Live counselor contact in a Facebook intervention predicts smoking cessation outcomes

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Abstract

Digital smoking cessation interventions frequently use automated delivery of content. Integrating a counselor may improve participant engagement and facilitate health behavior change.

We investigated engagement with live counseling compared to automated content in a Facebook intervention, and the impact of engagement on smoking cessation outcomes.

The Tobacco Status Project (TSP) is a 90-day smoking cessation intervention for young adults utilizing automated posts and weekly sessions with a live counselor in Facebook groups tailored to readiness to quit (pre-contemplation, contemplation, preparation). Data came from the treatment group of a randomized trial. Post-level analyses investigated participant engagement (number of comments) by post type (e.g., counselor posts or automated posts based on Transtheoretical Model of behavior change, clinical practice guidelines, motivational interviewing), stratified by readiness to quit. Participant-level analyses examined whether extent of participant engagement with counselor posts predicted abstinence at 3 months.

We analyzed data of N=251 participants and N=2,941 posts, 11% of which were live-counselor initiated, and together generated 8,403 comments. Post-level analyses found that compared to the most engaging automated content (motivational content for pre-contemplation and contemplation, informational content for preparation), live counseling generated more engagement among participants in preparation, similar engagement in pre-contemplation, and less engagement in

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contemplation. Extent of live counseling participation predicted 3-month verified abstinence (adjusted Odds Ratio=1.10 [95% CI 1.02, 1.20]).

In digital interventions, counselor contact may be beneficial in addition to automated posts at yielding engagement and abstinence; however, participants engage differently with counseling according to readiness to quit.

Keywords

smoking cessation; intervention; Facebook; digital health; young adults

Introduction

Young adults have high smoking rates (Kasza et al., 2017) and low utilization of existing treatment options (Thrul & Ramo, 2017; Watkins, Thrul, Max, & Ling, 2018). Novel evidence-based smoking cessation interventions catering to young adult smokers are needed. Since young adults use social media at high rates (Villanti et al., 2017) and almost all young adults have a Facebook account (Pew Research Center, 2018), Facebook may be a viable platform to deliver smoking cessation interventions in this population (Ramo, Thrul, Chavez, Delucchi, & Prochaska, 2015; Ramo et al., 2018). Yet, more evidence is needed on how to best engage young adults in social media delivered health behavior change interventions and whether or not live counseling intervention components are needed to maximize engagement.

Previous research has shown the potential of using digital interventions for smoking cessation and there is evidence for different platforms including web-based interventions (Graham et al., 2016), text messages (Scott-Sheldon et al., 2016), smartphone apps (Vilardaga, Casellas-Pujol, McClernon, & Garrison, 2019), and social media (Naslund et al., 2017; Thrul, Tormohlen, & Meacham, 2019). Engagement is critical to the success of a behavior change intervention, especially for interventions delivered digitally that are as easy to leave as they are to adopt, and evaluations show high attrition among participants (Eysenbach, 2005). Recent literature demonstrated that high engagement with online and social media health behavior change interventions is associated with beneficial behavior change outcomes (Hales, Davidson, & Turner-McGrievy, 2014; Turner-McGrievy & Tate, 2013). Similar results have been found among digital smoking cessation interventions (Klatt et al., 2008; Pechmann, Pan, Delucchi, Lakon, & Prochaska, 2015; Schwarzer & Satow, 2012; Strecher et al., 2008). For example, participants who were more engaged in a web-based smoking cessation community by posting comments, answers, messages, and using the chat rooms reported more smoke free days than those who did not engage as much (Schwarzer & Satow, 2012). With regards to intervention message design, posts that are personalized, have highly tailored content (Strecher et al., 2008), or solicit feedback (Hales et al., 2014) have been shown to generate higher engagement. However, a majority of the studies measuring engagement reported a decrease in engagement over time as the interventions progressed (Glasgow et al., 2007; Turner-McGrievy & Tate, 2013). Intervention approaches to maintain long-term participant engagement in digital health behavior change interventions are needed.

Face-to-face counselor support has been the traditional form of behavioral smoking cessation therapy. Online and social media interventions are able to reach more individuals because they are not constrained by the same financial, time, and space constraints as face-to-face counseling. For example, a recent randomized trial of a fully automated Twitter smoking cessation intervention combined with nicotine patches achieved 40% self-reported sustained abstinence at 60-days post quit date, compared to 20% abstinence in the control group (Pechmann, Delucchi, Lakon, & Prochaska, 2017). This study also reported an association between participant engagement (Tweet volume) and abstinence in the intervention group. These data demonstrate that fully automated interventions on social media can be efficacious for smoking cessation.

However, according to the Supportive Accountability model, providing human support can improve participant adherence to online interventions through participant accountability to a trustworthy and benevolent coach with expertise (Mohr, Cuijpers, & Lehman, 2011), suggesting it may be important to integrate contact with a counselor into social media interventions. Online health behavior change counseling can reduce stigma, provides ease of access to patients, and can successfully develop and leverage a therapeutic relationship between patient and provider. However, depending on the technology used, a potential time-delay in conversations and the loss of visual or verbal cues can be potential challenges (Richards & Viganó, 2013). Recent studies suggested that the unique contribution of online counselors that go beyond automated content includes increased social support, participants' accountability, and the potential for tailored feedback (Santarossa, Kane, Senn, & Woodruff, 2018). Moreover, individuals may prefer supportive messages from a human peer over those sent by a bot (Morris, Kouddous, Kshirsagar, & Schueller, 2018). Indeed, previous online interventions targeting weight loss and reductions in cannabis use were more efficacious when a counselor component was integrated (Gold, Burke, Pintauro, & Buzzell, 2007; Schaub et al., 2015), and human email counseling resulted in better weight loss outcomes over 6-month follow-up compared to automated computer-tailored emails (Tate, Jackvony, & Wing, 2006). Similarly, an online intervention to reduce problematic alcohol use that included seven synchronous text-based chat-therapy sessions resulted in better alcohol use outcomes among problem drinkers compared to a solely online self-help control intervention (Blankers, Koeter, & Schippers, 2011). In line with these findings, a recent randomized trial investigating a text-message delivered smoking cessation intervention reported improved participant outcomes when messaging was provided by peer mentors compared to automated messages (White et al., 2019). Overall, integrating interaction with a human counselor into a behavior change intervention may have the potential to improve social media intervention engagement and facilitate health behavior change.

In previous studies we have investigated engagement with automated Facebook posts for feasibility of a smoking cessation intervention (Thrul, Klein, & Ramo, 2015). The most successful automated post content identified in this previous research varied by participant baseline readiness to quit "Decisional Balance & Motivational Interviewing (MI)" (i.e. pros and cons of behavior and behavior change) were most engaging for pre-contemplation and contemplation stages and "Consciousness Raising" (i.e. learning new facts, ideas, and tips that support the behavior change) for the preparation stage (Thrul et al., 2015). We have also established promising quit rates of the Tobacco Status Project (TSP) intervention (Ramo,

Thrul, Chavez, et al., 2015) and demonstrated short-term intervention efficacy to increase biochemically verified abstinence in a randomized controlled trial (Ramo et al., 2018). However, how to best engage participants in social media smoking cessation intervention is still an open question in the scientific literature, especially when the intervention may consist of both automated and live counselor delivered content.

In the current study, we investigated how well participants engaged with live counseling sessions compared to automated content in a Facebook intervention and if engaging in live sessions predicted smoking abstinence.

Methods

Procedure

Participants were recruited from October 2014 to July 2015, primarily from Facebook, based on an advertisement campaign developed and used previously by the team (Ramo, Thrul, Delucchi, et al., 2015). Inclusion criteria were English-literate young adults, aged 18–25 years, who reported smoking 100 cigarettes life-time, and at the time of recruitment reported smoking, on average, at least one cigarette per day on 3 or more days of the week. Intention to quit smoking was not required for trial enrollment. The intervention condition was tailored to readiness to quit smoking. Additional inclusion criteria were regular Facebook use (4 days per week) and access to a digital camera (e.g. on a phone or computer) to send a picture as part of the biochemical validation procedure (see 'Outcome measures' below). Individuals who had participated in the TSP feasibility study were excluded (Ramo, Thrul, Chavez, et al., 2015). In total, 500 participants completed a baseline assessment and were randomized to a study condition. Following baseline completion, the participants were randomized to the TSP Facebook intervention (n = 251) or control (n = 249) 1:1 using a blocked random assignment sequence (Ramo, Thrul, Delucchi, et al., 2015). Randomization was stratified by daily smoking status (yes/no) and Transtheoretical Model readiness to quit smoking (pre-contemplation, contemplation, and preparation) (DiClemente et al., 1991; Prochaska & DiClemente, 1983).

Within the TSP intervention condition, participants were placed in a Facebook group tailored to their baseline readiness to quit (pre-contemplation, contemplation, preparation). TSP groups began on a rolling basis starting when the first participant had been waiting no longer than 2 weeks; thus, group size varied from 3 to 18 participants, with an average 8.6 participants per group (Ramo, Thrul, Delucchi, et al., 2015). Twenty-nine private ("secret") Facebook groups were created (9 pre-contemplation, 11 contemplation, and 9 preparation). Groups were open for the duration of the trial (12 months), although content was posted daily by the study team only for the first 3 months. Immediately after randomization, participants in both conditions were referred by e-mail to the Smokefree.gov website and encouraged to use it actively for the duration of the trial. We had no access to participant engagement data with Smokefree.gov. Assessments were conducted online at baseline and 3-month follow-up. Participants received gift cards in the amount of $20 per assessment. Upon completion of the intervention, data from secret groups were extracted from Facebook through the Facebook application programming interface (API) for analysis. All study

procedures were approved by the University of California San Francisco Institutional Review Board.

Tobacco Status Project Intervention

All participants were invited to a Facebook group tailored to their readiness to quit: Pre-contemplation: "Not Ready to Quit"; Contemplation: "Thinking about Quitting"; or Preparation: "Getting Ready to Quit." Participants received one daily Facebook post for 90 days tailored to readiness to quit. Posts were created by research staff and adapted from U.S. Clinical Practice Guidelines (Fiore et al., 2008) and Transtheoretical Model (TTM) skills for smoking cessation (Pro-Change Behavior Systems, 2009). Within each stage of readiness to quit, TTM content included posts related to Decisional Balance or the 10 processes of change, according to TTM theory. For example, posts focusing on Decisional Balance were used in groups of all 3 stages of readiness to quit smoking, but focused more on eliciting the pros of change in precontemplation, and eliciting both pros and cons of change and reducing cons in contemplation and preparation groups, according to TTM theory. Table 1 gives an overview of the TTM components used in the different stages of readiness to quit. Posts had a mix of imagery and text. Sample posts can be found in the Appendix.

The intervention also incorporated weekly "The Dr. Is In" live sessions with a PhD level smoking cessation counselor within the secret Facebook groups. The counselor scheduled each live session multiple days in advance by creating a Facebook event and inviting all group members. Each session lasted one hour, during which the counselor posted some limited content as a discussion prompt and participants could respond or ask questions and receive support using Facebook commenting features on the counselor's post. Participants could also comment on these live posts after the one-hour session was over, but the counselor only responded to participant comments during the scheduled session. Content for sessions was initially based on Motivational Interviewing, and cognitive behavioral coping skills for smoking cessation were discussed as participants were ready to make a quit attempt. The initial counselor post was pre-developed by our group and the rest of the counseling session was non-scripted to allow the conversation to develop organically, but with an MI orientation (e.g., reflective statements, open-ended follow up questions, etc.). Most content for these counseling sessions was identical across groups, although some content was tailored according to readiness to quit of participants. The same counselor delivered live sessions for the entire trial and posted from the same Facebook account.

Measures

Engagement with automated and live counselor posts—Engagement was operationalized as the number of participant comments a Facebook post received (regardless of the number of individual participants commenting). We decided on comments as primary engagement outcome, because participants were instructed to comment on automated study posts every day and responding to post prompts in their own words was part of the intended mechanism of behavior change in this intervention. This choice of outcome is consistent with previous studies our group conducted (Thrul et al., 2015) and based on existing literature, which considers Facebook comments a higher level of engagement than likes (Neiger, Thackeray, Burton, Giraud-Carrier, & Fagen, 2013). Moreover, we argue that

compared to likes, commenting on intervention content creates a greater depth of processing of content, as participants have to formulate a response in their own words, and a higher level of participant accountability, in line with the Supportive Accountability model (Mohr et al., 2011).

Smoking cessation outcome—The smoking cessation outcome was biochemically-verified 7-day point prevalence abstinence at 3 months, in line with recommendations by the Society for Research on Nicotine and Tobacco Workgroup on abstinence measures (Hughes et al., 2003). Participants reporting "no smoking, not even a puff" in the past 7 days were coded as reporting abstinence from cigarettes and mailed a NicAlert saliva cotinine test strip with previously establish diagnostic accuracy (Cooke et al., 2008) and asked to record two pictures: one giving a saliva sample and another of the test result. Participants with a salivary cotinine level <11 ng/ml (Jarvis, Tunstall-Pedoe, Feyerabend, Vesey, & Saloojee, 1987) were considered confirmed nonsmokers. In analyses, those who reported abstinence from all tobacco other than an e-cigarette to quit smoking and returned saliva cotinine results showing a cotinine range between 11–30 ng/ml were treated as abstinent nonsmokers (Ramo et al., 2018). There were no significant differences in participant characteristics between those who did and did not complete biochemical verification procedures among those who reported abstinence (Thrul, Meacham, & Ramo, 2018).

Participant baseline characteristics and smoking behavior—At baseline, demographic information included age, gender, race/ethnicity, education, and household income. We also assessed average number of days smoking per week (from which we computed percent smoking 7 days per week as "daily"), number of cigarettes per day, and presence of past year quit attempt (yes/no) (Hall et al., 2006). Time to first cigarette upon waking (<30 min or >30 min) was used as a measure of dependence (Baker et al., 2007). The Tobacco Smoking Stages of Change Questionnaire (Prochaska & DiClemente, 1983) assessed readiness to quit at baseline, categorizing smokers into one of the stages of change.

Post content and features—Posts were classified as live counseling or, if automated content, according to one of 11 TTM and Decisional Balance & Motivational Interviewing (MI) concepts (see Table 1). Additional features of Facebook posts included group membership (one of 29 Facebook groups) and day of the ongoing intervention each post was uploaded onto Facebook (days 1–90).

Statistical analyses—Post-level analyses: Predictors of extent of engagement (i.e. number of comments) were investigated using multilevel Poisson regression analyses (posts nested within groups), stratified by readiness to quit. The main comparison was engagement with live counselor session posts vs. the most successful automated post type identified in previous research: Decisional Balance & MI for pre-contemplation and contemplation stages of readiness to quit and Consciousness Raising for the preparation stage (Thrul et al., 2015). These reference post types were chosen rather than posts with the most descriptive comments given that post type order was not randomized and content posted earlier in the intervention tended to receive more comments. We controlled for group number (1–29) to account for between group differences, as well as for number of days in the ongoing

intervention (1–90) to account for timing of automated posts and weekly live counseling sessions.

Participant-level analyses: Logistic regression analyses examined whether extent of counselor contact (number of comments on counselor posts) predicted saliva cotinine verified abstinence at 3 months (yes/no), controlling for number of cigarettes per day, readiness to quit, and extent of engagement with automated content (i.e. number of comments on automated TSP posts).

Results

Sample description

Participants were 20.9 years old on average (SD=2.0); the majority were female (55%) Non-Hispanic White (77%) with some college education, a college degree, or higher (54%); and came from all four major U.S. regions (South: 36.4%; Midwest: 28.4%; Northeast: 11.6%; West: 23.6%). They smoked on average 10.8 (SD=6.3) cigarettes per day, 87.3% smoked daily, and 53.8% smoked within the first 30 minutes after waking. With regard to their readiness to quit smoking, 29.9% of participants were in pre-contemplation, 47.4% were in contemplation, and 22.7% were in preparation. Participant baseline characteristics did not predict extent of intervention engagement (data not shown).

Engagement (post-level analyses)

The analytical sample consisted of 2,941 posts, 331 (11%) of which were live-counselor initiated; the rest were automated. All posts generated 8,403 participant comments (mean=2.8 comments per post). Descriptive statistics on number of comments on different post types stratified by readiness to quit smoking can be found in Table 2. Predictors of engagement were investigated using multilevel Poisson regression analyses, stratified by readiness to quit (Table 3). In pre-contemplation, there was no significant difference between engagement with the live counselor compared to the most engaging automated content (Decisional Balance & MI), which means participants engaged as much with live counseling as they did with the most engaging automated content. Participants in contemplation engaged significantly less with the counselor than with the most engaging automated content (Decisional Balance & MI). Participants in preparation engaged significantly more with the counselor than with the most engaging automated content (Consciousness Raising). With the exception of one group in the pre-contemplation model, every dummy predictor for group membership was significantly associated with engagement, suggesting that group membership had a significant impact on engagement. Timing of post in the intervention was significantly negatively related to post engagement across readiness to change categories, suggesting diminishing engagement with intervention posts over time.

Smoking cessation (participant-level analyses)

The analytical sample consisted of N=251 intervention participants. At 3-month follow-up, 12 participants were biochemically confirmed abstinent, and an additional 2 participants reported current (electronic nicotine delivery system) ENDS use and were considered abstinent (total of N=14). Of all participants, 76% (n = 191) commented at least once to

automated posts in their Facebook group, with a median of 29 comments (interquartile range IQR = 7–81), and 101 participants (40.6%) commented at least once during a live counseling session, with a median of 5 comments (IQR = 3–12). The extent of engagement (i.e. number of comments) in live counseling predicted 3-month abstinence (adjusted Odds Ratio=1.10; 95% CI 1.02 1.20; p<.05), controlling for cigarettes per day, readiness to quit, and extent of engagement with automated posts. Each additional comment participants posted in response to a live counselor post increased the odds of abstinence by 10% (Table 4).

Discussion

The goal of the current study was to investigate engagement with a live counselor and automated posts among young adults participating in a Facebook smoking cessation intervention. Participant engagement with live counseling varied between participants in different stages of readiness to quit: Compared to automated content, live counseling generated higher levels of engagement among participants in preparation (those ready to quit smoking), similar engagement among participants in pre-contemplation (those not ready to quit smoking), and lower levels of engagement among participants in contemplation (those thinking about quitting smoking). Moreover, greater engagement with the live counselor via commenting on counselor-initiated posts was associated with improved biochemically verified smoking cessation outcomes.

Previous research on online weight loss, cannabis, and alcohol use interventions showed that including a human counselor improved participant outcomes (Blankers et al., 2011; Gold et al., 2007; Schaub et al., 2015; Tate et al., 2006). The findings of our current work support these previous findings, since we showed that engagement with a live counselor was associated with improved smoking cessation outcomes in the context of a Facebook intervention. In contrast, the current study did not find associations between participant engagement with automated content and smoking cessation outcomes. There are several potential explanations for these findings: In contrast to automated posts, the counselor was able to tailor comments and responses to participants. Moreover, participants may have perceived the counselor as a source of social support and accountability. The explanations are in line with the existing literature, which suggest that social support, accountability, and tailored feedback are important active ingredients of online counseling (Santarossa et al., 2018). Lastly, participants were instructed to comment on automated daily posts, which could mean that participants engaging with the counselor could have done so due to greater intrinsic motivation. These potential explanations have to be investigated in future research.

The current study extends the existing literature by demonstrating that engagement with live counselors may vary as a function of participant readiness to change their health risk behavior. In considering limited resources and scalability potential with regards to live counseling in social media interventions, these findings suggest that including a counselor may be most efficient to improve engagement in interventions targeting participants in a preparation stage of readiness to quit and could be helpful among participants in pre-contemplation, but may not be beneficial to improve engagement for participants in contemplation. However, it should be noted that, across stages of readiness to quit, extent of

engagement with the live counselor was associated with biochemically verified smoking cessation at the end of the intervention.

While external support by practitioners or clinicians in digital interventions tends to improve outcomes, the nature of this support may vary quite a bit (Fairburn & Patel, 2017). The less external support there is, the more scalable digital interventions become. Yet, scalability may come at the cost of reduced improvement in outcomes, in part due to more limited personalization (Pagoto et al., 2016). In the framework of digital treatments (Fairburn & Patel, 2017), this external input can range from non-existent ("autonomous"), to contact with a non-specialist practitioner ("supported"), to in-person supervision or treatment from a clinician ("blended"). The Facebook program presented here could be described as a combination of autonomous and supported digital intervention that includes automated content and limited social media contact with a counselor. In light of our findings that greater engagement with the counselor predicted smoking abstinence and that live counseling generated more engagement than automated posts only for those in the preparation stage, the resources devoted to the live counselor could be focused on those in preparation groups. Future research should empirically examine these tradeoffs through cost-effectiveness studies or those that test components of the intervention.

Consistent with previous research (Glasgow et al., 2007; Turner-McGrievy & Tate, 2013), we also found that participant engagement decreased over time among participants in all stages of readiness to quit. There remains a need to improve long term engagement in digital health behavior change interventions. Also in line with previous research (Thrul et al., 2015), our results show that engagement varied widely across groups. These findings suggest that there may be aspects of groups that get participants to engage more or less. The current study with 29 groups also lacked the adequate sample size to investigate group-level factors such as group size, group composition (e.g., gender ratio, individual participant tendency for active vs. passive social media engagement, percentage of daily smokers, or future smoking intentions), or group processes (e.g., whether participants motivate others to engage) that may have caused these group level differences in engagement. Future studies with larger samples are needed to investigate this topic.

When comparing the most engaging post types of the present TSP efficacy trial with those in a smaller feasibility trial (Thrul et al., 2015), Decisional Balance & MI posts received the most engagement for pre-contemplation and contemplation groups in both studies. In preparation groups, Consciousness Raising posts received the most comments and second most comments in the feasibility and efficacy trials, respectively. In the efficacy trial, posts about e-cigarettes received on average the most comments for preparation groups and second most comments for contemplation groups. This likely reflects the mixed evidence surrounding the use of e-cigarettes to support quitting smoking (Glasser et al., 2017; Kalkhoran & Glantz, 2016), and this type of post seemed to generate engagement regarding the availability of evidence and intentions of e-cigarette companies. In general, the most engaging types of automated content in this efficacy trial mirrored those in feasibility trial.

Limitations

Our findings have several limitations. This study relied on a self-selected convenience sample of young adult smokers using Facebook, with relatively lenient inclusion criteria with regards to heaviness of smoking, and the sample was predominantly white, which may limit the generalizability of these findings to other social media interventions and populations. Further, our intervention was tailored to baseline readiness to quit smoking in accordance with the TTM, and thus participants in each stage of readiness to quit received different intervention content both in terms of automated post content and live counselor prompts. This study design feature was accounted for by examining engagement stratified by baseline readiness to quit; however, it precluded us from comparing engagement with posts between different stages, and future studies utilizing different designs may be needed to investigate the relationships between engagement and readiness to quit.

Moreover, when comparing automated posts to counselor posts, it should be kept in mind that while posts across modalities were based on the same theoretical smoking cessation approaches (Motivational Interviewing and CBT), they were not systematically matched according to tone, sentiment, content, and other factors, all of which could be responsible for differences in engagement. Also, the counselor responded to participant comments and tried to engage in follow-up conversations, whereas this was not done for automated posts. A single PhD psychologist smoking cessation counselor provided all live counseling in this trial. Counselor likeability and skills could thus have impacted participant engagement. As noted elsewhere (Thrul et al., 2015), the absence of commenting does not necessarily mean a person did not see or make some cognitive or behavioral change as a result of an intervention post. These, however, were impossible to measure in the context of this study conducted entirely on Facebook where we are not able to access page view data. We also did not account for participant comment content and length, or engagement of participants with each other in the current study (Meacham et al., 2019). Qualitative analyses of participant comments have been conducted in existing studies (McKelvey & Ramo, 2018) and this is an important area to expand in future research.

Participants were not randomized to a smoking cessation counselor and our design can therefore not determine the causality between engagement with a live counselor and smoking cessation outcomes. Finally, biochemically verified abstinence (assuming missing = smoking) was low in the current study (5.6% at 3-month follow-up) and a longer intervention with additional sessions may be warranted to boost quit rates.

Conclusions

Results demonstrate the potential benefits of incorporating a live smoking cessation counselor to engage participants in social media smoking cessation interventions, especially those in the preparation stage of readiness to quit. Moreover, engagement with a live counselor was associated with improved smoking cessation outcomes. Although social media are generally integrated into the lives of young adults, strategies are still needed to improve participant engagement in social media smoking cessation interventions over time and in a scalable manner.

Acknowledgements:

Appendix: Sample Facebook posts

Tsp Study
July 28, 2015 · Buffer

33. Having a phrase or mantra that's motivating and centering that you can repeat to yourself when things get tough can be a HUGE help to deal with cravings. Think of your own mantra or phrase and post it here. #feelinghealthy

SPOTLIGHT ON CRAVINGS

Repeat your mantra

👍 Like   💬 Comment

Figure 1: Automated post

Figure 2: Live-counselor post

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Table 1.

TTM components

TTM concept	Definition
Decisional Balance & Motivational Interviewing	Pros and cons of behavior and behavior change
Counter-Conditioning	Substituting healthy alternative behaviors and thoughts for old behaviors
Consciousness Raising	Learning new facts, ideas and tips that support the behavior change
Dramatic Relief	Experiencing negative emotions that go along with old behaviors and positive emotions that go along with new behaviors
Environmental Reevaluation	Realizing the negative impact of one's behavior and the positive impact of change on others
Helping Relationships	Seeking and using social support to make and sustain change
Reinforcement Management	Increasing rewards for healthy behavior change and decreasing the rewards for old behaviors
Stimulus Control	Removing reminds/cues to engage in old behavior, and using cues to engage in the new healthy behavior
Self-Liberation	Making a firm commitment to change
Social Liberation	Realizing that social norms are changing to support new behavior
Self-Reevaluation	Realizing that the behavior change is an important part of one's identity

Table 2

Post Descriptive Statistics – Number of posts per group and mean number of comments received

Post Content	Number of posts per group	Number of comments received (M, SD)
Pre-Contemplation		
Live counseling	12	3.7 (4.3)
Consciousness Raising	40	2.8 (2.4)
Decisional Balance & MI	20	4.4 (2.7)
Social Liberation	16	2.4 (2.1)
E-Cig	7	2.8 (2.3)
Environmental Reevaluation	7	3.4 (2.4)
Contemplation		
Live counseling	12	2.0 (3.1)
Consciousness Raising	19	2.8 (2.6)
Decisional Balance & MI	13	3.9 (3.0)
Counter-Conditioning	12	2.7 (2.7)
Environmental Reevaluation	9	3.0 (2.5)
Dramatic Relief	8	2.3 (2.4)
Social Liberation	8	2.7 (2.4)
E-Cig	7	3.8 (3.1)
Self-Reevaluation	7	2.6 (2.4)
Self-Liberation	5	3.0 (2.6)
Helping Relationships	1	3.6 (2.7)
Reinforcement Management	1	2.0 (2.0)
Preparation		
Live counseling	12	2.8 (3.3)
Stimulus Control	19	2.1 (1.4)
Counter-Conditioning	17	2.2 (1.3)
Reinforcement Management	17	2.1 (1.4)
Consciousness Raising	15	3.3 (1.8)
Helping Relationships	10	2.3 (1.5)
Decisional Balance & MI	5	3.2 (1.6)
E-Cig	3	3.4 (2.0)
Self-Reevaluation	3	2.0 (1.3)
Self-Liberation	1	3.0 (1.4)

Table 3:

Poisson Regressions predicting number of comments by intervention message content, stratified by stage of readiness to quit smoking

	Coefficient	Standard Error	z-value	p-value
Pre-contemplation				
TTM content				
Live counseling	0.034	0.068	0.5	.621
Decisional Balance & MI	Reference			
Consciousness Raising	−0.199	0.060	−3.3	.001
E-cig	−0.200	0.090	−2.2	.026
Environmental Re-Evaluation	−0.161	0.079	−2.0	.042
Social Liberation	−0.240	0.083	−2.9	.004
Dummy group 1	Omitted			
Dummy group 2	1.660	0.191	8.7	.000
Dummy group 10	2.021	0.124	16.3	.000
Dummy group 11	2.932	0.209	14	.000
Dummy group 12	2.239	0.237	9.5	.000
Dummy group 19	−1.060	0.198	−5.3	.000
Dummy group 20	1.878	0.159	11.8	.000
Dummy group 26	−0.133	0.120	−1.1	.269
Dummy group 27	1.952	0.232	8.4	.000
Day in intervention	−0.007	0.001	−6.7	.000
Contemplation				
TTM content				
Live counseling	−0.409	0.078	−5.2	.000
Decisional Balance & MI	Reference			
Consciousness Raising	0.017	0.063	0.3	.789
E-cig	−0.043	0.072	−0.6	.550
Counter-Conditioning	−0.068	0.070	−1	.329
Self-Liberation	−0.048	0.090	−0.5	.593
Self-Reevaluation	0.046	0.087	0.5	.598
Dramatic Relief	−0.133	0.086	−1.6	.121
Reinforcement Management	−0.019	0.222	−0.1	.932
Environmental Re-Evaluation	−0.025	0.073	−0.4	.726
Social Liberation	0.022	0.082	0.3	.788
Helping Relationships	−0.105	0.164	−0.6	.521
Dummy group 3	Omitted			
Dummy group 4	−2.132	0.314	−6.8	.000
Dummy group 5	2.425	0.160	15.2	.000
Dummy group 13	−2.055	0.182	−11.3	.000
Dummy group 14	1.193	0.155	7.7	.000
Dummy group 15	3.065	0.139	22	.000

	Coefficient	Standard Error	z-value	p-value
Dummy group 21	0.757	0.097	7.8	.000
Dummy group 22	2.545	0.121	21.1	.000
Dummy group 23	2.958	0.148	19.9	.000
Dummy group 28	−1.720	0.156	−11.1	.000
Dummy group 29	1.928	0.114	17	.000
Day in intervention	−0.012	0.001	−15.3	.000
Preparation				
TTM content				
Live counseling	0.170	0.082	2.1	.038
Decisional Balance & MI	−0.010	0.098	−0.1	.915
Consciousness Raising	Reference	.	.	.
Stimulus Control	0.054	0.087	0.6	.535
E-cig	0.082	0.114	0.7	.471
Counter-Conditioning	0.026	0.084	0.3	.754
Self-Liberation	−0.104	0.123	−0.8	.397
Self-Reevaluation	0.091	0.154	0.6	.554
Reinforcement Management	0.046	0.089	0.5	.606
Helping Relationships	−0.032	0.092	−0.3	.733
Dummy group 6	Omitted			
Dummy group 7	1.237	0.196	6.3	.000
Dummy group 8	1.389	0.147	9.4	.000
Dummy group 9	2.842	0.239	11.9	.000
Dummy group 16	0.328	0.104	3.2	.002
Dummy group 17	2.977	0.206	14.5	.000
Dummy group 18	2.814	0.276	10.2	.000
Dummy group 24	0.288	0.128	2.2	.025
Dummy group 25	3.301	0.255	12.9	.000
Day in intervention	−0.012	0.001	−10.0	.000

Table 4:

Logistic Regression predicting biochemically confirmed smoking abstinence at end of treatment (N=251)

Predictor	Adjusted Odds Ratio	95% confidence interval	p-value
Extent of engagement with live-counseling	1.10	[1.02,1.20]	0.018
Number of cigarettes per day	0.76	[0.64,0.91]	0.003
Readiness to quit			
Pre-contemplation	Reference	-	-
Contemplation	4.90	[0.43,55.66]	0.200
Preparation	18.98	[1.84,196.17]	0.014
Engagement with automated content	1.00	[0.99,1.02]	0.630