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Using High-Risk Adolescents' Voices to Develop a Comprehensible CBT-Based Text-Message Program

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Abstract

At-risk adolescents' comprehension of, and preferences for, the content of a text-message (SMS) delivered, CBT-based depression prevention intervention was investigated using two qualitative studies. Adolescents with depressive symptoms and a history of peer violence were recruited from an urban emergency department. Forty-one participants completed semi-structured qualitative interviews. Thematic analysis using deductive and inductive codes were used to capture *a priori* and emerging themes. Five major themes were identified: CBT-based messages resonated with at-risk adolescents; high levels of peer violence, comorbid symptoms, and prior exposure to the mental health system were variables affecting preferred content; participants endorsed emotional regulation messages, but found mindfulness content difficult to understand via SMS; cognitive awareness and restructuring content was most acceptable when framed by self-efficacy content; adolescent participants generated applicable CBT content in their own voices. Overall, CBT-informed content was able to be distilled into 160-character text messages without losing its comprehensibility.

Keywords

adolescent; mobile health; text messaging/SMS; depression prevention; qualitative

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INTRODUCTION

In 2013, 30% of high school students in the United States (US) reported they felt sad or hopeless¹ and 10.7% of American adolescents experienced at least one major depressive episode.² Though depressive symptoms are prevalent among adolescents, depression prevention interventions, defined by their aim to reduce depressive symptoms and the likelihood of future depressive episodes, are effective.³ Peer violence and depressed mood are closely linked in adolescent populations, as poor-self esteem, difficulty regulating emotions and using coping strategies, and indifference to personal safety are known correlates of both phenomena.⁴⁻⁶ Teens with depressive symptoms are more likely than their non-depressed peers to be victims of bullying^{7,8} and mental health has been identified as a primary concern for violently-injured youth.^{9,10} Few of these at-risk adolescents, however, have access to preventive services.¹¹

Novel solutions are necessary to improve access to preventive mental health services for this high-need population. Mobile health or “mHealth” interventions provide an innovative framework for delivering mental health preventive interventions that facilitate the delivery of content via mobile phones or wireless devices. mHealth interventions may overcome traditional barriers to accessing mental health services, such as stigma, lack of specialists, and transportation barriers.^{12,13} They may be delivered directly, instantly, and have the capacity to be interactive.¹⁴ mHealth preventive interventions may also permit non-mental health specialists (e.g. emergency physicians, primary care providers) who identify at-risk adolescents to link these teens to an easily-accessible preventive intervention, without needing to develop specialized therapeutic skill-sets.¹⁵

In particular, SMS (short-message-service, also known as “text messaging”) is an mHealth delivery channel that is especially attractive for adolescent mental health preventive interventions. SMS is inexpensive and universally available with 91% of adolescent cell phone owners text-messaging and exchanging a median of 30 texts each day.¹⁶ Adolescents are strongly interested in technology-based interventions and have been shown to have higher rates of text-messaging than smartphone ownership.¹⁷ mHealth interventions addressing a wide range of sensitive behavioral health topics including obesity, diabetes, vaccination uptake, and medication adherence have previously been shown to be acceptable and accessible for adolescents.¹⁸⁻²² Potential limitations of SMS-based interventions include lack of personal contact, restricted character count (maximum 160 characters/message), and limited interactivity in comparison to other mHealth modalities.²³

While SMS provides a novel delivery model, its compatibility with well-established frameworks for depression prevention is unknown. Cognitive behavioral therapy (CBT) is a widely accepted, effective depression prevention strategy for adolescents,^{24,25} including those with a history of violence exposure.²⁶ The fundamental principle of CBT is that thoughts and emotions impact behavior. The goal of CBT in individuals with depressive symptoms is to challenge negative thinking and process through difficult emotions in order to positively change behavior.²⁷ Little is known about the comprehensibility, acceptability, and accessibility of CBT-based preventive content to be delivered via SMS in an at-risk adolescent population. Few studies have examined the potential for SMS-based depression

prevention interventions, and none, to our knowledge, have focused on our population of interest: at-risk American adolescents with a history of peer violence and depressive symptoms. One study by Whittaker et al. 2012 found high acceptability and feasibility in an SMS depression prevention intervention for adolescents in New Zealand delivered universally in the school setting. However, authors noted the need for qualitative formative research to understand ways adolescents use CBT strategies.²⁸ Critical formative development work – including defining adolescents’ preferences for content and understanding of CBT through an SMS medium – has not, to our knowledge, been published.²⁹

Though a preventive CBT-based SMS intervention has potential to be initiated in many settings, the emergency department (ED) plays an especially important role in providing both health and mental health care to a large number of at-risk adolescents.³⁰ Adolescent ED populations include a significant subset of adolescents with underlying depressive symptoms and a history of peer violence,^{5,31,32} who are particularly at-risk for psychiatric disorders.^{5,33} To our knowledge, no mental health SMS programs have been initiated in the ED setting.

This manuscript describes the findings from two related formative studies regarding preventive mental health SMS interventions. Both studies were conducted with at-risk adolescents—those with a history of peer violence and depressive symptoms—presenting to the ED for any reason. Our objective in these studies was to elucidate at-risk adolescents’ comprehension of and preferences for the *content* of an SMS-delivered, CBT-based, depression prevention intervention, adapted from effective in-person interventions.^{26,34} Our prior work^{35,36} describes the preferred *structural* components of an SMS-based depression prevention intervention for at-risk adolescent ED patients. Our previous analyses have elucidated at-risk adolescents’ preferred level of intervention interactivity, individual tailoring, and message frequency, and have established their strong endorsement of the concept of a depression prevention intervention. This manuscript represents an extension of these analyses, with the goal of presenting novel data regarding how CBT-based content can be transformed into SMS preventive interventions for adolescents.

METHODS

The first study (henceforward referred to as “Study A”) and the second study (henceforward referred to as “Study B”) were conducted at the same Level I trauma pediatric emergency department (ED). The ED from which the sample of participants was drawn is a primary children’s hospital in the Northeast US and serves over 50,000 pediatric patients each year. Though the ED is located in an urban setting, patients from urban, suburban, and rural settings alike seek care at this center regularly. The two studies were managed by the same principal investigator (MLR) and used similar research methods, though conducted at different points in time. Both studies received IRB approval, as well as a Certificate of Confidentiality from the National Institute of Mental Health, prior to their initiation.

Study Design and Sampling Frame

In both research studies, patients were screened systematically upon presentation to the pediatric ED with any chief complaint. Recruitment of participants occurred during a convenience sample of shifts (~16 hours/week) during peak volume hours and days of the week by a Research Assistant (RA).

Study A was conducted from July 2012 to April 2013 and Study B was conducted from August 2013 to May 2014. The inclusion and exclusion criteria from Study A and Study B were similar with the exception that Study A recruited only females. Inclusion criteria for both studies included: 13 to 17 years old; English-speaking; parent present to provide written informed consent. Exclusion criteria for both studies included: presenting with acute suicidality, psychotic symptoms, sexual assault, or child abuse; medically unstable; unable to understand consent/assent process; had previously completed the study; in police custody or state service custody.

For both studies, the RA approached each potentially eligible patient in the ED to take a brief screening survey. This 10–20 minute screening survey was completed on an iPad after screening eligibility was confirmed and parental consent/adolescent assent were obtained. All screened participants received a small gift (valued \$1–\$2) as compensation for their time, as well as a list of local behavioral health resources.

For both studies, patients were eligible for the full study if they were deemed at-risk for depression based on their screening survey results. Based on prior research,^{5,31,32} being at-risk was defined as meeting *both* of the following criteria: 1) at least one episode of past-year physical peer violence as either a victim or perpetrator measured using the 14-item modified version of the Conflict Tactics Scale-2nd edition with a score ≥ 1 ; Cronbach's alpha $\alpha = 0.79–0.95$;³⁷ and 2) past two-week depressive symptoms measured using the Patient Health Questionnaire-2 (PHQ-2) score ≥ 3 ^{38,39} in Study A and using the Patient Health Questionnaire-9 (PHQ-9) score ≥ 5 ⁴⁰ in Study B. Eligible participants were invited to return for a semi-structured interview. Written parent/guardian consent and participant assent for the interview were obtained in the ED. At this time, a date and time for the interview were scheduled for after the current ED visit.

Additional measures in Study A and Study B were selected for research, and were not criteria for the qualitative interviews. Study A included: the Center for Epidemiologic Studies-Depression (CES-D).⁴¹ Study B measures of comorbid mental health conditions included: the Child PTSD Symptom Scale,⁴² suicidality items from the Youth Risk Behavior Surveillance System (YRBS),⁴³ the National Longitudinal Study of Adolescent to Adult Health (Add Health), and the Child and Adolescent Service Assessment (CASA).^{44,45} In both studies, demographic data were collected: including age, race (select any that apply: American Indian/Alaska Native, Asian, Black/African American, Native Hawaiian/Pacific Islander, White, Prefer Not to Answer, Other- fill in), ethnicity (Hispanic or Not Hispanic, Prefer Not To Answer), socioeconomic status (defined as “low” if participant indicated that they are receiving public assistance and/or free/reduced lunch at school), cell phone ownership, residence with biological parent, and access to a primary care physician (see Table 1).

Interview Protocol and Message Development

Each qualitative interview was conducted using a semi-structured interview guide. In both Study A and Study B, the first half of the interview elicited participants' own experiences and strategies: Study A's guide focused on participants' experience with violence and depression prevention as well as with technology, and Study B's guide focused more specifically on participants' prior use of text-messaging to deal with sadness, stress, or fights. Questions in both studies were open-ended, such as: "Have you ever used texting to get support? Tell me about it". However, questions in each semi-structured interview varied, as they were tailored to each individual. When indicated by the content of participants' responses, more specific probes such as, "how do you use texting before or after a fight?" (Study B) were asked.

For both Study A and Study B, the second half of the interview elicited participants' feedback on CBT-based preventive text messages ("Tell me more about your thoughts on this [example text message]"), both by eliciting participants' own words and by providing a standardized set of example messages to the participants. In every interview, participants were asked to write their own messages, often prompted by: "What would you say to a friend?" or "What text would you like to receive?" during times of stress or negative mood. The packet of sample text-messages that was presented to participants during their semi-structured interviews was iteratively refined throughout each study. In Study B, we proposed ideas for messages that arose from Study A; for instance, in Study B we requested feedback from participants on daily query messages that asked them about their emotions (e.g., How are you feeling today? 1= really bad, 5=great). While several messages were originally created by the research team using CBT concepts, many messages in participants' own words were integrated into the proposed intervention throughout the course of each study. As we refined the messages, participants in the semi-structured interview were informed that the messages they were reading were written or edited by teens who also experience depressive symptoms and peer violence. In every interview, we explicitly asked participants for their honest feedback, revisions, and own additions.

Interview facilitators were either the principal investigator (MLR) or an RA, all of whom were extensively trained in qualitative interview methods. Interviews were conducted face-to-face in a private area or via telephone (only if face-to-face interviews could not be arranged logistically). All interviews were audio-recorded and transcribed verbatim. Interviews for Study A lasted up to 60 minutes, and participants were compensated \$20. Interviews for Study B lasted up to 90 minutes, and participants were compensated \$25. Participants in both studies were reimbursed up to \$10 for transportation costs.

Data Analysis

Thematic analysis⁴⁶ was used to create initial coding structures for both Study A and Study B. Deductive codes were developed from the topics and questions used to facilitate the interviews (e.g., participant understanding of message content), as well as from the major topics covered by CBT-based depression prevention interventions.^{47,48} CBT categories were defined using standard descriptions of CBT techniques,²⁷ then iteratively refined based on expert guidance from clinical psychologists (AS, KMG) to form the following categories:

Cognitive Awareness and Restructuring (e.g., identifying negative/automatic thoughts, problem solving); Behavioral Modifications (e.g., staying active with healthy activities, increasing the amount of structure in one's life); Recognizing and Regulating Emotions (e.g., naming emotions, using specific technique to calm oneself down); and Self-Efficacy (e.g., the belief in one's own ability to, in this case, handle challenges). After each interview, the coding structure was iteratively refined and inductive (data-driven) codes were created to capture any emerging themes generated by the adolescents' interviews. Any changes to the coding structure or other aspects of the investigators' analysis were tracked with an audit trail and summaries of the codes in the coding structure were written describing the range of data in each code.

Each interview transcript was read at least once before analysis. Major topics and sub-topics were coded on hard-copy transcripts by at least two investigators independently. The coded transcripts were then compared and discussed by the research team to ensure comprehensiveness and accuracy of coding. After codes were agreed upon, each code was entered into a qualitative software program, NVivo Version 10 (QSR International Pty Ltd., Doncaster, Victoria, Australia), which allowed the research team to organize, link, and analyze codes (and quantitative data) within electronic interview transcripts. Thematic saturation of the data was reached after twenty interviews in Study A and twenty-one interviews in Study B. To complete this manuscript, the data from both studies were queried and combined. Themes regarding CBT-based SMS content were then iteratively developed and refined based on group discussions by the research team, led by the first author (MT, a medical student) and principal investigator (MLR, an emergency physician). Descriptive statistics were analyzed using STATA 12 (StataCorp. Stata Statistical Software: Release 12. 2011).

RESULTS

Study demographics are described in Table 1. As described above, recruitment for study A was intentionally all female. Otherwise, demographics for the two studies mirror that of the ED from which patients were recruited.

Based on our team's analysis, five major themes regarding translation of CBT content into SMS were identified. (Quotes supporting these themes are provided in Table 2, as well as in the text below.)

Themes

Theme 1. Short, SMS-style messages in all CBT categories were comprehensible and relevant to at-risk adolescents—The majority of participants ($n_{\text{Study A}} = 18, 90\%$; $n_{\text{Study B}} = 16, 76\%$) described ways in which they already use SMS to communicate CBT-based concepts when either seeking or receiving emotional support from friends and family. They were particularly likely to describe already using SMS to communicate Recognizing and Regulating Emotions, and Self-Efficacy skills. They felt that SMS was an acceptable and accessible medium to communicate these concepts: “When you're talking...it's just so much harder to just get it all out. It's easier when you just text” (#11B, 16yo, F).

Participants both endorsed and spontaneously generated messages in *all* CBT categories. Specific examples of the endorsement of each major category (Cognitive Awareness and Restructuring; Behavioral Modifications; and Recognizing and Regulating Emotions; as well as Self-Efficacy) are provided in Table 2. Participants were *most* likely to endorse Recognizing and Regulating Emotions and Self-Efficacy during the structured feedback portion of the interview:

“...if we know that someone’s going through a rough time or something we’ll send them texts and be like, ‘Oh, you okay?’ (#6A, 17yo, F);

“just like let it out...like I write in my notes in my phone” (#10A, 14yo, F);

“I [text] her like, ‘you’re better than that,’ like ‘you have a future to go through,’ like ‘you could be somebody successful’” (#2A, 15yo, F)

These messages resonated with their existing use of SMS.

When participants were presented with messages providing new skills, such as naming their emotions and modifying negative thoughts, they expressed a willingness to use text-messaging to develop new ways of coping: “Cuz I don’t think of those things to do. I don’t...It doesn’t come to me. So it’s nice to have someone tell me” (#11A, 17yo, F).

Theme 2. Variables affecting preferred SMS content included high levels of peer violence, prior exposure to the mental health system, and comorbid conditions. Gender and age did not affect preferences for content

Theme 2A. High violence vs. low violence adolescents had different preferences for text-message content, particularly regarding Behavioral Modifications: Study A showed that higher violence participants (those with a CTS-2 score above the median score of study participants) preferred different SMS message content. All but one of the higher violence participants in Study A who reviewed messages focused on problem-solving to avoid fights expressed a particular dislike for these messages. They directly challenged these proposed content with comments such as: “but when you’re my age, fighting is the best way to get respect” (#17A, 16yo, F). Higher violence participants also disliked messages that suggested they “do something fun” as a form of behavioral activation or distress tolerance. They worried that messages of this nature could encourage risky behaviors (see Table 2). Based on this feedback, the researcher-provided messages were edited for Study B. In Study B, in which messages were more nuanced and specific (“Do fun stuff” in Study A vs. “Is there something fun and safe that you can do to feel better?” in Study B), we found few differences in preferences based on baseline violence.

Theme 2B. Participants with prior exposure to the mental health system particularly welcomed the idea of CBT-based SMS: Participants in both studies who had prior exposure to counseling were, not surprisingly, able to talk more clearly about their thought processes and general CBT concepts. Those who spontaneously mentioned previous exposure to the mental health system ($n_{\text{Study A}} = 12, 60\%$; $n_{\text{Study B}} = 9, 43\%$) felt that the intervention was worthwhile in different ways and would enhance their ability to apply these skills in their real life. One participant stated, “[my therapists], like they teach you like

coping strategies and stupid stuff that I have already heard before. It's boring" (#19A, 16yo, F). This same participant described our intervention as something that "would definitely help me out like a lot, and it could actually help me change and be a better person...It's not like you have to like go somewhere to get positive like a counselor. It's something that's like there, just a little side thing to help you" (#19A, 16yo, F). They also felt that the SMS reinforced concepts that they'd heard before: "now that I'm in [counseling], hearing about somethin' like that, it's like, damn, that could really help me through the day" (#17A, 16yo, F).

Participants with previous exposure to the mental health system also expressed ways in which the program could uniquely meet their in-the-moment needs and combat barriers to receiving care through traditional mental health delivery systems. They cited accessibility: "receiving a text is easier than talking, you know, more face to face the whole time" (#9B, 15yo, M); lack of judgment: "there's really no one judging me...I don't have to think about... what the other person's thinking" (#21B, 16yo, F); and comfort with the medium of communication: "It's helpful because...I can always look at a text" (#17B, 16yo, M).

Theme 2C. At-risk adolescents who describe other symptoms of mental illness, such as anxiety and PTSD, gravitated toward messages focused on Recognizing and Regulating Emotions: Half of participants in Study A spontaneously mentioned symptoms consistent with PTSD or anxiety disorders. In Study B, where PTSD symptoms were quantified in the screening survey using the Child PTSD Symptom Scale, 23.3% of participants indicated moderate symptoms of PTSD as indicated by a cutoff score of 11 or higher.⁴² Participants in both studies who experienced anxiety or PTSD symptoms tended to prefer messages focused on Recognizing and Regulating Emotions: "[it's] like positive things...like relief, basically" (#19A, 16yo, F). They also felt as though the messages reflected "something [they] like to do" (#9B, 15yo, M) to cope with difficult situations.

Theme 2D: Gender, age, and socioeconomic status did not affect preferences for SMS content: Not only did we find no difference in message preferences and comprehension by age, gender, and socioeconomic status but a few participants even expressed spontaneously that the proposed intervention "applies to all teens" (#2B, 14yo, M). They felt as though, "guys and girls, pretty much go through the same thing. Like, even though people or the media wanna make it different" (#21B, 16yo, F). In fact, in Study A where all participants were female, one participant specifically mentioned that she felt the intervention would also be applicable for adolescent males: "I just have one question...So sometimes guys need that help, that boost, too. So I was just wondering why you weren't doing it for guys as well" (11A, 17yo, F).

Theme 3: Recognizing and Regulating Emotions were overall extremely popular, but: (A) Participants needed reinforcement to be aware of their emotions and (B) Participants found mindfulness difficult to understand via SMS—Messages focused on Recognizing and Regulating Emotions were generally endorsed and were even described as "what I [they] would say" (#7A, 15yo, F).

Participants said that they wanted messages focused on naming and labeling emotions, because they felt as though they needed support and encouragement in this skill. Participants recognized the value in explicitly identifying the way they feel through a text-message program: "...when I'm feeling a type of way, I feel like when I write it, that it, like, helps" (#15A, 16yo, F). Some participants, however, were concerned that they "wouldn't always be able to answer those questions" (#20B, 14yo, F) when asked to identify their emotions via text. Indeed, a few participants explicitly noted, when asked "how would you describe this emotion?" that labeling their feelings was difficult: "I don't know" (#6B, 16yo, F; #18B, 17yo, F) or that "I don't have a name for it" (#9B, 15yo, M).

The one group of messages toward which participants expressed a strong dislike were those promoting regulation of emotions via mindfulness and deep-breathing techniques. Mindfulness messages may be difficult for some participants to understand via SMS: "But if someone doesn't know how to calm down, how—what are they gonna do?...the content isn't really saying a way to help you" (#9B, 15yo, M). Six of the participants who reviewed mindfulness messages felt as though "it's just not helpful" (#7B, 14yo, M) or expressed that these messages could exacerbate their problems: "The deep breath thing will make me breathe even heavier" (#13B, 15yo, M). Some participants felt as though these messages might make them less likely to take part in the intervention: "I don't like doing the deep breathing...it just make some mad and I don't- I don't know why" (#8A, 15yo, F).

Theme 4: SMS regarding Cognitive Awareness and Restructuring were more likely to be acceptable to at-risk teens if paired with Self-Efficacy content—

Teens were sometimes confused or frustrated by Cognitive Awareness and Restructuring messages. For instance, one teen stated in response to a message challenging automatic thoughts: "um, usually you are 100 percent sure that [your thought] is true; it's your thought. Maybe later you'll change it but in the moment it is true and that's the only thing you're going to think about" (#6A, 17yo, F). Messages that challenged negative thoughts directly (e.g., "what if it's not as bad as you think it is?") frequently elicited defensive statements from participants, such as "everything I see positively, I feel like it always ends in a bad way" (#12A, 13yo, F).

In contrast, study participants almost always gave positive feedback to messages which simultaneously promoted cognitive restructuring *and* self-efficacy (e.g., "you can change your thoughts"): "That is actually something really deep...if I was to receive that every time I got angry, I'd probably change my mood right away" (#13B, 15yo, M). Most participants preferred cognitive restructuring messages that focused on agency in the context of thinking positively (e.g., "What is one way you controlled your thoughts or actions today? Good for you!!"). Participants also frequently proposed their own content that incorporated both self-efficacy and cognitive modification: e.g., "Life can be tough, but you can push through anything" (#19B, 16yo, M).

Not only did self-efficacy content improve participants' understanding of cognitive modifications, but the reverse was also true. Cognitive restructuring was viewed as a means to bolster one's self-efficacy: "If you look at your life, even if it is bad, you could still try

and look at it in a good way...so that means that whatever's going on right now, you'll just—you'll get through it" (#13B, 15yo, M).

Theme 5: Teens offered many helpful edits to the content; their own language can be used in the development of a proposed intervention—Participants offered many valuable edits and additions to proposed content (see Table 2). For instance, one participant changed our text-message, “U r strong,” to “You are strong, and you can deal with ANYTHING! ☺” (#11A, 17yo, F). Participants suggested content or changes to the language in every CBT category. The incorporation of participant voices into the intervention content was thought to increase authenticity and acceptability. One participant even stated, “You guys already have teenagers- tell them to put the word out; [other teenagers] probably would listen more cuz they are teenagers themselves...” (#2A, 15yo, F).

DISCUSSION

This study presents findings from two qualitative studies of at-risk adolescents regarding comprehensibility and message content preferences of a preventive SMS-based intervention. Text message content based on the tenets of CBT was accessible, comprehensible, and endorsed, despite the short character limit and technical challenges to interactivity inherent in SMS. The proposed SMS intervention resonated with at-risk adolescents for its accessibility, perceived lack of judgment, and compatibility with their existing use of cell phones and texting for coping. While at-risk adolescents are difficult to reach via traditional mental health care delivery models,¹¹ SMS is a universally available, relatively low-cost, and eminently disseminable preventive strategy.⁴⁹ To create an effective SMS-based intervention incorporating CBT, our two studies highlight key strategies, which may inform other SMS-based preventive interventions for at-risk adolescents.

Although our themes suggest that CBT-based text messages are, overall, comprehensible and actionable, participants often requested further explanation of the more nuanced messaging and the less-familiar skills (e.g. naming emotions). For instance, deep breathing and mindfulness messages may require more context and explanation than an SMS-delivered intervention can provide. Though mindfulness is a popular strategy with acceptability among at-risk adolescent populations in preliminary research,^{50,51} it may be best for CBT-based SMS-interventions to lead with distress tolerance content that teens already know and understand. Likewise, because the proposed intervention was an automated SMS interaction rather than a two-way therapeutic relationship, it would be difficult to explore or counsel about “healthy” vs. “unhealthy” forms of behavioral modifications.

In light of these challenges, there are a few potential solutions for those designing SMS-delivered depression prevention interventions to consider. One option is to improve individualization and interactivity in SMS programs.⁵² As described in the Methods, Study B proposed a daily query that encouraged adolescents to identify and name their emotions (e.g., How are you feeling today? 1= really bad, 5=great). If SMS-interventions for depression prevention lead with an in-the-moment mood check, content may be tailored accordingly. This daily query also reinforces a basic CBT skill on a daily basis. Additionally, staged delivery of content could be helpful: for instance, more straightforward categories

(social support, problem-solving, self-efficacy) could be introduced earlier on in the intervention. Topics, such as mindfulness, that are more difficult to understand without prior exposure to the mental health system could be introduced into the intervention after laying the baseline scaffolding for these concepts.

Despite theories suggesting different coping mechanisms by gender⁵³ and differences in cognitive development between early and late adolescence,⁵⁴ we found that participants of all ages and genders equally comprehended the various CBT-based messages. Our qualitative data suggest that messages should be tailored on different variables, instead. For instance, participants without prior exposure to the mental health system were sometimes confused by the content of CBT categories that required higher-level reasoning, particularly Cognitive Restructuring, and responded better to content that included Self-Efficacy messages. Similarly, adolescents with different baseline risky behaviors may require different messaging. High-violence participants expressed an aversion to problem-solving messages focused on fight avoidance and were more apt to interpret behavioral modifications messages as promoting risky behaviors. Future depression prevention programs delivered via SMS should consider tailoring message content according to pre-existing behavioral risk factors, as these individual characteristics influenced preferences for CBT content in both studies.

Researchers in the field of depression prevention often voice concerns about safety and ethicality of delivering mental health content remotely via technology.^{55–57} Our findings may provide insight for future intervention developers to promote healthy behaviors and reduce the risk of harm. It seems important that the SMS-based intervention content avoid messaging, such as *non-specific* behavioral activation messages (e.g., “Do something fun to get your mind off it”) that may inadvertently trigger negative or harmful behaviors. This finding is consistent with a recent study showing that adolescents preferred *specific* messages to help them reach *achievable* health behavior change.⁵⁸ Because SMS-interventions are relatively limited in their interactivity, the lack of therapeutic interaction could pose a risk. Thus, it is important that intervention content reinforces skills with which they feel comfortable, in addition to introducing new *concrete*, skills.

Self-efficacy, a tenet of most accepted behavior change models,⁵⁹ was universally endorsed and increased acceptability of more abstract CBT-based content, including cognitive modifications. Previous research has elucidated adolescents’ endorsement of messages with a positive tone,³⁶ a characteristic of most self-efficacy messages. This may explain high levels of endorsement for this proposed content and underscores the importance of incorporating self-efficacy content into future interventions for at-risk teens.

Likewise, congruent with an existing study on preferred content of an SMS intervention for obese adolescents,⁶⁰ participants were enthusiastic about content derived from peers’ voices. In contrast to a traditional intervention development strategies, patient-centered design and patient-generated content improve intervention uptake.⁶¹ Thus, future SMS-delivered depression prevention interventions for adolescents should incorporate peer-driven content and emphasize it when framing the program. Additionally, our study findings highlight how depression prevention programs directed at unique target populations should engage in

formative research in early stages of intervention content design to incorporate participant voices.

Limitations and Directions for Future Research

Certain groups of at-risk adolescents were not eligible to consent to participate in the study due to state regulations: in particular, adolescents in police and state agency (e.g., foster care or group home) custody and those without a parent/guardian were systematically excluded. The absence of these viewpoints in our thematic analysis may limit generalizability of the study to all groups of adolescents. Of particular importance is the fact that low parental involvement is a risk factor for violence.⁶²

While this study elucidates acceptability and comprehensibility of CBT-based content delivered via SMS to at-risk adolescents, it is important to recognize that the results of this qualitative study may not be generalizable to other populations. Furthermore, a rigorous randomized-controlled trial should determine efficacy of the proposed intervention prior to widespread dissemination. Additional research is needed to real-world application safety, especially for teens with higher levels of peer violence exposure and depressive symptoms.

In addition to a need for a randomized controlled trial to determine intervention efficacy and safety, there is also a need for research regarding theories of behavior change when mobile devices are used as the primary tool or medium. Health behavior change models, such as the Transtheoretical Model,⁶³ have not been adapted to inform the development of mHealth interventions that have unique capacity to be interactive and adaptive in the content they deliver.⁶⁴ If conducted well, this needed theoretical research could be triangulated with formative research to inform intervention design, increasing the likelihood of intervention success. Future research should also explore how race, ethnicity, and culture may influence preferences for CBT-based prevention intervention.

CONCLUSION

Overall, CBT messages resonated with at-risk adolescents, but participants had distinct preferences for certain types of messages. Message preferences differed by level of past-year violence, exposure to the mental health system, and comorbid conditions. This study highlights the importance of valuing participant voices in intervention content development, especially given their familiarity and fluency with the delivery method and the potentially sensitive nature of depression-prevention content. Overall, the findings from the two studies demonstrate that CBT-informed content was able to be distilled into 160-character text messages without losing its essential character. Future studies should explore applications of SMS as a delivery model for CBT-content due to its demonstrated feasibility and potential. A randomized controlled trial (conducted by MLR) is currently underway to assess efficacy of the proposed intervention in reducing depressive symptoms and peer violent incidents.

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Table 1

Study Demographics

	Study A N (%)	Study B N (%)
Number of participants (N)	20	21
Gender: Female	20 (100%)	9 (43%)
Age [mean (Standard Deviation)]	15.4 (1.4)	15.3 (1.2)
Ethnicity: Hispanic	8 (40%)	9 (43%)
Race:		
American Indian/Alaska Native	0 (0%)	0 (0%)
Asian	0 (0%)	0 (0%)
Black	1 (5%)	2 (9.5%)
Multiracial	2 (10%)	3 (14%)
Native Hawaiian/Pacific Islander	1 (5%)	0 (0%)
Prefer not to answer OR Other *	5 (25%)	7 (33%)
White	11 (55%)	9 (43%)
Socio-economic status: Low (receiving public assistance or free/reduced lunch)	13 (65%)	14 (67%)
Current cellphone access: yes	17 (85%)	21 (100%)
Lives with either biological parent	19 (95%)	19 (90%)
Has a source of primary care	13 (65%)	19 (90%)
Conflict Tactics Scale- 2 Score		
Mean (Standard Deviation)	16.4 (21.2)	11.0 (9.5)
Patient Health Questionnaire (PHQ)		
Mean (Standard Deviation)	4 (0.9)	11.3 (6.5)

* When selecting their race(s), all of the participants in Study A who selected "Prefer not to answer" or "Other" and six of the seven participants in Study B who responded "Prefer not to answer" or "Other" also identified as "Hispanic."

Table 2
Participants' Quotes Regarding Applicability and Comprehensibility of Three Major CBT Concepts in SMS Format

Intervention Topic	A. Examples of messages that were liked	B. Illustrative quotes as to why participant LIKED messages	C. Example of messages that were disliked	D. Illustrative quotes as to why participant DISLIKED messages	E. Spontaneously Proposed Content for Intervention	F. Illustrations of how SMS is already employed in this context
1. Cognitive Restructuring: identifying negative/automatic thoughts, problem solving	<i>What else could u say? What else could u do?</i>	#19A, 16yo F: "I feel like it could like help me want to be more positive about the situation or the argument. And I feel like it would make my attitude positive and not just be—not just yell and say rude comments and stuff like that."	<i>Think of I bad thing that happened today. What might be a different way to deal with it next time?</i>	#13B, 15yo M: "The first thing that would pop into my head is something negative"	#19B, 16yo M: "Instead of focusing on the problem, focus on finding the solution"	#11A, 17yo F: "...Usually after a fight I will text a friend of mine... he always tries to find something positive in the fight. Like oh well, at least this didn't happen or...at least this certain part didn't go further, you know?...Cuz I have trouble with that sometimes. Or all the time."
2. Behavioral Modifications: staying active with healthy activities, increasing the amount of structure in one's life	<i>What helpful things can you do to get your mind off it for a little bit (sports, music, dancing, etc)?</i>	#8B, 14 yo F: "Well, sometimes, like, when you—you're into sports or dancing, it just makes you feel happy, like, dancin' to the music with friends."	<i>Do fun stuff</i>	#17A, 16yo F: "That's kinda, like, vague. Like, that could mean anything. That could mean I wanna smoke a blunt, this and that."	#9B, 15yo M: "Think of something positive to go do...And, if I get to go do that for a day, that would change my whole mood"	#13B, 15yo M: "I only got, uh, two pieces of advice through the, uh, text message which was breathe in and out and run a lap"
3. Recognizing and Regulating Emotions: naming emotions, using specific technique to calm oneself down	<i>Your feelings are a result of what you think.</i>	#14A, 14 yo F: "[I like that] because you'd be thinking of how you, how you think of the world, saying, alright, the world's good. You know, and how everything is. You could, part of the positive thing of the world. But then sometimes you think of the bad things I start to believe that wants to control you. You think of what's going on in your mind."	<i>Deep breathing exercise: Breathe in for 5 and out for 5.... Do this again and again until you've calmed down and can think straight.</i>	#13A, 17yo F: "taking deep breaths isn't my thing, I guess"	#10B, 16yo M: "What is it about this that makes me sad?"	#16B, 17yo M: "I need to talk to someone to get the tension away... [I text] just to talk...I just want to be able to relax."
4. Self Efficacy: the belief in one's own ability to handle challenges	<i>No one controls how u react!</i>	#13B, 15yo M: "They don't own you. There's nothing that they can do or say that controls how I'm gonna react."	<i>Your feelings are a result of what u THINK and what u DO. No one else can MAKE u feel a certain way.</i>	#13A, 17yo F: "you're in control and stuff, but it's not, like, directly saying it, so it wouldn't, like, capture my attention."	#16B, 17yo, M: "Everybody can take control of a situation no matter how big or how bad or how small it is"	#2A, 15yo F: "I [text] her like, you're better than that, like you have a future to go through, like you could be somebody successful"