking in with their adolescent about mood and alcohol use, reaching out to their own supports, and practicing self-care. To accompany these reminders, they suggested app content on issues such as sexual activity, healthy eating, exercise, social media use, anxiety, depression, suicide, and parental monitoring, as well as tips on how to talk with their adolescents about social scenarios (e.g., pressure to drink from peers).

Parents endorsed a willingness to answer questions, via text or app, related to their adolescent's mood. They indicated that such questions would be a useful way to help with accountability, serve as a reminder to check in with their adolescent, and possibly trigger an exchange between the parent and adolescent. Parents also endorsed GPS tracking on their adolescent's phone, with some parents already having this feature.

Feedback on mHealth Booster Frequency

Adolescent Participants.—Adolescents indicated a desire to engage with the booster, via an app, at least once per week, with many participants indicating a desire to log in multiple times per week (See Appendix A.4). If regular logins were required (e.g., to track mood and drinking), participants were mostly in favor of the required frequency changing over time, as a function of meeting their goals. With regard to the total length of time spent receiving booster content (i.e., the length of the full intervention), the majority of participants felt this should be individualized and would depend on a variety of factors such as their progression in treatment. Overall, participants added that the booster should range from one month to about six months.

Parent Participants.—Parents were generally in favor of using the app from about once a week to every day, with the condition that use should decrease over time in most situations (See Appendix B.4). Parents wanted the option to customize the frequency as needed, related to their adolescent's wellbeing. Parents wanted more frequent messages immediately following discharge, as well as if their adolescent was in a crisis.

General Thoughts on mHealth Booster

Adolescent Participants.—All participants thought that the booster would be useful in helping them with their alcohol or other drug use, and seven of eight participants felt the booster could help with improving mood (See Appendix A.5). One adolescent highlighted the importance of receiving this booster in the vulnerable time period immediately following discharge:

“Especially just getting out of the hospital, people are a little bit—I don't wanna say culture shock, because they weren't out for too long. It's the same culture, it's just you were out of society and then got thrown back in. You're just having some sort of check-up. A nice little check-up.”

Adolescents were aware that assistance with mood problems, via the booster, could subsequently be useful in decreasing alcohol use. They felt this could be achieved through having others check in with them, remind them about their skills, have someone who they can talk to if needed, and raise awareness about unhealthy drinking patterns.

When asked about thoughts for how to best synthesize the in-person intervention and the app, participants highlighted the importance of maintaining parent-child communication. Others suggested creating a checklist in the app that would help them remember the goals and the change plan they developed during the intervention, after discharge. Adolescents also thought that the app should contain their most important reasons to change, because it could help remind the teen of not only *what* they want to change, but also *why* they want to change. Adolescents emphasized the need for personalization with respect to goals and motivators. For example, they were interested in having a data entry format, with the option to track their mood and substance use over consecutive days/weeks. They also desired to receive positive feedback on their progress if they met self-identified goals for mood or substance use.

Parent Participants.—Parents felt the app could act as an arbiter, asking the “*questions that parents want to ask,*” (i.e., about drinking) and setting the stage to begin a conversation about alcohol use and suicide risk (See Appendix B.5). Parents also endorsed the utility of an app as an important tool in helping with their adolescent’s mood. One parent indicated that it could help with their adolescent’s mood because adolescents “*don’t wanna be asked every couple of hours by your parent, ‘Hey, are you doing okay?’*” Similarly, another parent commented about its utility to serve as an impartial party, a sentiment echoed by many of the parents:

“It’s just another tool in their toolbox to help them cope. I think it will definitely relieve some of that tension where parents really don’t know how to question their kids without it being an interrogation. Now you have this third party asking questions for the parents that the parents wanna ask. The kids can’t say, “Well, why are you asking me about that?” The parent (can say), “I didn’t ask you about that. This is a professional question that is geared to—you know what? About 15 other teenagers going through what you did just got this same question from this service, from the app. Answer the question. [Laughter]”

Parents also felt that using the app would be easy, as they are used to carrying a phone at all times. As one parent pointed out, “*People carry their cellphones with them all the time. I think they’re more apt to get the message and in the moment, grab your phone and look, versus if you have to go and sit at the computer to look it up.*”

Parents indicated that the app could help maintain support for the adolescent after inpatient hospitalization has ended, while also providing support to the parents themselves, as many expressed feelings of isolation after their adolescent had left the inpatient unit. Finally, parents stated that psychoeducation provided within the app could also be useful when linkages to outpatient care were not strong.

Discussion

The findings from this treatment development study demonstrated that adolescents and their parents felt that the brief alcohol intervention they received during hospitalization was helpful, and that an mHealth-based booster to supplement the intervention would be both useful and fit into their lifestyle. Indeed, technology-based approaches to intervention are

appealing to young people, with many youth rating them as more favorable than face-to-face interactions around changing health behaviors (Pilowsky & Wu, 2013). New data indicate the same can be said for adults, as a technology-based intervention for adults with severe mental illness resulted in higher engagement and treatment retention when compared to clinic-based care (Ben-Zeev et al., 2018). Although additional development is needed, we have established a strong foundation from which to expand and improve mHealth alcohol intervention boosters for suicidal adolescents who have been discharged from inpatient care.

Our results indicated that participants desired a dual mode (i.e., adolescent and parent) smartphone application with messaging capabilities to push individual and family intervention content to users in the months following hospitalization. Both groups felt that the booster would be particularly useful in extending the information they obtained from our in-person intervention. That is, participants indicated that although some of the in-person content was difficult to digest during their inpatient stay, they were interested in revisiting these issues in the weeks after discharge. These encouraging findings fit with our theoretical model, in that participants provided salient ways in which we could increase the perceived usefulness and ease of using our proposed intervention. Our mHealth booster could provide the same content as the in-person intervention, while also offering additional information, options to personalize settings, and provide customized feedback to young people in the moment, offering further opportunities for engagement and effectiveness (Ondersma, Chase, Svikis, & Schuster, 2005). Such ecological momentary interventions can take place in the context of everyday life and in the adolescent's natural setting, rather than in an office or at the hospital (Heron & Smyth, 2010) and can play a major role in helping adolescents practice coping skills which may enhance the effectiveness of hospital-based interventions.

Although adolescents varied on the extent to which they desired content to be shared with their parents, most endorsed an interface that would allow parents to see real-time mood scores, drinking behavior, goals for mental health and drinking, and their change plan. Adolescents emphasized that it would be useful to receive supportive encouragement and positive praise through the mHealth booster when meeting their goals. Adolescents also requested the capability to receive support from peers via an online forum. Because the idea for a supportive online forum came organically from the adolescents and was endorsed by many, it will be important to consider and must be done with attention to critical ethical issues such as who and how the forum would be monitored.

Parents, on the other hand, expressed the need for resources related to adolescent mood, alcohol use, and communication in order for the intervention to be useful. The latter was strongly endorsed, as parents desired to communicate with their teens about safety, suicide risk, and drinking. The dual mode interface suggested by participants could provide families a springboard from which to continue discussing important issues that were underscored during the inpatient stay. That is, the combination of tools and skills provided to parents, feedback and goal setting options for adolescents, and shared tracking of behaviors and mood creates a wealth of information that families can use to keep consistent lines of communication open. A monitored forum, moreover, could provide a doctor-is-in function, where participants could submit new questions or topics on which they would like advice. Parent interest in prioritizing parent-adolescent communication may serve as a means to

decrease parent-adolescent discord, a predictor of adverse outcomes, including self-harm (Ferdinand, Van Der Ende, & Verhulst, 2004). Additionally, parental understanding of their teen's suicidality is often very limited (Ferdinand et al., 2004) highlighting the need for direct communication regarding suicidal thoughts and behaviors in order to prevent suicide attempts and deaths.

There were several limitations to our study. Because our sample consisted of 16 participants from the same hospital in an urban area of the northeastern US, it is not representative of all adolescents and parents, although our sample did contain representation by race, ethnicity, and sexual orientation. Participants may have provided socially desirable responses to our questions, especially about the intervention. We tried to minimize this by having the interviewer be a different person than the original interventionist, emphasizing the confidentiality of the interviews, separating the interview from clinical treatment, and underscoring that we want the booster to be as useful to adolescents and families as possible and thus the need for total honesty. Although our sample was small, the interviews provided the type of rich feedback that is imperative in successfully designing intervention approaches for both adolescents and their parents.

In sum, the findings from our study emphasize the helpfulness of the brief individual and family alcohol intervention received during inpatient psychiatric treatment, as well as the utility of an accompanying mHealth booster to be delivered during the high-risk period following hospitalization. To be maximally useful and easy to use, adolescents highlighted the need for the booster to provide support and encouragement related to treatment goals. The ability to personalize the app's focus is consistent with an MI approach and aligns with the developmental stage of seeking increased independence (Naar-King, 2011). Parents expressed the desire for access to a library of resources as well as reminders to initiate conversations with their adolescent about their mood and alcohol use.

This study represents the first step in a Stage 1 intervention development project (Rounsaville, Carroll, & Onken, 2001). Following these methods, we have generated ideas for and will be preparing a mHealth booster based on the feedback provided here (Stage 1A); subsequently, we will test iASIST with the additional mHealth booster within an open trial and a pilot randomized controlled trial (Stage 1B) over the next two years. The adolescent mode of the booster will include access to strategies, goals, the change plan, mood and alcohol tracking, chat support with peers, and the crisis text hotline and Lifeline. The booster for parents will include messages about parent-adolescent communication, psychoeducation resources, chat support with peers, how parents can help with their adolescent's change plan, access to support from service providers, and the ability to view their adolescent's mood and alcohol tracking, if permitted by the adolescent. The booster will begin following discharge and extend mental health support through the transition to a step-down program or directly to their home, with the intent to increase support for both adolescents and parents during this critical period of risk.

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Appendix A.: Summary of Interview Questions and Responses by Adolescents (n=8)

<p>A.1. Feedback on In-Person Component of iASIST to Inform mHealth Booster Content</p>	<p>Reviewed specific sections of the in-person intervention (which are <i>italicized</i> in the right-hand column) and asked:</p> <ol style="list-style-type: none"> 1) what was helpful 2) how it could help teens when they are leaving the hospital 3) what did you <i>not</i> like 4) what would you change <p><i>Pros/Cons of Alcohol use:</i></p> <ul style="list-style-type: none"> • participants liked (6) • did not like (2) <ul style="list-style-type: none"> ◦ did not relate and was difficult to talk with an adult about what they liked about alcohol (1) ◦ difficult to think about what they liked about alcohol (1) <p><i>Relationship between alcohol and suicidality:</i></p> <ul style="list-style-type: none"> • participants liked (5) • did not like (2) <ul style="list-style-type: none"> ◦ did not fit their experiences (1), as had suicidal thoughts, not attempt so didn't see relationship (1) ◦ section scared them (1) <p><i>Personalized feedback:</i></p> <ul style="list-style-type: none"> • participants liked (4) • did not like (4) <ul style="list-style-type: none"> ◦ statistics did not shock them, as already knew information (1) ◦ felt shame by personalized feedback (1) ◦ personalized feedback was intended to make them feel bad (1) ◦ personalized feedback wasn't as relatable as data was national, and not focused on Massachusetts (1) <p><i>Interest and confidence in changing:</i></p> <ul style="list-style-type: none"> • participants liked (5) • did not like (3) <ul style="list-style-type: none"> ◦ upsetting as they didn't have confidence or interest (1) ◦ even though they didn't drink much, it made them worry they were addicted (1) ◦ section backfired when they left the hospital as they were over confident and then didn't reach their goals (1) <p><i>Future goals:</i></p> <ul style="list-style-type: none"> • participants liked (7) • things they did not like (4) <ul style="list-style-type: none"> ◦ alcohol column did not resonate and felt like general goals could be helpful especially by having it written down (2) ◦ was really difficult to do the future goals section as they did not want a future for themselves beyond one month (1) ◦ Didn't like how there were two different goals on substance use more broadly (1) <p><i>Strategies for change:</i></p> <ul style="list-style-type: none"> • participants liked (5) <ul style="list-style-type: none"> ◦ was difficult to think about cutting down their alcohol use, as neither themselves nor their parents think that they have a problem with alcohol use (1) ◦ was difficult as they didn't have any skills yet (1) <p><i>Change plan (n=8 shared during family session):</i></p> <ul style="list-style-type: none"> • participants liked (6) • particularly challenging as they couldn't identify people who could help them (1) <p><i>Family session:</i></p> <ul style="list-style-type: none"> • participants liked (3) • majority of the intervention wasn't applicable but could see how it would help others (1)
<p>A.2. Feedback on mHealth Modalities</p>	<p>Have you ever used your phone, whether it's texting, apps, or calling someone to get help for mental health or substance use?</p> <ul style="list-style-type: none"> • used their phone for communication in any sort of emergency or when additional support is needed (5) <ul style="list-style-type: none"> ◦ used their phone to text or call with friends, a partner for support, or family for support (5) ◦ used a mental health app when feeling dysregulated upon discharge (3) ◦ used breathing exercises on a mental health app (2) ◦ used phone to text with therapist (1) ◦ used phone to text with pastor (1) • never used their phone for help related to mental health or substance use (1)

<p>Which did you like best? Which was most helpful? What was it that made helpful? If you could have an option, what type of method would you have wanted when you came home from the hospital or residential treatment? Or what might other teens want?</p>	<ul style="list-style-type: none"> • preferred an app as the modality preference (7) <ul style="list-style-type: none"> ◦ an app would be helpful for teens to improve mood and reduce alcohol use because it could remind them of their goals, provide them with motivation, and remind them that they are not alone (2) ◦ liked that the help would give information they needed even if they didn't feel like seeing someone face-to-face (1) ◦ thought that it would be particularly helpful for teens' suicidal thoughts and behaviors as it could have clinical tools in the app, so they wouldn't have to physically search for them (1) ◦ an app would be helpful because there are activities and skills they can use, such as breathing exercises (1) ◦ an app would be helpful particularly because most teens already use their phones a lot (1) • texting would be the best modality (3) <ul style="list-style-type: none"> ◦ texting is best as phone conversations make them nervous, and apps can go unopened (1) ◦ texting/calling would be most helpful because their therapist can remind them skills (2) ◦ texting would be the best modality, but phone calls or an app could be helpful (1) ◦ texting friends and family is helpful, especially in a group text (1) ◦ texting was best as it is easiest (1) ◦ texting with a real person would be helpful because someone is listening to them (1) • did not like texting because you cannot understand emotions (2) • a combination of modalities would work best (2) <ul style="list-style-type: none"> ◦ texting plus the app would be the best (1) ◦ phone calls plus the app would be the best, while texting would not be helpful as it is difficult to express emotions over text (1) • phone calls would be the most helpful (1)
<p>What do you think about having a booster in the form of an app? Would you log into the app (it would be like a banking app with a username and password)?</p>	<ul style="list-style-type: none"> • would log in (6) <ul style="list-style-type: none"> ◦ wanted the app to stay logged in, like their banking app (1) ◦ would log in "because it would be nice to have just one place that you can go to for everything" (1) ◦ would log in, but would not remember and thus wanted reminders (1) • log in once a week to every day depending on how simple and easy it was (1) • log in every other day (1)
<p>What would be the best way to remind you about logging in? Text message that repeats until you log in? When? That morning? Previous day? Text your parents, too?</p>	<ul style="list-style-type: none"> • notifications to log in would be a helpful reminder (8) <ul style="list-style-type: none"> ◦ text notification or a push notification would be helpful (4) ◦ daily notifications would be appropriate (1) ◦ notifications be in the form of a question regarding how the participant is doing (1) ◦ a text notification to the parents to remind the teen to log in would be helpful (1) • notifications should be in the afternoon, after school hours (1) • later in the evening (1) • best if the participant could work with a clinician to decide when reminders are set, particularly so that the notifications can occur more often when the person drinks (1)
<p>A.3. Feedback on mHealth Booster Content and Functionality</p>	
<p>What kind of content should we have in the mHealth booster? What kind of topics should be covered? What resources should be available?</p>	<ul style="list-style-type: none"> • a calendar on the app, like bullet journaling, where they can report how much they drank, what their level of safety is, their mood, etc., and that they use bubbles or check marks so that it is convenient and not require a lot of writing (3) • wanted the app to be tailored around drinking (1) • add a component where they can mark their goals (2) • a peer component on the app to provide extra support upon discharge (2) • give statistics or information based on how they answered questions prompted by the app (1) • a coping skill a day (1) • the frequency with which they use the app should change over time, with the teen, doctors, and parents helping to decide when that happened (1) • notifications to help them remember to log in (1) • have suicide prevention hotline automatically call them if they reported feeling down (1)
<p>What types of messages would you want to receive? What should the messages say? What topics should the messages cover? Should we focus on</p>	<ul style="list-style-type: none"> • encouraging or motivating (5) • should focus on facts (2) • did not want to receive random facts (1) • combo of polling and facts (1) • focus on relationships (1)

things other than alcohol and mood?	<ul style="list-style-type: none"> • should respond with something positive if safety concerns (1) • focus on anxiety (1) • focus on skills (1) • resources would be helpful via text (1) • send memes (1)
What should the tone of the messages or prompts be? Funny? Supportive? Scary? Factual?	<ul style="list-style-type: none"> • factual (4) • funny (2) • positive/supportive (2) • scary (2) • should not be scary (2)
Would you answer questions via text? What kinds of questions should we ask?	<ul style="list-style-type: none"> • would respond to text questions (4) • would respond to text questions only if they were struggling (2) • would depend on the situation and where they were if they answered texts (1) • may not have their phone if they were feeling down (1) • would not respond to texts (1) • questions should be conversational, e.g., "How are you doing" (1) • should be their safety scale (1) • should be a lot of questions asked (1) • should be about their goals (1)
In what ways would you like your parents to be involved? Notify them when you drink? How much? Notify them when you're down? How down? Once they have been notified, what would you like them to do? How would you like them to be involved?	<ul style="list-style-type: none"> • wanted parent involvement (6) <ul style="list-style-type: none"> ◦ ok with parents being notified if safety concerns (6) ◦ parent involved when feeling down, but not related to substance use (3) ◦ parents notified if they drank (2) ◦ would be ok if the app could ask if they wanted to involve the parents if safety concerns (1) • did not want parent involvement (2) • want parent to have their own app with their own community and resources (1)
We could also involve others. Would you want the opportunity to talk with someone when you felt like it? Who would you want to talk with? Family? Friends? Professionals? Crisis Hotline? Peers you DON'T know?	<ul style="list-style-type: none"> • wanted others to be involved (5) <ul style="list-style-type: none"> ◦ professionals (5) ◦ peers (4) ◦ an adult who had similar experiences in the past to be involved (1) ◦ crisis hotline (2) • should be an option (1)
Do you want us to know where you are and be able to text you based on location?	<ul style="list-style-type: none"> • did not want the app to text based on location (3) <ul style="list-style-type: none"> ◦ could be particularly helpful to have texts if they were at a liquor store to remind them of their sobriety (1) ◦ could potentially be helpful, but would need to have the option to turn that off (1) • tracking could be helpful particularly if they were unsafe (1)
A.4. Feedback on mHealth Booster Frequency	
<i>Texts</i>	
How often would you want to get text messages? Once/day? More than once/day? Every other day? Should it change over time?	<ul style="list-style-type: none"> • texting frequency should decrease over time (5) • daily texts (4) • should be flexible per person because some may need daily reminders while others may find that "annoying" (2) • reminders should come every other day (1) • texts every other day (1)
How often would you want to answer texted questions? How many questions would you answer in a row? Should it change over time?	<ul style="list-style-type: none"> • polling texts every day or every other day but motivation texts every couple of days (1) • weekly to twice a week texts (1) • frequency should depend on their mood (1) • Would answer couple of questions in a row (4)
<i>App log-in</i>	
How often would you log into the app? Once/week? Should it change over time?	<ul style="list-style-type: none"> • log in every few days (2) • log into the app once per week (1) • up to 3–4 times per week (1) • log in amount should change over time (4) • decrease over time (3) • option for participants to increase usage if needed (1) • frequency with which they would log in would vary based on the function of the app (1)

How much time in the app would be too much?	<ul style="list-style-type: none"> • approximately 20 minutes a day (3) • approximately 10 minutes (2) • about 30 minutes every day or every other day (1) • up to 45 minutes in the app, but would depend on mood (1) • would depend on what was in the app (1)
How long would you want the mHealth booster to last? One month? Three months? Six months? Should it change over time?	<ul style="list-style-type: none"> • the length of the mHealth booster should be individualized per participant and would depend on a variety of factors such as how they are doing (5) <ul style="list-style-type: none"> ◦ 6 months (2) ◦ always be available (2) ◦ a couple of months (1) ◦ one month (1) ◦ some participants may want to use it until they're older (1)
A.5. General Thoughts on mHealth Booster	
Do you think this could help someone change their alcohol use? How? Why? Do you think this could help someone change their mood? How? Why?	<p><i>Helpful for alcohol</i></p> <ul style="list-style-type: none"> ◦ the booster could help them with their alcohol or other drug use (8) <ul style="list-style-type: none"> ▪ could potentially help in terms of its ability to help people with their use of alcohol (4) depending on their motivation and mood but may not help everyone ▪ the booster may "make them feel worse and want to drink more" or it could help by having people "check in" and provide "more support" (2) ▪ particularly helpful by reminding participants about their skills, and having someone who they can talk to if needed (2) ▪ would be helpful because it would raise awareness about unhealthy drinking patterns (1) <i>Helpful for mood</i> ◦ the booster could help with improving mood (7) <ul style="list-style-type: none"> ▪ booster could help them via a support system (2) ▪ could help with their mood by helping with their alcohol use (2) ▪ booster could help develop better coping skills to control behavior and thought patterns (1) • booster could help by utilizing distraction techniques and mindfulness activities (1)
How could it help teens when they are leaving the hospital?	<ul style="list-style-type: none"> • focusing on goals would be helpful in preparing for discharge (3) <ul style="list-style-type: none"> ◦ the goals for change worksheet helped them think about their change plan (1) ◦ the future goals worksheet being integrated into an app would be helpful because they can track their goals over time and see what they've done over time (1) • the importance of planning around alcohol use prior to discharge (2) <ul style="list-style-type: none"> ◦ to learn specific strategies to reduce or refuse drinking (1) ◦ to identify their goals around drinking (1) • the importance of trusted adults and parent-child communication as they plan for discharge (2) <ul style="list-style-type: none"> ◦ identifying trusted adults who the participant is prompted to check in with every two weeks, month, etc., upon discharge (1) • specific communication strategies with their parent (1)
Is there anything else we are not capturing that could help someone after a hospitalization with things like mood or alcohol use?	<ul style="list-style-type: none"> • importance of a community or trusted adult (a real person) (3) <ul style="list-style-type: none"> ◦ a check in with them after discharge (2) ◦ need help identifying who their support group could be, before they are asked to identify specific people (1) ◦ engaging the family more in the intervention on the unit, such as completing the work sheets with the family during the family session, and highlighting the importance of the family checking in with them after discharge (1) • would be helpful to identify strategies for each of the situations that put them at risk for using alcohol (or that they felt confident in abstaining from alcohol use) so that they could really expand that part of the intervention (1) • identified specific tools that could be integrated into the app, such as mindfulness activities and distraction activities (1) • identified other topical areas that may be helpful to include (such as stress, as it ties into mood and substance use) (1) • focusing on goals is needed (1) • "more is less" and suggested not overloading the app (1) • use emojis to lead participants through a breathing exercise (1) • have reminders of their motivators to stay safe and to not drink (1) • have parents involved with the app, so that they could see their information (1) • rewards for meeting goals (1) • have the police, or suicide hotline call them if they reported certain data around sadness (1) • check-ins each month related to their goal (1)
Additional thoughts	<ul style="list-style-type: none"> • booster should be personalized (6) <ul style="list-style-type: none"> ◦ for how long they use the app (4) ◦ for what the app is focused on (1)

	<ul style="list-style-type: none"> wanted to interact with a real person (2) vs. ok with not interacting with a real person (1)
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Note: Due to the semi-structured nature of the interviews and the fact that questions did not require a binary response, responses in this table did not always sum to 8.

Appendix B.: Summary of Interview Questions and Responses by Parents (n=8)

B.1. Feedback on In-Person Component of iASIST to Inform mHealth Booster Content	
What parts did you like, and <i>not like</i> , about the family session? What stuck out to you?	<p><i>Positive:</i></p> <ul style="list-style-type: none"> helpful to have elements discussed together with parent and child and helpful to both (3) highlighted need for continuing to work on communication (1) discussing alcohol at the time of the study seemed nominal, but was useful later on (1) discussing goals was powerful element and could be focus, discussing communication about substances was needed/relevant for their family (1) would be useful to talk specifically about how to discuss substances with their child (1) couldn't remember the specific plan, but said it was helpful in starting a dialogue, including identifying who could help (1) <p><i>Neutral:</i></p> <ul style="list-style-type: none"> not sure (1) couldn't remember the specifics of the session enough to provide feedback, saying it maybe was because it was such a stressful time (1) <p><i>Negative:</i></p> <ul style="list-style-type: none"> already considered parental monitoring (1) thought parent-child communication about substances was important but not that applicable to their family, although said they want to keep having that conversation (1)
B.2. Feedback on mHealth Modalities	
Have you ever used your phone, whether it's texting, apps, or calling someone to get help for mental health or substance use, whether it was for you or for your teen?	<ul style="list-style-type: none"> used phone in past for texting relating to help child directly or to communicate about them in getting them help (2) googled information related to child's mental health on phone (1) googled information related to child's mental health through laptop (1) introduced to an app following a previous discharge, but didn't use it (1) didn't use phone at all for that (1)
Which did you like best? Which was most helpful? What was it that made helpful? If you could have an option, what type of method would you have wanted when your teen came home from the hospital or residential treatment? Or what might other parents want?	<ul style="list-style-type: none"> email as a modality (1) website as a modality because of the bigger screen (1) immediacy of response is important (1) texting as preferred modality (3) <ul style="list-style-type: none"> because didn't have to deal with voicemails and calling back (1) because wouldn't have to remember to log into something (1) because children couldn't overhear them being talked about (1) app was first choice because it could have more capabilities than a text (2) texting first choice, app second choice (1) phone or text and then changed it to email or text because they don't consider themselves tech-savvy (1) email, such as by receiving a list of strategies (1)
What do you think about having a booster in the form of an app? Would you log into the app (it would be like a banking app with a username and password)?	<ul style="list-style-type: none"> would log onto an app (8) would prefer a website (1) <ul style="list-style-type: none"> would log in probably daily, especially if their child was having a hard time (1) would log in if easy (1) way to communicate, such as with the psychiatrist (1) want it to be locked or auto-logged out for privacy (1)
What would be the best way to remind you about logging in? Text message that repeats until you log in? When? That morning? Previous day?	<ul style="list-style-type: none"> need to find a balance with text messaging and push notifications, as they can be useful reminders, but too many can be burdensome and cause people to become annoyed or shut down (1) need a reminder because they are busy, balancing multiple commitments (1)

	<ul style="list-style-type: none"> • one reminder text message, but no more than one (6)• a message and not just a reminder symbol so they knew what it was for (1)
B.3. Feedback on mHealth Booster Content and Functionality	
What kind of content should we have in the mHealth booster? What kind of topics should be covered? What resources should be available?	<ul style="list-style-type: none"> • psycho-ed resources helpful, especially how to discuss mood and check in with child (2) • learn about topics such as medication (1) • a tracker to help compare mood ratings or substance use on different days (1) • reaching out to others for help and validation regarding parenting choices (1) • apps linked as a means of communication between parent-child (1) • helpful medium for getting resources (4), including pointers about how to talk with their child, how to respond to mood swings, getting resources in general • helpful reminder to check in with their child (1) • could be used to track mood patterns or substance use patterns (1)
What types of messages would you want to receive? What should the messages say? What topics should the messages cover? Should we focus on things other than alcohol, mood, and parenting tips?	<ul style="list-style-type: none"> • answer content/questions related to their child's mood (5) • based on child's response, provide parent with resources/tips for how to help them (3) • mood scale for teens (2) • motivational quotes (2) • if safety concern, notify directly (1) • similar to a warning, giving the example of reminding the child if they're drunk and need a ride home they can call the parent (1) • reminder to check in with child even if response is positive because kids can mask struggles (1) • having a question about their child's mood would be useful because it would help with accountability and serve as a reminder to check in (1) • trigger an exchange between parent-child (1) • would like emojis/smiley face (1) • medication reminders built in (1) • reminders about self-care related to healthy eating, exercise, mindfulness/ breathing (1) • provide parents with resources (6); parent-child communication (2); parental monitoring tips (2); talking with child about sexual activity/safe sex (1); checking in with child and discussing/role-playing social/drinking scenarios (1); social media use, anxiety/depression, suicide (1); school performance, school attendance (1)
What should the tone of the messages or prompts be? Funny? Supportive? Scary? Factual?	<ul style="list-style-type: none"> • combination of funny and serious/factual messages (3) • a fact that is eye-opening can be helpful (1) • didn't like scary because of child's trauma history - funny only (1) • need for compassionate language (e.g. "I know you're tired, but can you answer this question about alcohol use?") (1) • doesn't always have to be words, could be relaxing image like a picture of a sunset (1) • personalize it to questions their child would answer honestly or certain responses are cues the child is struggling (1)
Would you answer questions via text? What kinds of questions should we ask?	<ul style="list-style-type: none"> • would respond to questions over text (4) • was more skeptical (concerned with frequency) but agreed they would (1) • would if only a few questions (also concerned with frequency/receiving too many) (1) • use texting minimally so would probably not (1) • questions would need to be related in terms of content so the flow was attuned to what the parent was dealing with (1)• would be a helpful reminder to check in with their child (1)
Would you like to be notified of any of the answers to these text questions given by your teen?	<ul style="list-style-type: none"> • if their child's mood was very low and they were in a dangerous place, a pattern of suicidal thoughts (4) • if child isn't doing well, a link with suggestions on how to respond (1) • mood tracking for child (1) • notified if the child is reaching out to therapist or someone else for help (1) • give the child the option to notify therapist or parent (1) • 911 called if child enters safety concern (1)
We could also involve others. Would you want the opportunity to talk with someone about your teen when you felt like it? Who would you want to talk with? Family? Friends? Professionals? Crisis Hotline? Peers you DON'T know?	<ul style="list-style-type: none"> • individual counselor (4), professionals (2), other parents who have been through this (2), psychiatrist (1), school staff (1) • for teen to be able to call crisis hotline or 911 if in crisis and then parents be alerted or text message alerting others (1) • can reach out to family and friends on own so don't need support with that (1) • general resource to text for validation about parenting choice (1) • concerns about involving others, including the need to know who the supports are because: <ul style="list-style-type: none"> ◦ could be other teenagers (1)

	<ul style="list-style-type: none"> ◦ opeople not able to commit to the responsibility (1)
Also, we could involve others for YOUR support. Would YOU want the opportunity to talk/text with someone when you felt like it? Who would you want to talk with? Family? Friends? Professionals? Crisis Hotline? Peers you DON'T know?	<ul style="list-style-type: none"> • want to speak with a counselor/therapist (2) • family therapist (1) • DBT support (1) • have app connect with a designated friend of the parent (1) • didn't need to be connected directly, but would like a text message reminder about parent self-care (1) • would like text reminder to reach out to their social support network (1) • would like advice from someone about how to communicate with child (1)
Do you want us to know where you are and be able to text you based on location?	<ul style="list-style-type: none"> • already uses GPS tracking on their child's phone (1) • has GPS but hasn't used it (1) • liked the idea of knowing where parents are too in case of emergency (2), or if the child is unsafe (1)
B.4. Feedback on mHealth Booster Frequency	
<i>Texts</i>	
How often would you want to get text messages? Once/day? More than once/day? Every other day? Should it change over time?	<ul style="list-style-type: none"> • daily (4) • leave it up to the user to customize (2) • depending on how child is doing (2) • every couple of days/couple of times a week (1) • weekly (1) • or if they are going to be traveling/separated from the parent (1) • would like more frequently than daily/every few hours if child just discharged (1)
How often would you want to answer texted questions? How many questions would you answer in a row? Should it change over time?	<ul style="list-style-type: none"> • once a week (3) • option to adjust frequency (2) • once a week for 6 months to a year (1) • change over time after 1.5 years (1) • every day might be too much (1) • 4-5 questions in a row (1) • depends on if parent responds (1) • questions have to be related (1)
<i>App log-in</i>	
How often would you log into the app? Once/week? Should it change over time?	<ul style="list-style-type: none"> • option to adjust frequency (2) • need-based on how child is doing, with more frequency if child is struggling (2) • daily (1) • weekly (1) • once a month (1) • frequency of log in would also depend on how easy it was (1) • usage as a communication tool between child-parent would influence frequency (1)
How much time in the app would be too much?	<ul style="list-style-type: none"> • a couple minutes (1), 5 minutes (1), no more than 15 minutes a day (1) • "depends" (1) • immediately following discharge or during times of crisis, the time might be increased, while during more stable times, it would have less than daily usage (1) • first-time parents or those with children who are newly diagnosed may especially benefit from resources and spend more time on it (1)
How long would you want the mHealth booster to last? One month? Three months? Six months? Should it change over time?	<ul style="list-style-type: none"> • want control over length and option to access it depending on your personal situation • based on child age and how much they rely on it (1) • if they were re-hospitalized (1) • the severity of the situation (1) • as needed (1) • as long as they feel they need the support (1) • 6 months (1) • 6 months-year with option to extend permanently (1) • 6 months with the option to renew for another 6 months (1)
B.5. General Thoughts on mHealth Booster	
Do you think this could help parents/guardians to help teens change their alcohol use? Do you think this could help parents/guardians to help teens	<ul style="list-style-type: none"> • thought it could be helpful with mood especially (8) • could help mediate communication between parent-child by having a middle party checking in on them and asking the 'questions that the parents want to ask' and as a minimum, serve as a conversation starter (1) • consider it as another 'tool in their toolbox' and a 'gentle reminder' to be aware of their wellbeing (1)

change their mood? How? Why?	<ul style="list-style-type: none"> • apprehension that it would be useful, especially for alcohol use, as that education should/could be coming directly from the parents, including parents own behavior (such as their own alcohol use) (1) • ease of use because typically carry a cellphone with you (1) • can help maintain support after immediate supports have ended (1)
Is there anything else we are not capturing that could help parents/guardians after a teen's hospitalization with things like their teen's mood or alcohol use?	<ul style="list-style-type: none"> • psycho-ed information could be helpful to supplement services received (2) <ul style="list-style-type: none"> ◦ especially if they didn't have a strong social worker (1) ◦ or not enough support through therapy (1) • would be helpful in supporting parents (2) <ul style="list-style-type: none"> ◦ to prevent against the parent becoming socially isolated (1) ◦ provide the parent with emotional regulation/self-care/mood support (1) • offering sibling support and ways to involve the whole family (2) • how to support child's mental health, specifically how family members can help (1) <ul style="list-style-type: none"> • support bridging communication gap (1) • support dealing with child's friends and friends' parents (1) • provide scenarios e.g. "What are you gonna do if somebody says you should drink," as conversation starters between child-parent, similar to family therapy (1) <ul style="list-style-type: none"> • required check-in for the child (1) • graphics and presenting the data for patterns of behavior/use (1)
Additional thoughts	<ul style="list-style-type: none"> • theme of personalization, especially as related to child's wellbeing with less support needed as they were 'doing better' (4) • when their child was in crisis was when they were receiving a lot of in-person support, so less would be needed from the app (1) • options to customize frequency (1) • options to customize time of day/week received, or what content to include and having the option to opt-in as it relates to you, such as spirituality (1) • personalization could be based on enabling cookies (1) • personalization could be giving child choice to share info with parent or therapist • alert parents to friends child has "checked in" with/who they are spending time with (1) • questioned how the app service/program would be evaluated for effectiveness? (1)

Note: Due to the semi-structured nature of the interviews and the fact that questions did not require a binary response, responses in this table did not always sum to 8.

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Table 1.

Respondents Demographics of Adolescents and Parents (N=16)

	Adolescents (<i>n</i> =8) M [range] or n (%)	Parents (<i>n</i> =8) M [range] or n (%)
Age (years)	16.50 [13–18]	53.50 [45–68]
Ethnicity		
Hispanic or Latino	2 (25%)	1 (12.5%)
Not Hispanic or Latino	6 (75%)	7 (87.5%)
Race		
American Indian/Alaskan Native		1 (12.5%)
Asian	1 (12.5%)	1 (12.5%)
Black or African American		
Native Hawaiian or Pacific Islander		
White or Caucasian	6 (75%)	5 (62.5%)
Other	1 (12.5%)	1 (12.5%)
African American		
Sexual Orientation		
Heterosexual/straight	4 (50%)	8 (100%)
Gay/lesbian/homosexual	2 (25%)	
Bisexual	2 (25%)	
Not sure		
Decline to state		
Gender Identity		
Male	1 (12.5%)	4 (50%)
Female	6 (75%)	4 (50%)
Transgender, Male-to-female (MTF)		
Transgender, Female-to-male (FTM)		
Transgender do not identify as male or female	1 (12.5%)	
Not sure		
Declined to state		