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Developing a Theory Driven Text Messaging Intervention for Addiction Care with User Driven Content

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Abstract

The number of text messaging interventions designed to initiate and support behavioral health changes have been steadily increasing over the past five years. Messaging interventions can be tailored and adapted to an individual's needs in their natural environment--fostering just-in-time therapies and making them a logical intervention for addiction continuing care. This study assessed the acceptability of using text messaging for substance abuse continuing care and the intervention preferences of individuals in substance abuse treatment in order to develop an interactive mobile text messaging intervention. Fifty individuals enrolled in intensive outpatient substance abuse treatment completed an assessment battery relating to preferred logistics of mobile interventions, behavior change strategies, and types of messages they thought would be most helpful to them at different time points. Results indicated that 98% participants were potentially interested in using text messaging as a continuing care strategy. Participants wrote different types of messages that they perceived might be most helpful based on various hypothetical situations often encountered during the recovery process. While individuals tended to prefer benefit driven over consequence driven messages, differences in the perceived benefits of change among individuals predicted message preference. Implications for the development of mobile messaging interventions for the addictions are discussed.

Keywords

substance abuse treatment; mobile phone; text message; treatment development; behavior change

The mobile phone is considered by many to be the next frontier in health behavior change because it is a vehicle to deliver personal, intelligent and adaptive health information anywhere in realtime (Patrick, Griswold, Raab & Intille, 2008; Riley et al., 2011). There is a growing body of research on text messaging for a range of health and mental health problems such as diabetes, asthma, obesity and weight loss, tobacco dependence, bulimia, and even for increasing levels of daily functioning for those with schizophrenia (Cole-Lewis & Kershaw, 2010; Fjeldsoe, Marshall & Miller, 2009; Heron & Smyth, 2010; Krishna, Boren & Balas, 2009; Pijnenborg et al., 2010). This is due in part to text messaging or short message service (SMS) being the most accessible and common form of mobile communications. Over 95% of phones are SMS capable, and more text messages are being sent and received every day than mobile phone calls. In addition, while there is a large

discrepancy in home internet access between high and low income households and ethnicities, this is not the case with mobile phone use (Pew Internet & American Life Project, 2010), highlighting that SMS is a particularly useful intervention medium for disenfranchised population groups such as substance users (Fjeldsoe, Marshall & Miller, 2009; Heron & Symth, 2010).

Mobile interventions are particularly well suited for addictions continuing care because they can be utilized with individuals in their natural environment and adapt to their needs in real time using just-in-time therapies. Similar strategies have been used in the empirically supported phone based continuing care literature (e.g., Extended Case Monitoring, Assertive Continuing Care, Recovery Management Check-ups, Early Warning Signs Relapse Prevention and Concurrent Recovery Monitoring) which focus on minimal contact over longer periods of time, adapting to the current needs of individuals (McKay, 2009). Despite the promise of SMS interventions for addiction and the encouraging results from tobacco cessation studies (Free et al., 2011), there have been no published studies using SMS for addiction continuing care nor studies examining methods to develop effective mobile interventions.

More than other mediums of intervention development, our current behavioral theories may not adequately capture the capabilities of behavior change interventions using mobile phones across disorders. Riley and colleagues (2011) highlight that mobile technology's greatest strength is that it offers the opportunity to use dynamic interactive real-time therapies and that our current behavior change intervention theories, possibly aside from self-regulation theory (Carver & Scheier, 1998), need to be adjusted to account for real-time adaptations at the moment level. Numerous studies have revealed that individuals have very different needs at different times of the change process (Herd & Borland, 2009) and that a range of psychological processes have varying importance throughout the change process (Prochaska & Velicer, 1997; Rothman, Baldwin, & Hertel, 2004). SMS interventions for smoking cessation have integrated these important just-in-time therapies for participants by providing tailored messages based on participant characteristics and their quit date as well as just-in-time adaptations to care based on ones current level of functioning (e.g. Brendryen, Kraft, & Schaalma, 2010; Rodgers et al., 2005). Understanding these specific and critical events, as well as in the moment decision making, can shape future mobile interventions. With careful understanding, interventions can be individually tailored to each person's needs and specific circumstances.

More than most delivery mediums, mobile interventions are by nature multiple, repeated, brief interventions. Each brief contact can be considered a micro intervention to foster a positive cognitive, affective or behavioral reaction in the moment. Therefore, creative strategies should be used to further develop interventions that move the field toward using these new mediums. For example, SMS interventions can borrow from the large public health literature on tailored benefit driven (gain-framed) vs. consequence driven (loss-framed) messaging, as well as from the decisional balance literature to push specific types of tailored messaging. There is evidence that health messages that are congruent to underlying motivational orientation or personality style are more effective than those that are incongruent (Rimer & Kreuter, 2006; Noar, Benac & Harris, 2007; Williams-Piehota, Schneider, Pizarro, Mowad, & Salovey, 2004). Additionally, the foundational literature on matching change processes to readiness to change (Prochaska, DiClemente, Velicer, & Rossi, 1993) can be replicated through existing messaging interventions (Brendryen, Kraft, & Schaalma, 2010).

Despite the growing empirical support for mobile interventions targeting general behavioral changes, there is little information on the acceptability of text messaging systems for those

with substance abuse problems, particularly for those in addiction treatment. Because addiction carries such stigma, there is a need to understand the acceptability of mobile interventions among the individuals it might serve. This includes understanding: what types of messaging are most appropriate; when might messages be perceived as most helpful; what concerns exist regarding using drug related terms in the intervention content; how many individuals have unlimited messaging plans; and whether individuals are interested in real-time support and social networking as part of mobile interventions. When combined with the lack of research on developing empirically guided mobile content, there is a need to perform foundational research on mobile intervention development for addictive disorders. To help achieve this aim, we performed an exploratory study consisting of a one-time assessment to examine self-reported user acceptance of integrating an interactive SMS system into addiction care. In addition to inquiring about user preferences in relation to messaging logistics, the assessment included questions about the types of messages individuals may prefer receiving (consequence based vs. benefit based). Participants were also asked to generate their own messages in relation to different situations during the change process that they perceived would be most helpful for themselves. These user-generated messages were collected to help develop intervention text messages for specific situations (e.g. treatment entry vs. high craving/risk for relapse). Due to our interest in using messaging as a continuing care intervention for behavioral maintenance, the assessment battery was focused on acceptability, feasibility, and preferences related to messages that would be received in throughout the treatment process, from entry to aftercare. It is important to note that we did not send actual messages to participants but rather obtained this preliminary information through a one time self-report assessment to eventually develop a pilot continuing care intervention program. The study was approved by the Bronx Lebanon Hospital Institutional Review Board and funded through a grant from the National Institute on Drug Abuse (R43 DA029359-01A1; Muench).

Method

Participants

Participants included 50 individuals (41 men, 9 women), ranging in age from 26 to 64 years old ($M = 43.5$, $SD = 8.1$), who were enrolled in intensive outpatient substance abuse treatment at an inner city clinic. Potential participants were recruited through flyers placed in the treatment program and were instructed to contact their counselor if interested in the study. To be included, participants needed to be fluent in English, read at least at an 8th grade level, be drug free for 30 days and be referred by their primary counselor to participate. Participants were excluded if they were unable to comprehend the consent form quiz, or if their primary counselor reported the presence of a mental or psychiatric disorder that would inhibit completion of the assessment. Three participants were excluded due to language barriers.

Roughly half of the sample was African-American ($n = 27$, 54.0%), 40.0% were Hispanic ($n = 20$), 4.0% were Caucasian ($n = 2$), 2.0% were Asian ($n = 1$), and 2.0% were biracial ($n = 1$). The majority were unemployed ($n = 40$; 80.0%), 4% were employed full-time ($n = 2$), and 4.0% were either employed part-time or students ($n = 2$), and 12% ($n = 6$) individuals chose not to respond regarding employment status. Individuals were drug free for an average of 98 days ($SD = 104$) at the time of the study. Individuals reported that the substances which caused the greatest consequences in their lives were alcohol ($n = 32$; 64%), cocaine ($n = 30$; 60%) and heroin ($n = 18$, 32%).

Procedure

Participants who met eligibility criteria were given a copy of the consent form by their primary counselor prior to their attendance at one of four group meetings. Upon arrival at the meeting, the consent form was reviewed, and participants were further screened by the experimenter and given an overview of the 90 minute session. In the group setting, participants independently completed three, self-report questionnaires. Questions were related to mobile adoption, preferences for logistical integration of mobile interventions for continuing care, process variables, and preferences for which of two messages (gain framed vs. loss framed) they would rather receive. They were also asked to write messages they thought would be most helpful to receive during different periods of the change process. Then, as part of the larger treatment development study and not included in this manuscript, they participated in a structured focus group where they were presented with different types of experimenter generated messages and asked to discuss with the group which messages they thought would be most helpful and which ones would be least helpful to receive.

Assessment

Participants completed three separate questionnaires. The first questionnaire was specifically designed to inquire about the acceptability and feasibility of an interactive SMS system for addiction care. Domains covered in this questionnaire included: demographics, cell phone usage and features, acceptability and helpfulness of SMS for addiction care, and preferences for specific types of features within a system. The second questionnaire consisted of items intended to assess for specific participant characteristics covering a wide range of domains (e.g. demographics, treatment history, harm appraisals) that could guide text messages. These items were taken from a questionnaire specifically designed for a web-based assessment and adapted for the current study. For the current study, we focused only on the single item process variables including overall harm from substance use and benefits to being drug free derived from the Primary Appraisal of Harm Measure (PAM: Morgenstern, Labouvie, McCrady, Kahler, & Frey, 1997), self-efficacy and commitment/readiness derived from readiness rulers (Heather, Smailes, & Cassidy, 2008; Sobell and Sobell, 1995). The response format for each item was a 7-point Likert-type scale ranging from *not at all* (1) to *extremely* (7).

The third questionnaire focused on participants' preferences for certain types of messages. This questionnaire was comprised of two domains. The first domain consisted of six experimenter developed messages that were nearly identical in their wording, except for modifications designed to either highlight the benefits of changing or the consequences of not changing. We then asked participants to choose the message they preferred of the two similarly worded items. In the second domain, participants were asked to create messages (i.e., 160 characters or less) that they felt would be most helpful at four different time periods of recovery, including treatment entry, after 90 days being drug free, when an individual was at risk for relapse, and if an individual had relapsed.

In an attempt to classify the messages written by participants for each researcher-defined time period (e.g., at risk for relapse), we used the taxonomy of behavior change techniques developed by Abraham and Michie (2008) and the processes of change developed by Prochaska and DiClemente (1984; Prochaska, DiClemente, & Norcross, 1992). Because several of the techniques and processes, such as *prompt self-monitoring of behavior*, are inherent in text messaging (i.e., getting a relevant text message itself is a prompt, regardless of the content of the text) or were not relevant (e.g., *model the behavior* or *agree on behavioral contract*, both of which are described as physical actions), we only used a subset of strategies primarily taken from the processes of change. Messages written by participants for each of four situations (treatment entry, 90 days being drug free, at risk for relapse, and

actual relapse) were coded into 10 behavior change techniques including messages that fostered: helping relationships, self and environmental re-evaluation, motivation/self-liberation, spirituality, general encouragement/self-efficacy, cognitive reframing, behavioral counter-conditioning, consciousness raising, reinforcement management, and stimulus control. Helping relationships included anything that fostered social support whether from a group (e.g., get to a meeting) or an individual (e.g., call a friend now). During the coding process, we added another category called Alcoholics Anonymous “Pearl” due to the number of individuals writing messages using slogans such as “one day at a time” or “easy does it”. While these could be seen as a cognitive reframe, we decided to keep them as their own category to differentiate between these and other types of cognitive reframing.

Statistical Analyses

A dichotomous variable was created regarding a preference for messages concerning the benefits versus the consequences of treatment, based on a participant’s majority preference (i.e., at least 2/3 of benefit or consequence messages were selected). This was used to run univariate ANOVA among the five process variables, and all significant relationships were regressed on the dichotomous preference variable using logistic regression. For user generated messages, two researchers independently coded all text messages using the taxonomy described above. Each was given a definition and example of a message for each category. Agreement was dichotomous (yes/no). In cases where there was disagreement about the categorization of a message, the message was discussed and subsequently placed either in a category based on agreement between both coders or marked as uncoded and excluded from the analyses. Of the 317 messages provided by the participants, 8 (2.5%) messages were left uncoded and dropped due to either rater disagreement about the proper classification or because they did not make sense in the context of the assignment. The remaining 309 messages were coded by two reviewers, resulting in 89% agreement. Figure 1 presents the percentage of messages corresponding to each type of behavior change strategy by situation.

Results

Participant Characteristics and Feasibility of Text Messaging System

The majority of participants owned at least one phone in the past year ($n = 45$, 90.0%), with an average of 2.9 phones ($SD = 2.4$; Range: 0–15) in the past three years. About half of the participants had additional features on their phones, most notably, 62% ($n = 31$) could send an attachment in a text, 56% ($n = 28$) had access to the internet, 46% ($n = 23$) could download applications, 48% ($n = 24$) had a camera, 40% ($n = 20$) had audio recording, and 32% ($n = 16$) had video recording and playback. Roughly half of those who knew of their messaging plan had unlimited text messages ($n = 22$, 48.0%). Some individuals received an overwhelming number of text messages per week (e.g., 900). Therefore the top 5% of responses were excluded to provide a more representative mean. Excluding the top 5%, participants received a mean of 17.3 ($SD = 27.5$) texts in the past week.

Interest in Using the System

Almost all participants ($n = 49$, 98%) reported they would be interested in using an interactive text messaging system during and after treatment. Thirty-four percent ($n = 17$) of individuals thought the system would be most helpful at treatment entry, 22% ($n = 11$) during later stages of treatment and 44% ($n = 22$) following treatment. Almost two-thirds (62%) reported they would prefer receiving at least one message daily as compared to 14% who reported preferring weekly messages. When asked about whether they would use certain system features, 80% ($n = 40$) reported they would inform the system of a lapse to drug use, 84% ($n = 42$) would send a “help message” if they were in a high risk situation for

using drugs and looking for guidance, 78% ($n = 39$) would want their counselor alerted if at risk for relapse, and 96% ($n = 48$) would want a friend alerted in this situation. Sixty percent ($n = 30$) of individuals reported no concerns with the use of addictions terms (e.g., using, drugs) in SMS messages.

Message Preferences

Table 1 presents the results of the user messaging preferences comparing consequence driven vs. benefit driven messages. Individuals tended to prefer messages about the benefits of changing (64%) versus the consequences of not changing (34%). However, as noted in table 1, one message about imagining the benefits of changing versus the consequences of not changing was evenly endorsed. To understand whether process variables predicted message preferences, we compared scores on the four process rulers (*readiness for change, benefits of changing, harm of past use, and confidence to change*) for those who preferred benefit driven messages to those who preferred consequence driven messages using univariate ANOVA. Individuals who preferred benefit driven messages had significantly higher ratings for perceived benefits to being drug free, $F(1, 45) = 8.76, p < .05$, and readiness for change, $F(1, 45) = 4.84, p < .05$. There were no significant differences between groups on ratings of self-efficacy or harm from past use. Stepwise logistic regression revealed that the level of benefit from being drug free mediated the relationship between readiness for change and choosing benefit driven messages accounting for 12.5% of the variance, $R^2 = .125$, incremental $F(2, 44) = 4.28, p < .05$.

Only those strategies that had approximately a 5% endorsement for at least one situation were included in Figure 1. Those excluded were stimulus control and reinforcement management. Overall, Helping Relationships was most frequently endorsed at all time points with significant increases during risk for a lapse (30%) and following a lapse (53%). Motivational messages (self-liberation) followed an opposite trend, with higher values early in the change process and at the 90 day mark. As could be expected, general encouragement/efficacy messages spiked at the 90 day mark, reinforcing success; re-evaluation messages were written early in the change process and during risk for a lapse. AA pearls accounted for about 15% of messages for all periods aside from following a lapse (6.1%). Spirituality messages remained fairly constant across situations at just under 5%.

Discussion

The current exploratory study revealed that individuals in substance abuse treatment would be interested in receiving text messages that support their recovery and that the messages individuals believed would be most helpful to them differed depending on the point in the change process. While participants reported that benefit driven messages were perceived as more helpful than consequence driven messages, these preferences differed based on their ratings of their personal perceived benefits for change and readiness for change, suggesting that message tailoring to preferences and readiness for change can be a useful undertaking, a finding consistent with the computer based intervention literature.

The use of SMS in continued care appears feasible, as 90% of even the most disenfranchised individuals in substance abuse treatment had mobile phones and expressed willingness to use SMS as a continuing care intervention. While nearly all phones are SMS capable, making it a widely disseminated and far reaching medium for intervention, it is striking that nearly half of the sample had smart phones, an adoption rate that is higher than the general U.S. adoption rate at the time of the study (Nielsen, 2011). This highlights the possibility of expanding mobile web features, tracking applications, and adding audio and video messaging to mobile intervention development with disenfranchised populations. It was also notable that 78% of individuals wanted a counselor alerted and 96% would want a friend

alerted if they were at risk for relapse, validating current trends in increasing social networking and support through technology as an important component of behavior change interventions. Moreover, there was a high level of endorsement for using help and crisis messaging, a component that would be proactively initiated by the user. These results emphasize a need and role for both proactive and reactive pushing of intervention content.

It is worth mentioning that participants' desires may differ from clinicians' recommendations. In a separate survey (Muench & Weiss, 2011), we examined the preferences of 34 addiction treatment providers and found that while 87% would use a similar system as part of their care, providers were less likely to prefer the instant alert option, with only 8% wanting to be alerted to a possible relapse in the moment. However, 80% would be interested in some type of alert, with 31% opting for an email, and 40% desiring an alert the next working day. Interestingly, this former survey also revealed that only 11% of providers believed the system would be most beneficial after treatment compared to 44% of clients, stressing the importance of taking both provider and client perspectives into account when developing systems that extend the reach of care.

One concern that may inhibit effectiveness was that individuals had an average of 2.9 cell phones in the last year. A recent study revealed that service interruptions and length of time with the same phone number was the best predictor of outcome in an SMS intervention study of oral contraceptive use in a low income inner city sample of women (Castaño, Bynum, Andrés, Lara & Westhoff, 2012). These potential obstacles to continued and consistent phone service suggest the need for proactive techniques to improve engagement in messaging and other phone related mobile interventions, such as collateral phone numbers when client phones may be inactive. That only 60% of participants approved of using language that could potentially identify them as an individual in recovery suggests that mobile interventions need to take the privacy needs of individuals into account and that more research is needed in developing acceptable mobile interventions for those attempting to change addictive behaviors. For example, in our mobile intervention development study for problem drinkers, we are developing "mirrored" messages in which participants can choose a code word (e.g. coffee, soda) to replace the word alcohol in messages for confidentiality purposes. Overall, despite some barriers to effective integration, the user characteristics and preferences found in the current study indicate that mobile interventions for the addictions are very promising.

General preferences for benefit driven messages correspond to the general message tailoring literature. For example, a meta-analytic review of disease prevention messages found that gain-framed appeals, which emphasize the advantages of compliance with the communicator's recommendation, are slightly more persuasive than loss-framed appeals, which emphasize the disadvantages of noncompliance (O'Keefe & Jensen, 2006). In addition, individuals were drug free for over three months, which corresponds to the theory that benefit driven interventions may be more efficacious for individuals in maintenance stages (Rothman et al., 2004). However, higher scores on the benefits of being drug free were the uniquely associated with preferring benefit driven messages, emphasizing the need for tailored messaging programs based on decision support paradigms. These findings correspond to the health promotion literature on messaging that is congruent with motivational styles being more efficacious than incongruent messaging (e.g., Mann, Sherman, & Updegraff, 2004) and therefore suggests that there is a base from which to draw tailoring content for messaging interventions.

User generated content that related to researcher defined points during the treatment and recovery process revealed interesting information as to the strategies individuals in drug treatment think they may use. There were some logical patterns in the data, such as the

spikes in messages that fostered social support during times of crisis; messages that encouraged individuals to change early in the change process; messages that trigger self and other re-evaluation during transition or decision points (e.g., early in treatment and at risk for relapse); and messages that encourage self-efficacy when milestones are met (e.g., 90 days clean). We were surprised to find that some techniques associated with positive outcomes in the addiction treatment process literature, such as avoiding high risk situations were not written about more often across periods of recovery.

As noted earlier, each contact in a mobile intervention should be considered a stand-alone intervention that is a part of a larger whole. Messages should be designed to intervene with the user in their environment, in response to the particular time and place both physically and in their recovery using ecological momentary interventions. Self-regulation theory highlights that very different techniques may be more effective or used more depending on the level of arousal or at different time points (e.g., cognitive reappraisals for lower arousal and distraction for higher arousal) (Sheppes & Gross, 2010). Results of the current study stress that individuals know that reappraisal or re-evaluation and helping relationships are important when one might have high craving, but that once a lapse has taken place, social support is the crucial factor. Including user driven content has numerous advantages but has not been utilized often in the treatment development literature. Coding these messages based on empirically derived behavior change techniques can help determine the active ingredients and preferences of the individuals receiving these mobile interventions.

Overall, results highlight the promise of using mobile interventions for addiction care and underscore the need for empirically tested models for this new medium. Mobile applications for addictions are readily available in smart phone app stores, and while some are based on empirically sound intervention strategies, very few are using the available theoretical underpinnings of effective treatments (Cohn, Hunter-Reel, Hagman, & Mitchell, 2011). The mobile phone can enhance many techniques such as: relapse prevention, tailored individualized messaging, self-regulation in the moment, increasing salience of therapeutic cues and social support alerts—all of which have been theorized or known to be effective mechanisms of change. Moreover, the mobile phone allows for new theoretically based interventions which have been explored less in the addictions field, such as self-modeling interventions through user generated content (e.g. record me when I am motivated and play it back later) (Muench, Tryon, Travaglini & Morgenstern, 2006). Finally, more research is needed to understand both how user preferences will drive intervention development, as well as which types of messages are effective for which types of individuals.

This exploratory study had several limitations and results should be viewed as preliminary until further research is conducted. The intent of this study was to begin to establish a foundation of knowledge about the feasibility and acceptability of an SMS system for addiction continuing care and to begin to develop the content for a pilot intervention using such a system. Its aim was not to pilot test the efficacy of the system. The primary limitation is that this study did not examine the preferences of these messages in a real world setting where individuals could rate the benefits to measure preferences in certain situations. Future research should include sending the types of messages individuals find helpful in-vivo at various points during treatment, and/or to test different types of messages (e.g., self-written vs. gain-framed) and compare outcomes. While this study only examined preferences, it is still useful to understand what individuals in treatment prefer. Nonetheless, there may be a discrepancy between what is objectively most effective for patients and what is perceived as most effective by patients. However, even if this discrepancy exists, it is likely that once a patient returns to his or her home environment (or is allowed to leave a legally required treatment program), he or she will continue to engage in strategies *perceived* as effective. A second limitation is that our sample skewed male, and our population was a disenfranchised

inner-city treatment population potentially limiting the generalizability of these findings. Our sample was too small to examine gender differences or race/ethnicity differences, but such characteristics could have a profound impact on which messages are preferred by users. Future studies can improve on these limitations and test the real world efficacy of mobile interventions with substance abusing populations.

References

- Abraham C, Michie S. A taxonomy of behavior change techniques used in interventions. *Health Psychology*. 2008; 27:379–387. [PubMed: 18624603]
- Brendryen H, Kraft P, Schaalma H. Looking Inside the Black Box: Using Intervention Mapping to Describe the Development of the Automated Smoking Cessation Intervention ‘Happy Ending’. *Journal of Smoking Cessation*. 2010; 5(1):s29–s56.
- Carver, CS.; Scheier, MF. On the self-regulation of behavior. Cambridge, UK: Cambridge University Press; 1998.
- Castaño PM, Bynum JY, Andrés R, Lara M, Westhoff C. Effect of daily text messages on oral contraceptive continuation: A randomized controlled trial. *Obstetrics and Gynecology*. 2012; 119:14–20.
- Cohn AM, Hunter-Reel D, Hagman BT, Mitchell J. Promoting behavior change from alcohol use through mobile technology: The future of ecological momentary assessment. *Alcoholism: Clinical and Experimental Research*. 2011; 35(12):2209–2215.
- Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. *Epidemiologic Reviews*. 2010; 31(1):59–69.
- Fjeldsoe BS, Marshall AL, Miller YD. Behavior change interventions delivered by mobile telephone short-message service. *American Journal of Preventive Medicine*. 2009; 36:165–173. [PubMed: 19135907]
- Free C, Knight R, Robertson S, Whittaker R, Edwards P, Zhou W, Roberts I. Smoking cessation support delivered via mobile phone text messaging (txt2stop): A single-blind, randomized trial. *Lancet*. 2011; 378(9785):49–55. [PubMed: 21722952]
- Heather N, Smailes D, Cassidy P. Development of a readiness ruler for use with alcohol brief interventions. *Drug and Alcohol Dependence*. 2008; 98(3):235–240. [PubMed: 18639393]
- Herd N, Borland R. The natural history of quitting smoking: Findings from the International Tobacco Control (ITC) four country survey. *Addiction*. 2009; 104:2075–2087. [PubMed: 19922573]
- Heron KE, Smyth JM. Ecological momentary interventions: Incorporating mobile technology into psychosocial and health behaviour treatments. *British Journal of Health Psychology*. 2010; 15:1–39. [PubMed: 19646331]
- Heron KE, Smyth JM. Ecological momentary interventions: Incorporating mobile technology into psychosocial and health behaviour treatments. *British Journal of Health Psychology*. 2010; 15:1–39. [PubMed: 19646331]
- Krishna S, Boren SA, Balas EA. Healthcare via cell phones: A systematic review. *Telemedicine Journal and e-Health*. 2009; 15:231–240. [PubMed: 19382860]
- Mann T, Sherman D, Updegraff J. Dispositional motivations and message framing: A test of the congruency hypothesis in college students. *Health Psychology*. 2009; 23:330–334. [PubMed: 15099176]
- McKay JR. Continuing care research: What we've learned and where we're going. *Journal of Substance Abuse Treatment*. 2009; 36:131–145. [PubMed: 19161894]
- Muench, F.; Weiss, R. Integrating Interactive SMS into Addiction Continuing Care; A symposium at the American Psychological Association 119th Annual Convention; Washington DC. 2011.
- Nielsen. 2011. http://blog.nielsen.com/nielsenwire/online_mobile/generation-app-62-of-mobile-users-25-34-own-smartphones/
- Noar SM, Benac C, Harris M. Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychological Bulletin*. 2007; 113:673–693. [PubMed: 17592961]
- O’Keefe, DJ.; Jensen, JD. The advantages of compliance or the disadvantages of non-compliance? A meta-analytic review of the relative persuasive effectiveness of gain-framed and loss-framed

- messages. In: Beck, CS., editor. Communication yearbook. Vol. 30. Mahwah, NJ: Erlbaum; 2006. p. 1-43.
- Patrick K, Griswold WG, Raab F, Intille SS. Health and the mobile phone. *American Journal of Preventative Medicine*. 2008; 35(2):177-181.
- Pew Internet & American Life Project. 2010. http://www.pewInternet.org/~media/Files/Reports/2010/PIP_Mobile_Access_2010.pdf
- Pijnenborg GH, Withaar FK, Brouwer WH, Timmerman ME, van den Bosch RJ, Evans JJ. The efficacy of SMS text messages to compensate for the effect of cognitive impairments in schizophrenia. *The British Journal of Clinical Psychology*. 2010; 49:259-274. [PubMed: 19735607]
- Prochaska, JO.; DiClemente, CC. The transtheoretical approach: Crossing the traditional boundaries of therapy. Malabar, FL: Krieger; 1984.
- Prochaska JO, DiClemente CC, Norcross JC. In search of how people change: Applications to addictive behaviors. *American Psychologist*. 1992; 47:1102-1114. [PubMed: 1329589]
- Prochaska JO, DiClemente CC, Velicer WF, Rossi JS. Standardized, individualized interactive, and personalized self-help programs for smoking cessation. *Health Psychology*. 1993; 12:399-405. [PubMed: 8223364]
- Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *American Journal of Health Promotion*. 1997; 12(1):38-48. [PubMed: 10170434]
- Riley WT, Rivera DE, Atienza AA, Nilsen W, Allison SM, Mermelstein R. Health behavior models in the age of mobile interventions: are our theories up to the task? *Translational Behavioral Medicine*. 2011; 1(1):53-71. [PubMed: 21796270]
- Rimer B, Kreuter M. Advancing tailored health communication: A persuasion and message effects perspective. *Journal of Communication*. 2006; 56:S184-S201.
- Rodgers A, Corbett T, Bramley D, Riddell T, Wills M, Lin R, Jones M. Do u smoke after txt? Results of a randomized trial of smoking cessation using mobile phone text messaging. *Tobacco Control*. 2005; 14:255-261. [PubMed: 16046689]
- Rothman, AJ.; Baldwin, AS.; Hertel, AW. Self-regulation and behavior change. In: Baumeister, RF.; Vohs, KD., editors. *Handbook of self-regulation: Research, theory, and applications*. New York: Guilford; 2004. p. 130-148.
- Sheppes G, Gross JJ. Is timing everything? Temporal considerations in emotion regulation. *Personality and Social Psychology Review*. 2010; 5(4):319-331.
- Sobell, LC.; Sobell, MB. Alcohol consumption measures. In: Allen, JP.; Columbus, M., editors. *Assessing alcohol problems: A guide for clinicians and researchers*. Treatment handbook series 4. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism; 1995. p. 55-73.
- Williams-Piehot P, Schneider TR, Pizarro J, Mowad L, Salovey P. Matching health messages to locus of control beliefs for promoting mammography utilization. *Psychology and Health*. 2004; 19:407-423.

Figure 1.
Preferred behavior change strategy based on stage of treatment

Table 1

Preference for benefit versus consequence focused messages

Benefit Focused Message	% Preferred	Consequence Focused Message	% Preferred
Close your eyes – imagine the benefits of staying clean.	52	Close your eyes - imagine the consequences if you keep using.	48
Think of all you can achieve being drug free.	77	Think of all you have lost from using.	23
Being drug free will offer you a new lease on life.	63	Being drug free will stop the cycle of consequences from using.	37
Overall Benefit Messages	64	Overall Consequence Messages	34