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REMIT: Development of a mHealth theory-based intervention to decrease heavy episodic drinking among college students

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ABSTRACT
mHealth apps are an effective means of delivering health interventions, and the college-age population is particularly proficient at using apps. Informed by current theories of Ecological Momentary Interventions (EMI), Motivational Interviewing (MI), and the Transtheoretical Model (TTM) of Change, investigators have developed a self-monitoring app—Reductions through Ecological Momentary/Motivational Intervention/Transtheoretical (REMIT)—with the aim of reducing hazardous drinking among college students. The app was developed using the Integrate, Design, Assess, and Share (IDEAS) framework. This step-by-step process for developing digital behavior change interventions was conducted in five phases to: (1) understand the users, (2) determine target behavior, (3) base the intervention in behavioral theory, (4) create delivery strategies, and (5) develop the REMIT prototype. REMIT uses assessments (informed by EMI) and components of MI and TTM to guide administration of nine modules designed to engage users in reducing alcohol use and related problems. REMIT users self-monitor their alcohol consumption and develop strategies to change drinking behaviors using a range of easy-to-use features, such as the Virtual Coach, automated text messages, interactive gaming mechanisms (gamification), drink consumption tracking, and Blood Alcohol Concentration (BAC) calculators. mHealth interventions have been shown to reduce alcohol use among college students when they are applied in real-life, real-time contexts. REMIT is a theory-based app that incorporates user-friendly features to reduce hazardous drinking among college students. The next step is to conduct a pilot trial to test the efficacy of the app and enhance the REMIT prototype.

INTRODUCTION
More than $250 billion is spent each year in the United States to address excessive alcohol use. The burden to society has been significant. Individuals under the influence of alcohol suffer unintentional injuries, physical and sexual assaults, and death (CDC 2015). College students are at risk. More than 80% of college students say they consume alcohol, and more than 40% report binge drinking, defined as five or more drinks on one occasion for men, four or more for women (USDHHS 2015). This level of use is associated with substantial morbidity and mortality in this vulnerable population (Hingson et al. 2011; Azofeifa et al. 2015). A 2016 national survey of 33,512 college students found that of those who drank in the previous 12 months, 13% were physically injured, 32% did something that they later regretted, 28% had memory loss, and 22% engaged in unprotected sex (ACHA-NCHA II 2016).

Substantial research has led to interventions aimed at reducing risky drinking among college students (Berman et al. 2016). Brief Motivational Interventions (BMIs) are empirically supported peer programs for college students ages 18–24 who experience alcohol-related problems (Carey et al. 2007; Ray et al. 2014; Carey et al. 2016). BMIs often incorporate Motivational Interviewing (MI) (Miller, 1996) and involve one to two individual and face-to-face meetings with clinicians (each session is approximately 50 minutes). Despite the evidence supporting BMI’s success in facilitating change in alcohol consumption and associated problems among college students, many students continue to drink heavily and experience alcohol-related consequences. Furthermore, feasibility issues (e.g. staff training, face-to-face meetings with clinicians, and the costs of implementing and sustaining such an intervention) hinder widespread implementation (Cowell et al. 2012; Kazemi et al. 2014; Zarkin et al. 2015).

Could mobile technology deliver alcohol interventions in a more cost-effective and scalable manner? A systematic meta-analysis showed promising evidence that electronic screening and brief interventions (eSBIs) are effective in reducing alcohol consumption (Donoghue et al. 2014). Furthermore, recent reviews of technology-delivered...
adaptations of motivational interviewing (e.g. text, web-based) indicate preliminary and positive effects on health behaviors (Shingleton and Palea 2016) and substance use (Jiang et al. 2017). The growing demand for mobile apps highlights their potential to reach a large number of individuals and disseminate information (Cranee et al. 2015; Hall et al. 2015; Yasini and Marchand 2015; Quelly et al. 2016; Voth et al. 2016; White et al. 2016). Recent research highlights the popularity of mobile apps (Shrier et al. 2013) and the use of apps to deliver health information and interventions to college students (Patrick et al. 2008; Fjeldsoe et al. 2009), including alcohol abuse interventions (Shrier et al. 2014; Berman et al. 2016).

Most mobile health, or mHealth, interventions for college students are delivered via a smartphone app with a variety of features, including automated text messages, interactive gaming mechanisms (gamification), drink consumption tracking, and Blood Alcohol Concentration (BAC) calculators (Moore et al. 2013; Gajecki et al. 2014; Mason et al. 2014; Andersson 2015). To date, little research has tested interventions targeting risky drinking with mobile technologies and applications for college students (Witkiewitz et al. 2014; Berman et al. 2016). The few mobile-based apps for university students that have been tested in clinical trials have provided valuable information to users (Gajecki et al. 2014; Gajecki et al. 2013), but few of these apps have integrated evidence-based approaches from behavioral health change theories (Cranee et al. 2015; Berman et al. 2016). Thus, little is known regarding its efficacy in regards to alcohol intervention using evidence-based strategies or theoretical grounding (Cohn et al. 2011; Weaver et al. 2013).

This study seeks to fill this gap in the literature by detailing our efforts to develop the REMIT app, grounded in the essential, evidence- and theory-based components of BMIs that facilitate change in drinking behaviors. Guided by components of the IDEAS framework (Mummah et al. 2016), we created a smartphone app that delivers an intervention in real time to reduce risky drinking among college students.

**Methods**

Over the course of nine months, investigators from multiple disciplines developed the REMIT app (e.g. nursing, computer science, mathematics) along with experts in product design and graphics. Five of the most relevant phases of the IDEAS framework were used to guide the integration of theory in the REMIT design (Mummah et al. 2016): (1) understand the users, (2) determine target behavior, (3) intervention based in behavioral theory, (4) create delivery strategies, and (5) develop the REMIT prototype. Following a review of the literature, investigators conducted focus groups to gain insight into the purpose of the interventions and potential outcomes (phases 1 & 2). The next step was to ground the intervention in the BMI behavioral theory (phase 3). To develop creative implementation strategies and the prototype (phases 4 & 5), the team conducted brainstorming sessions to discuss the conceptual design and how to incorporate BMI technical and relational components.

**Phases 1 & 2. Understand the users to determine target behavior**

The investigators reviewed the literature and conducted four focus groups with college students ($n=26$) who reported engaging in risky drinking behavior and had completed an in-person intervention to address their heavy episodic drinking behaviors (see Kazemi et al. 2014; 2017). These groups focused on the role of heavy episodic drinking in the students’ lives and to determine their interest in interventions using mHealth technology. We also examined their views of the in-person intervention and thought on an alternative technology-based intervention app. Several themes emerged from these focus groups that later guided the development of REMIT features, such as automated text messages, interactive gaming mechanisms (gamification), drink consumption tracking, and BAC calculators. Insight gathered from the focus groups also helped investigators choose heavy episodic drinking as the behavior that the intervention would aim to modify (Kazemi et al. 2014). The focus group participants reported findings in phases 1 & 2 were consistent with two recent studies that examined engagement strategies for app users including feature and content preferences (Garnett et al. 2015; Milward et al. 2015). These studies found that desirable app features included self-monitoring tools, ease of use, goal setting, personalized feedback (PF), social support, and a plan to change drinking behaviors. Thus, the prototype was designed to change harmful drinking behaviors in at-risk students by motivating them to make a commitment to behavioral change.

**Phase 3. Intervention based on behavioral theory**

Ecological momentary interventions (EMIs), therapies provided to individuals during their daily lives in real time and real-world situations also informed development of the REMIT app (Heron and Smyth 2010). EMIs are often administered using mobile phones, personal digital assistants (PDAs), or handheld computers (see Heron and Smyth 2010, for a review), and have been well received by, and effective in, young adults (Cohn et al. 2011; Wray et al. 2014). Although ecological momentary assessment (EMA) is also used for real-time assessment of alcohol behaviors in real-life settings (Cohn et al. 2011; Wray et al. 2014), it is primarily intended to assess situational predictors of alcohol use and alcohol-related consequences with minimal impact on the behavior (Heron and Smyth 2010). In contrast, EMIs can combine the assessment of an EMA with the real-time delivery of the intervention to facilitate change.

Motivational Interviewing (MI) is an empirically supported, evidence-based approach to reducing alcohol use and problems among college students (Miller and Rollnick 2013). Often delivered in conjunction with PF, MI is a person-centered conversational-style intervention designed to strengthen motivation for change by using an individual’s natural language to explore his or her unique reasons for and against making a behavioral change. To integrate MI into the app, we reviewed the literature in search of components linked with alcohol use reductions. We used MI theory
to guide the clinical direction of the participants’ engagement with the app, as well as the specific language the app would use. Then, we used EMI and TTM (Prochaska and DiClemente 1984; Heron and Smyth 2010) theories to provide structure and content of the alcohol-related PF.

Regarding the clinical direction of the app, MI theory proposes four sequential and recursive processes that describe what occurs during motivational interviewing: engaging, focusing, evoking, and planning (Miller and Rollnick 2013). Engaging is an essential element of building trust and rapport. Focusing allows the individual to concentrate on a specific change (e.g., drinking behavior). Evoking involves eliciting reasons for change and reactions from the individual. Planning includes developing a strategic and concrete plan for success (Miller and Rollnick 2013). An important component of MI is giving individuals opportunities to react to feedback and to reflect on strategies that might be useful for their success (Miller et al. 2000). To promote individual self-reflection on alcohol use and foster commitment to use intrinsically relevant strategies for change, developers linked each component of REMIT to each of the four processes of MI.

The REMIT intervention approach also incorporates technical components of MI. Current MI theory (Miller and Rose 2009; Arkowitz et al. 2015) posits that post-session behavioral change is directly related to in-session client language, specifically referred to as change talk or language that is an argument for change (Miller and Rollnick 2013, p. 159). Therapists using MI-consistent (MICO) skills (also termed microskills) demonstrated the ability to evoke change language in college students (Apodaca and Longabaugh 2009; Apodaca et al. 2014; Borsari et al. 2015). This result was confirmed by three recent meta-analyses of MI sessions with other populations (Magill et al. 2014; Romano and Peters 2016; Magill et al. 2017). Thus, REMIT developers incorporated the evidence-based MICO language into the app. Table 1 provides a summary of REMIT components and their theoretical underpinnings.

TTM was incorporated into the app to provide a useful heuristic for the behavior change process (DiClemente et al. 2004). MI principles are compatible with the classical work of Prochaska and DiClemente (1984) Transtheoretical Model of change (TTM) and Roger’s (1951) client-centered critical conditions for change (Rogers 1959; Prochaska and Norcross 2010). To change behavior, TTM contends that individuals must move through five stages: Precontemplation (PC), Contemplation (C), Preparation (P), Action (A) and Maintenance (M). The model has been adapted to address heavy alcohol use in the college setting (Prochaska et al. 2004). Prochaska and colleagues’ study found that students in the precontemplation stage are unaware of the risk of drinking behaviors and unlikely to change. In the contemplation stage, students are aware of the pros and cons of alcohol use, but ambivalent about reducing or stopping consumption. Students in the action stage have been engaged in modifying hazardous drinking behaviors within the previous six months. Maintenance is a stage where students have sustained positive changes (Prochaska and DiClemente 1984; Prochaska et al. 2004). The TTM is also used to personalize text messages from the Virtual Coach to correspond with the participant’s current stage of change (Rollnick et al. 1992). Thus, language such as ‘Consider thinking about...’, ‘As you continue to think about...’ and ‘As you continue to...’ are used for participants in the pre-contemplation, contemplation, and action stages (see Table 2).

### Phases 4 & 5. Create delivery strategies & develop the prototype

The multidisciplinary team conducted iterative brainstorming sessions to identify creative ways to deliver BMI

<table>
<thead>
<tr>
<th>Table 1. REMIT theoretical components.</th>
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<tr>
<td>Feature</td>
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<tr>
<td>Introduction Video</td>
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<tr>
<td>Baseline assessment</td>
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<tr>
<td>Personalized Feedback</td>
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<tr>
<td>Response to Feedback</td>
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<td>Behavior tracking</td>
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<td>Virtual coaching</td>
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<tr>
<td>Static texts</td>
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<td>Dynamic texts</td>
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<tr>
<td>BAC Calculators</td>
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<tr>
<td>Educational games</td>
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<tr>
<td>Behavioral Strategies</td>
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<tr>
<td>Resources</td>
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</tbody>
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BAC: Blood Alcohol Concentration; MICO: Motivational Interviewing-Consistent.
components in real-time via REMIT (phases 4 & 5). BMIs cover a wide variety of topics (more than 30) ranging from quantity and frequency of alcohol use to personal genetic risk of alcoholism. We examined the research to determine how many topics to address in the different modules. First, Ray and colleagues (2014) found that more highly personalized topics (15–20 personal alcohol-related consequences) or fewer less-personalized topics (6–10 general risks of alcohol use) were related to reductions in alcohol use and related problems. However, these topics were delivered in individual or group BMI sessions often lasting 60 minutes or more. As REMIT users would access the app in briefer but more frequent instances, we felt that nine topics would be ideal. Second, we sought to include topics that would be of interest to the student. This decision was informed by research with high-risk college drinkers (heavy episodic drinking at least once a week) who rated 14 topics on relevance (personally relevant to me) and motivation (would motivate me to cut back on my drinking) (Miller and Leffingwell 2013). For example, if one of your strategies was to use a designated driver to get home after drinking, you might talk to a friend ahead of time about being your designated driver or make sure that you have the number of a taxi or other safe ride programed in your phone.

### Table 2. Example virtual coach language consistent with transtheoretical model stage of change.

<table>
<thead>
<tr>
<th>Module</th>
<th>Precontemplation</th>
<th>Contemplation</th>
<th>Action</th>
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<tbody>
<tr>
<td>Virtual Coach: ‘Do you think that you might drink tomorrow?’ Response: Yes</td>
<td>‘Thanks for sharing that information. In order to make smarter and safer choices around alcohol use if you choose to drink, planning ahead can be very important. If you do choose to drink tomorrow, you can consider using at least one of the harm reduction strategies that you’ve already selected and make plans to follow through. For example, if one of your strategies was to use a designated driver to get home after drinking, you might talk to a friend ahead of time about being your designated driver or make sure that you have the number of a taxi or other safe ride programed in your phone. Good luck and I’ll check back with you tomorrow to see how it went if you drank!’</td>
<td>‘Thanks for sharing that information. As you continue thinking about making safer choices about your drinking if you choose to drink, you can make plans to use two or more of the harm reduction strategies that you’ve already selected. So for example, if one of your strategies was to use a designated driver to get home after drinking, you could talk to a friend ahead of time about being your designated driver or make sure that you have the number of a taxi or other safe ride programed in your phone. Good luck and I’ll check back with you tomorrow to see how it went if you drank!’</td>
<td>‘Thanks for sharing that information. As you continue to take actions to help make safer choices around drinking, you can make definite plans to use all of the harm reduction strategies that you’ve already selected. So for example, if one of your strategies was to use a designated driver to get home after drinking, you could talk to a friend ahead of time about being your designated driver or make sure that you have the number of a taxi or other safe ride programed in your phone. Good luck and I’ll check back with you tomorrow to see how it went if you drank!’</td>
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REMIT modules

The research team designed the REMIT app to be delivered over the course of two weeks, consistent with the delivery of a two-session BMI. The modules are activated when they are downloaded to the participants’ smartphones. Users can then navigate the nine modules of the app with user-friendly directions.

#### Module 1. Introductory video

To facilitate navigation and engagement with REMIT, we developed an introductory video that provides directions and emphasizes personal choice and control. The video assures participants that they are the experts on themselves and that REMIT can help them gain a clear view of their drinking behaviors, needs, and goals. It also introduces and demonstrates the app’s various features.

#### Module 2. Assessment

**Baseline**

The baseline survey is the only module that users are required to complete. The data is used to develop a user profile and alcohol history in preparation to track use. Additional surveys require participants to complete a Daily Drinking Questionnaire (DDQ) (Collins et al. 1985), a brief questionnaire that takes about five minutes and measures quantity and frequency of consumption on peak occasions within the past month. The participant is also asked about his or her reasons for wanting/not wanting to reduce drinking, triggers and barriers to change, injunctive and descriptive norms, percentage of income spent on alcohol, and personal risk factors (e.g. genetic risk information, family history, tolerance, history of alcohol problems, social drinking motives).

#### Module 3. Virtual coach

The MI process is facilitated by establishing a trusting and respectful relationship with the individual (Miller and Rollnick 2013). Participants choose from a diverse selection of cartoon-like coaches: male and female gender expressions as well as a variety of physical attributes representative of various racial or ethnic identities. This Virtual Coach, whose communication is scripted to embody aspects of MI, guides participants through an exercise in which they explore the pros and cons of making a change in personal alcohol use vs. maintaining the status quo. This process promotes appropriate strategies to assist students in changing their drinking behaviors. The Virtual Coach, through daily text messages and alerts, encourages participants to develop personalized plans to change their drinking behaviors. For example, the Virtual Coach engages participants by asking them to
provide reasons for wanting (or not wanting) to reduce drinking, by facilitating goal setting, offering harm reduction strategies, and reminding students to complete their daily drink logs. The Virtual Coach emphasizes personal responsibility and choice and encourages reflection and action.

Module 4. Text messages

Alcohol use, motivation to change, and perceived behavioral control naturally fluctuate on a daily basis. Using EMI daily self-monitoring and real-time self-assessment of alcohol use has been linked to successful behavioral change (Cohn et al. 2011; Wray et al. 2014). The Virtual Coach provides static and dynamic text messages.

Static

Several daily messages do not directly ask participants to reply to questions or take any action. These texts were adapted from another trial that conducted focus groups with college student drinkers and created a library of more than 100 text messages (Bock et al. 2016). The messages include motivational quotes, myths, facts about drinking, and other ‘Did You Know?’ tips. These texts are consistent with the MICO microskill of giving information.

Dynamic

The dynamic text messages provided by the Virtual Coach are scripted and prompt the participant to provide information or complete a task. For example, such messages might ask about alcohol consumption the previous day. If the participant responds in the affirmative, the Virtual Coach encourages the participant to post the alcoholic beverages in his or her drink log. The app then engages in a ‘conversation’ with the participant to elicit information and facilitate thought about topics such as BAC (e.g. ‘Would you like to calculate your Blood Alcohol Concentration [BAC] from yesterday?’). The app might use the perceived effectiveness of harm-reduction strategies selected by the participant at baseline to frame additional questions for thought and reflection. For example, ‘When we first met, you identified some harm-reduction strategies that you thought might be helpful when you drink. Which of those strategies did you use when drinking yesterday?’ The Virtual Coach then asks if the participant would like to compare their pros and cons from the previous week. Asking permission is consistent with the MICO microskill of providing advice with permission. The respondent can answer ‘no’ and discontinue the conversation without consequence.

Module 5. Personalized feedback (PF)

Delivery

PF is based on assessment data provided by the students (Miller et al. 2013; Patrick et al. 2014). REMIT collects the data in surveys which are sent to students securely via the network. The surveys are then analyzed to compare drinking trends over multiple days. This information is stored in user profiles on a secured server. The PF is delivered to the students in text and graphics that help students understand their drinking patterns and allow them to compare their alcohol intake to typical students on campus. Data from the National College Health Assessment (ACHA-NCHA II) annual survey is used to provide normative personalized feedback to the students regarding their drinking behavior compared to the general university population. For example, a PF normative statement might be, ‘You typically drink alcohol on three days per month, which puts you in the 56th percentile. That means that you drink as much as or more frequently than 56% of university students.’ By comparing the participant’s data with data from the ACHA-NCHA II, the app provides normative strategies to the students on how to reduce their drinking (ACHA-NCHA II 2016; Davis et al. 2016).

Participant’s response to feedback from the virtual coach

As participants receive PF, REMIT prompts them to reflect on their behavior. Participants might be asked how they feel about the negative consequences of their drinking, their genetic risk, or what they think about the amount or frequency of their drinking. Other prompts encourage them to reflect on their readiness to change or how they feel when they see how their drinking compares to that of their peers. By eliciting emotional and cognitive reactions, the Virtual Coach prompts participants to use their language to begin identifying motivations for change. Consistent with MI, this increased change talk and evocation of personal reasons for change may increase the efficacy of REMIT for long-term behavioral change.

Behavior tracking

Participants complete daily drinking logs. Their logs provide the data, which is then analyzed on the server to provide personalized Virtual Coach text messages regarding their drinking. REMIT prompts participants to reflect on their drinking and respond with text messages to the Virtual.

Module 6. BAC calculators

Blood Alcohol Calculator (BAC) apps are commonly used among youth (Weaver et al. 2013), and college student drinkers consider BAC information relevant and motivating (Miller and Leffingwell 2013). Our app’s BAC calculator allows participants to track their drinking habits by recording the number and types of drinks consumed in a day. The BAC calculator enables them to identify alcohol concentrations and corresponding blood alcohol levels in alcoholic drinks. Based on the data entered, the calculator provides immediate results delivered via text message. The Virtual Coach gives the individual information regarding the degree of intoxication and offers them an opportunity to adjust their drinking.

Module 7. Gaming feature

Use of games in health and fitness apps has become immensely popular (Lister et al. 2014). Consistent with the TTM, students in precontemplation or contemplation stages
may benefit from more information to facilitate movement to the action stage (Prochaska et al. 2004). Therefore, we developed interactive educational games with rewards to encourage participants in changing drinking behaviors and preventing alcohol-related consequences. We developed a trivia game to deliver important concepts via responses to multiple-choice and true/false questions on the following topics: Alcohol & The Body, Drinking/Sobering Up Myths, BAC, Social/Physical Tolerance, Gender Differences, Alcohol & Pregnancy, and Healthy Behaviors Alternatives. Participants accumulate points, and high scores earn prizes. The trivia game is interactive with anonymous connections to other users (all are given fictitious names). This allows the users to play the trivia game in competition with each other. The more participants play, the more information they about the harmful effects of drinking.

### Module 8. Behavioral goals & strategies

In MI, the planning process occurs when the student is prepared to develop a specific plan for changing hazardous drinking behavior (Miller and Rollnick 2013). In REMIT, participants are offered the opportunity to create a specific action plan. They receive text messages that guide them in establishing realistic goals. They are given reasons for these goals and strategies to reduce hazardous drinking. Participants personalize these efforts by examining and identifying their strengths, coping skills, and potential barriers and facilitators to success. Participants receive a menu of empirically supported strategies that can limit risk (e.g., stay away from drinking in rounds or large groups), and they are encouraged to identify high-risk situations during which they can employ their selected strategies. Finally, participants establish signs/cues that the plan is working, and options to consider if it is not working. Table 3 provides examples of the Virtual Coach’s responses to a selection of behavioral goals and strategies.

### Module 9. Resource feature

The REMIT app provides a feature that identifies and provides immediate access to resources. An Uber search function provides phone numbers for taxis near the user’s geolocation. Alternative activities such as alcohol-free events offered on campus are promoted. The app provides a list of pleasurable nondrinking activities. This is also consistent with MI, as providing a menu of options is akin to the microskill of giving information, and the information is provided in a way that emphasizes personal autonomy and responsibility in selecting alternatives to drinking.

### Discussion

This study aimed to integrate theory and current research into a mHealth intervention. We created the REMIT app with automated mobile features to deliver BMI in real time to college students with heavy episodic drinking behaviors. REMIT merges a variety of interactive features that provide encouragement, advice, tips, and strategies to change drinking behaviors. The app components are designed to enhance motivation to change through assessment and feedback and provide real-time access to empirically supported strategies and techniques for managing high-risk situations. Also, the components offer immediate access to resources, provide a list of pleasurable nondrinking activities, monitor drinking, and provide personal feedback on drinking. The next step is to evaluate the REMIT intervention for efficacy and acceptability by conducting a pilot trial. We will compare REMIT with BMI delivered face to face. The data collected will be used to continue to enhance the REMIT prototype.

There are limitations for the use of mobile devices including concerns regarding privacy (Proudfoot 2013). However, young adults reporting sensitive behaviors using mobile devices have few concerns about their privacy or the confidentiality of their data (Sunner et al. 2013; Black et al. 2014). Ethical issues related to privacy protection arise with the use of social networking features. For example, using competitive gaming features may raise the potential for personal data breaches. It is also important to note the digital divide that currently exists between racial/ethnic groups, rural/urban residence, age, and income, all of which are limitations to mHealth apps (Hong and Jinmyoung 2017). Research has shown that individuals most likely to have mHealth apps are better educated, have health insurance, and are confident in their abilities to care for themselves. Individuals who are less likely to use mHealth apps are older or live in rural areas (Bhuyan et al. 2016). Another notable drawback to the mobile-based delivery of interventions is the lack of personal engagement with healthcare practitioners. However, empirical evidence supports the use of mobile-based interventions delivered as stand-alone interventions (Weitzel et al. 2007;

Despite these limitations, this study provides valuable information for health practitioners looking for alternatives to costly BMIs that require resources many institutions do not have (Cowell et al. 2012; Kazemi et al. 2014). College students are comfortable with the use of mobile apps, and thus may be responsive to REMIT’s daily self-monitoring and real-time assessment of alcohol use. REMIT EMI features PF with statistics and graphics and a BAC app that allows students to compare their drinking trends, as well as their drinking vs. that of their peers. Daily self-monitoring and real-time self-assessment of alcohol use promote positive behavioral change. The gaming feature delivered in real time offers knowledge and connections to other users, along with resources for additional support.mHealth app interventions can reach a large number of individuals. Consistent with the principles of open science that encourage collaboration and sharing of knowledge, data, and resources to produce valid and replicable findings, there are several promising avenues of research we hope to pursue and facilitate (González 2005). First and foremost, we plan to examine the efficacy of mobile technology as an alcohol intervention for college students who are exhibiting heavy episodic drinking. Following the IDEAS framework, we will conduct a pilot study to compare REMIT with face-to-face interventions delivered by counselors. We will use data collected during the pilot project to continue to enhance the REMIT prototype. The smartphone app approach also has potential in addressing other important health issues, such as risky sexual behavior, HIV risk reduction, smoking cessation, and obesity. There is a need for randomized longitudinal studies to test the efficacy of mHealth app interventions for use in combating all of these behaviors. Larger sample sizes and multiple sites would increase generalizability, and longitudinal studies would help researchers understand the long-term effects of the interventions. Also, further investigation is needed to evaluate the efficacy of the app’s features and delivery as a stand-alone tool or in combination with other alcohol-focused interventions.

**Conclusion**

Delivering BMI interventions in the traditional way from clinicians to patients is expensive and often not easily accessible. While effective at reducing alcohol use, BMI interventions are simply unavailable to a vast number of individuals that mobile-based interventions can reach (Milward et al. 2015). mHealth interventions have shown promise in reducing alcohol use among college students when they are applied in real-life, real-time contexts. Guided by the IDEAS framework, we provided details on the step-by-step integration of EMI, MI, and TTM into the development of REMIT, an app for college students with risky alcohol behaviors. App features are delivered as stand-alone components (e.g. text messages) or in combination (e.g. BAC, Games, text). This innovative modality represents a shift in the current BMI clinical implementation paradigm by combining a proven intervention with enhanced mHealth technology for delivery. Future research will ultimately determine the app’s efficacy at reducing risky drinking among college students.

**Disclosure statement**

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