Original Investigation

A measure of smoking abstinence-related motivational engagement: Development and initial validation

Vani N. Simmons, Ph.D.,^{1,2,3} Bryan W. Heckman, B.S.,^{1,3} Joseph W. Ditre, M.A.,^{1,3} & Thomas H. Brandon, Ph.D.^{1,2,3}

¹ Department of Health Outcomes and Behavior, H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL

² Department of Oncologic Sciences, University of South Florida, Tampa, FL

³ Department of Psychology, University of South Florida, Tampa, FL

Corresponding Author: Thomas H. Brandon, Ph.D., 4115 E. Fowler, Tampa, FL 33617, USA. Telephone: 813-745-1750; Fax: 813-745-1755; E-mail: Thomas.brandon@moffitt.org

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Abstract

Introduction: Although a great deal of research has focused on measuring motivation and readiness to quit smoking, little research has assessed gross motivational changes after a smoker has made an attempt to quit smoking. Unlike previous single-item global measures of motivation to remain abstinent, we developed the abstinence-related motivational engagement (ARME) scale to evaluate the degree to which abstinence motivation is reflected by an ex-smoker's daily experience in areas that include cognitive effort, priority, vigilance, and excitement. The aim of this study was to collect reliability and initial construct validity data on this new measure.

Methods: Participants were 199 ex-smokers recruited from the community and smoking cessation Web sites. Participants completed online measures including a global motivation measure, the ARME scale, demographic questionnaire, and a measure of cessation self-efficacy.

Results: The 16-item ARME questionnaire demonstrated high internal consistency reliability ($\alpha = .89$). Analyses provided support for convergent, discriminant, and construct validity of the scale. ARME demonstrated the predicted correlation with a traditional measure of global cessation motivation, yet, also as predicted, only the ARME was negatively associated with length of abstinence. Moreover, as hypothesized, ex-smokers engaged in the quitting process via ongoing smoking Web site participation showed higher ARME scores than a comparison community sample. A five-item short form demonstrated similar psychometric properties.

Discussion: This study provided initial support for the ARME construct and offers two versions of a reliable instrument for assessing this construct. Future research will examine the ARME as a predictor of cessation outcome and a potential target for relapse prevention.

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Introduction

The assessment of motivational readiness to quit smoking has received a great deal of research and clinical attention. Measures of readiness to quit smoking such as the contemplation ladder (Biener & Abrams, 1991) and the stages of change algorithm (DiClemente et al., 1991) have indeed been predictive of future quit attempts. Yet, to date, little research has been conducted to capture gross motivational changes after a smoker has made an attempt to quit smoking. Whereas 40% of smokers make a quit attempt each year, the proportion of successful quit attempts is estimated at only 5% (Hughes, Keely, & Naud, 2004).

Although multiple factors are associated with smoking motivation and risk of relapse (Baker, Brandon, & Chassin, 2004; Brandon, Vidrine, & Litvin, 2007), a simple index of ongoing motivational level might account for a significant portion of variance in predicting successful maintenance of tobacco abstinence. Moreover, changes in motivational levels may precede relapse and serve as a marker of relapse risk. For example, Piasecki, Fiore, McCarthy, and Baker (2002) posited a dynamic model of smoking relapse proneness in which a loss of motivation (i.e., motivation/cessation fatigue) over time was proposed to be one factor contributing to an increased risk of relapse. To assess dynamic changes in motivation during the postcessation period, Piasecki et al. administered a single item of motivation to quit to smokers who completed multiple daily ecological momentary assessments as a part of a cessation trial. Results demonstrated a rapid drop in motivation levels at 30- to 40-day postquit among smokers who subsequently relapsed during 7 weeks of assessment. Hedeker and Mermelstein (1996) similarly used a sole item, "How motivated are you to stop smoking/stay quit," assessed at multiple timepoints. Participants in their study also demonstrated a precipitous drop in motivation levels in the weeks prior to the relapse. Thus, the measurement of temporal changes in motivation following cessation appears to be useful in understanding and examining the role of abstinence motivation on smoking relapse.

We suspect that single broad motivation items, such as those used in the studies cited above, may not fully capture the dynamic nature of abstinence motivation. Specifically, such items appear to capture desire to remain abstinent rather than the willingness to expend the effort necessary to stay quit (e.g., enduring withdrawal symptoms, using medication, engaging in coping responses, resisting urges to smoke). We term such effort, “abstinence-related motivational engagement (ARME),” to distinguish it from the more conventional notion of general motivational level for quitting smoking.

We have observed clinically that smokers tend to be highly engaged in the quitting process in the early days and perhaps even weeks following cessation but that motivational engagement typically declines over time. Accordingly, we have postulated that waning motivational engagement may be related to the high rates of smoking relapse. Decrements in motivational engagement are not surprising given that the acute challenges associated with quitting smoking, such as dealing with withdrawal symptoms and conditioned cravings, tend to be greatest shortly after quitting. However, declining motivational engagement may nevertheless leave the former smoker vulnerable to delayed challenges, such as major stressors and later emerging conditioned cravings. As a client who was a military veteran once told us that the first week or two of quitting smoking is like engaging in battle—frightening but exciting and requiring full attention and engagement. In contrast, the next several months are akin to being posted on guard duty. The excitement and challenge of immediate quitting fades, so the former smoker shifts his focus to other issues in his life. Yet, despite the boredom and routine of guard duty, there is always the danger of a surprise attack, so the soldier must struggle to remain alert and ready. Likewise, the former smoker must remain engaged in the quitting process and ready to respond to unexpected challenges.

For obvious reasons, most motivational assessment and intervention efforts have focused on the preparation for cessation and early phases of quitting. For example, the motivational interviewing approach typically targets the decision to attempt cessation of substance use and the early cessation process. Perhaps for this reason, its early efficacy tends to diminish rapidly over time (Hettema, Steele, & Miller, 2005).

The aims of the current study were to develop a measure of ARME and to collect reliability and initial construct validity data on this new measure. The first step in our approach to developing the ARME was to define the content domain. In contrast to single-item global measures of motivation to stay quit, we operationalized ARME to reflect ongoing engagement in the cessation and maintenance process. Using a rational scale development approach, we initially identified four themes upon which an individual's motivation to be a nonsmoker can be translated into daily experience and is amenable to self-reported assessment: (a) cognitive effort, that is, thinking about being abstinent; (b) priority, the relative importance placed on being abstinent compared with other issues in one's life; (c) vigilance, anticipating and preparing for high relapse risk situations; and (d) excitement, continued enthusiasm about being abstinent. Our rationale for inclusion of these themes was based on empirical and clinical grounds. As a key component of cognitive-behavioral theoretical models of relapse (e.g., Marlatt & Donovan, 2005), we constructed items that reflected a smoker's ability to muster cognitive and behavioral coping strategies. We

postulated that the degree to which a smoker actively remains alert to and prepares for high relapse risk situations (vigilance) and spends time thinking about being abstinent (cognitive effort) reflects continued motivational engagement with the quitting process. The concept of priority has been used in a measure of tobacco dependence to reflect a behavioral preference for smoking over other reinforcers (Shiffman, Waters, & Hickcox, 2004). Therefore, we extended this notion to the complementary assumption that an ex-smoker's willingness to expend the effort necessary to maintain abstinence would be affected by the degree that he or she prioritizes abstinence compared with alternative demands and more immediate reinforcers. Based on our clinical experience working with smokers, those who continue to be engaged with the process of quitting smoking maintain their energy and excitement toward being a nonsmoker. Moreover, sufficient energy or arousal is necessary to engage in cognitive-behavioral coping strategies. Therefore, items were included that assessed this continued excitement/energy. For each theme, four 7-point (0–6) Likert items were generated, yielding a 16-item developmental measure that was administered to participants. Importantly, we did not conceptualize the themes as separate factors or subscales; rather, we believed that they simply captured the range of the domain of the hypothetical construct of motivational engagement.

We hypothesized that ARME would be correlated with traditional global (trait-like) motivation items. However, we also expected that ARME scores would be more dynamic than the traditional measures. Specifically, whereas global motivation was expected to remain relatively stable, or gradually increase, over time (with the exception of the precipitous decline that can immediately precede relapse), we predicted that ARME would show a decline over time. That is, ARME scores should be negatively correlated with time since cessation.

It is possible that ARME scores would reflect nothing more than self-efficacy, one of the most robust predictors of behavior change in general (Bandura, 1977), as well as smoking cessation and maintenance (Brandon, Herzog, Irvin, & Gwaltney, 2004). ARME was posited as a separate construct; thus, we predicted that it would not be correlated with cessation self-efficacy and that the two variables would contribute unique variance to time since cessation.

Finally, we hypothesized that former smokers who remained actively engaged in some sort of cessation program (e.g., online smoking Web sites) should show higher ARME levels than former smokers in general. This difference might occur because the continued engagement in a cessation program would serve to sustain ARME and/or because those with higher ARME levels in the first place would be more attracted to an ongoing cessation program. To test this hypotheses, we compared ARME between ex-smokers who frequented smoking-related Web sites and those recruited from the local community.

Methods

Participants

Participants were 199 ex-smokers recruited from postings on smoking cessation Web sites ($n = 139$) and local newspaper advertisements ($n = 60$). Participants who responded to the newspaper advertisements were screened by telephone for

inclusion criteria. To be eligible, participants had to report that they had quit smoking for at least 1 week and no longer than 1 year, previously smoked ≥ 10 cigarettes/day for ≥ 1 year, and were ≥ 18 years of age. Eligible callers were directed to a Web site link to complete the measures online. Participants were sent a \$5 gift card to a national discount store for completing the measures. To recruit online participants, a link was posted to the survey on smoking-related Web sites that include support group forums for those who have already quit or for those who would like to quit (e.g., Whyquit.com, Nicotine Anonymous, Quitnet). The posting stated that we were seeking former smokers who had quit within the past year to complete a brief survey to share their experiences about quitting smoking. Eligibility questions were included within the online survey. To maintain anonymity and discourage fraudulent responders, participants recruited from the Web sites did not receive compensation. In total, 125 respondents were excluded from the study because they did not meet inclusion criteria ($n = 112$) or they had incomplete questionnaire data ($n = 13$).

Measures

Demographic questionnaire

We assessed basic demographic information, including gender, age, race, ethnicity, and education.

Situation-specific abstinence self-efficacy scale

This 20-item measure assessed self-efficacy to refrain from smoking in various situations (Velicer, DiClemente, Rossi, & Prochaska, 1990). The scale consists of three situational factors: positive/social, negative/affective, and habit/addictive. Participants were asked to indicate how confident they were that they could avoid smoking in each situation using a Likert scale that ranged from 0 (*not at all confident*) to 5 (*extremely confident*), with higher scores indicating greater self-efficacy. The total scale showed high internal consistency reliability ($\alpha = .96$). This measure was included to evaluate the discriminant validity of the ARME scale.

Smoking status questionnaire

This instrument was used to assess smoking status and smoking history. The smoking status questionnaire (SSQ) included items

such as the number of cigarettes smoked per day, years smoked, and time since last cigarette. The SSQ included a modified version of the Fagerström Test for Nicotine Dependence (FTND), a reliable and valid measure of nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). The wording of the FTND was changed to reflect nicotine dependence prior to quitting (Brandon, Collins, Juliano, & Lavee, 2000; Brandon, Meade, Herzog, Chirikos, Webb, & Cantor, 2004; e.g., When you were smoking, did you find it hard to keep from smoking in places where it was not allowed).

Global abstinence motivation measure

A four-item scale of global abstinence motivation was administered. These items were representative of those used in prior research, which typically use a single item (e.g., Hedeker & Mermelstein, 1996). The following four items were used: I am committed to being smoke-free, It is important for me to be a non-smoker, I want to become or stay smoke-free, and I am devoted to being smoke-free. The coefficient alpha for this measure was .96. This measure was included to allow us to compare the ARME with a more conventional general measure of abstinence.

Abstinence-related motivational engagement

The ARME scale is a 16-item self-report scale that was created utilizing a rational scale development approach. Our theoretical domain of interest was ARME, which we operationalized as the degree of ongoing engagement in the cessation and maintenance process. We conceptualized ARME as a unidimensional construct and developed items to reflect our domain of interest. Four Likert-type items were developed to represent each theme: cognitive effort, priority, vigilance, and excitement. The items can be found in Table 2.

Results

Participant characteristics

Table 1 lists the characteristics of the sample as a whole as well as the two subsamples. The sample was predominately woman, middle aged, and Caucasian. Prior to quitting, participants smoked an average of just over a pack of cigarettes per day, for

Table 1. Participants characteristics

Variable	Total sample, $N = 196$	Community sample, $n = 60$	Web site sample, $n = 136$
Female (%)	69.8	60.0	74.1*
>High school (%)	71.9	81.7	77.6
Race (%)			
Caucasian	94.5	91.7	95.7
Asian	1.0	0.0	1.5
American Indian/Alaskan	.5	1.7	0
Black	1.0	3.3	0
Hispanic (%)	2.5	8.3	0***
Age (years); M (SD)	44.5 (12.1)	43.1 (13.0)	45.1 (11.7)
Years smoked; M (SD)	25.3 (12.9)	21.8 (13.1)	26.8 (12.5)**
Prequit FTND; M (SD)	5.9 (2.5)	5.0 (2.5)	6.3 (2.4)**
Cigarettes per day; M (SD)	23.2 (10.8)	20.0 (8.2)	24.6 (11.4)**
Length of abstinence; M (SD)	4.7 (3.6)	6.0 (3.5)	4.1 (3.5)

Note. Three participants from Web site sample did not provide demographic data. FTND = Fagerström Test for Nicotine Dependence.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2. Abstinence-related motivational engagement scale

Item	Theme	Itemtotal correlation
Being smoke-free is my highest priority at this time	Priority	.567
I try to anticipate and prepare for any challenges to being smoke-free	Vigilance	.658*
The thought of being a nonsmoker still excites me*	Excitement	.640*
I spend little time thinking about becoming or staying smoke-free (R)	Cognitive effort	.358
I am doing whatever I can to avoid smoking	Vigilance	.528
I am no longer all that excited about being smoke-free (R)	Excitement	.437
I think about quitting smoking, or staying off cigarettes every single day	Effort	.505
Nothing is more important to me right now than being tobacco free	Priority	.611
I am willing to make sacrifices in other areas in order to be free of cigarettes	Priority	.524
At this time, I am still very excited by the idea of being smoke-free	Excitement	.621*
I spend a great deal of time thinking about becoming or staying smoke-free	Cognitive effort	.658*
I spend very little time preparing myself for any challenges to being smoke-free (R)	Vigilance	.594
Compared with other things in my life, fighting the urge to smoke is not the top priority for me right now (R)	Priority	.507
I am willing to spend a lot of mental energy on being smoke-free	Cognitive effort	.610
I feel energized just thinking about being smoke-free	Excitement	.563
I am carefully watching out for things that might put me at risk for smoking	Vigilance	.650*

Note. *Items retained for short form. R = reverse-scored item.

an average of about 25 years. Length of abstinence ranged from 1 week to 12 months, with a mean of 4.7 months.

Independent sample *t* tests revealed that participants from the two recruitment samples were equivalent on measures of age, education, and race. As seen in Table 1, differences emerged in gender composition and Hispanic ethnicity. With respect to smoking variables, the samples differed in cigarettes smoked per day prior to quitting, FTND score, and duration of smoking. In general, compared with the community sample, participants recruited from Web sites appeared to have been more experienced and dependent smokers prior to quitting.

Factor analysis

A principal factor analysis was conducted to assess the factor structure of the ARME scale. Three eigenvalues with values greater than 1 emerged. The first factor had an eigenvalue of 6.54. There was a significant dropoff for the remaining factors (2.20, 1.27). Thus, scree criteria (Cattell, 1966) supported a single-factor solution, indicating that the ARME was essentially unidimensional (Costello & Osborne, 2005).

Reliability analysis

Consistent with the single-factor solution, the 16-item ARME questionnaire demonstrated high internal consistency reliability ($\alpha = .89$). This again suggests that, despite the four themes used to assess the domain of interest, the instrument is sampling a unitary construct.

Convergent and discriminant validity

We were interested in contrasting the ARME construct with a more traditional assessment of abstinence motivation. We hypothesized that ARME would be correlated with a traditional motivational measure but that the two scales would differ in their associations with length of abstinence. As hypothesized, ARME was correlated with traditional motivational items, $r(199) = .40, p < .001$. Also as predicted, ARME was negatively

correlated with length of abstinence, $r(199) = -.31, p \leq .001$, whereas the traditional motivational scale was unrelated to length of abstinence, $r(199) = .09$, not significant (ns). The difference between these two dependent correlations was significant, $t(196) = -5.54, p < .001$.

As an additional test of discriminant validity, the relationship between the ARME scale and the measure of abstinence-related self-efficacy (Velicer et al., 1990) was examined. In line with our hypotheses, the measures were not significantly correlated, $r(197) = .12$, ns. Further, in a multiple regression model, ARME and coping self-efficacy independently predicted length of abstinence, $\beta_s = -.33$ and $.30$, respectively, $p_s < .001$, after controlling for smoking variables and recruitment method. Thus, as expected, the passage of time since quitting was associated with lower ARME scores, yet higher self-efficacy.

Finally, we examined the ability of the ARME to distinguish between a group actively engaged in their quit attempt (i.e., ex-smokers active on smoking cessation Web sites) and a community sample of ex-smokers. Consistent with predictions, ex-smokers recruited from smoking cessation Web sites reported higher ARME scores than those from the community, 92.08 versus 80.00, $t(197) = 4.73, p = .001$, even after controlling for group smoking differences.

Short form

While maintaining adequate reliability, we were able to eliminate 11 items from the full ARME scale, resulting in a shorter five-item version, abstinence-related motivational engagement-short form (ARME-SF; $\alpha = .82$). Specific items for the ARME-SF were chosen by retaining those with the highest item total correlations (Smith, McCarthy, & Anderson, 2000). Further item reduction would have dropped the reliability below .80. Moreover, the ARME-SF was highly correlated with the full ARME, $r(199) = .91, p < .001$. Items retained in the short form are identified by an asterisk in Table 2.

All construct validity analyses described above were repeated with the ARME-SF. Not surprisingly, given the high correlation between the two versions, results for ARME-SF were consistent with the full ARME scale. ARME-SF was correlated with traditional motivational items, $r(199) = .44$, $p < .001$, and length of abstinence, $r(199) = -.20$, $p = .005$, and uncorrelated with abstinence-related self-efficacy, $r(197) = .14$, ns. ARME-SF and coping self-efficacy independently predicted length of abstinence, $\beta_s = -.28$ and $.25$, $ps < .001$ and $=.001$, respectively, after controlling for smoking variables and recruitment method. Ex-smokers recruited from smoking cessation Web sites reported higher ARME-SF scores than those from the community, 29.35 vs. 26.90, $t(197) = 2.56$, $p = .011$. The pattern of significant construct validity findings reported with the full ARME scale were reproduced using the short form, albeit generally with slightly smaller effects, as would be expected due to the lower reliability of the short form.

Discussion

To date, there has been surprisingly limited data and attention paid to assessing changes in motivation postcessation and to measuring varied levels of engagement in the quitting process. Most of the work on assessing cessation motivation has focused on the period leading up to a cessation attempt and perhaps immediately thereafter. For example, although the Transtheoretical Model (Prochaska & DiClemente, 1984) includes a maintenance stage, the vast majority of the research stimulated by this model has focused on the earlier stages. Traditional measures of abstinence motivation reflect one's broad desire to remain abstinent (e.g., "I am committed to being smoke-free."). The few studies that have utilized such measures of motivation at multiple datapoints after abstinence have demonstrated sharp declines in abstinence motivation prior to resumption of smoking (Hedeker & Mermelstein, 1996; Piasecki et al., 2002). Our broader conceptualization of motivational engagement captures an ex-smoker's postcessation motivation as evidenced by his/her level of involvement in the quitting process. The primary aim of this study was to develop and collect initial psychometric data on a measure of smoking ARME.

Both the full and short form of the ARME scale demonstrated very good internal consistency reliability, suggesting that it is capturing a unitary construct. In contrast to traditional global measures of motivation, we were interested in developing a measure that was more sensitive to temporal changes in abstinence motivation that are likely to occur after a quit attempt. As predicted, unlike the traditional motivation measure, ARME was negatively associated with length of abstinence, suggesting that it may be more sensitive to the dynamic aspects of ongoing abstinence motivation. Indeed, the negative correlation observed is consistent with clinical observation that active motivation to stay quit is greatest earlier in the cessation process and wanes as time passes. It is plausible that greater ARME is necessary early in cessation efforts to achieve and maintain cessation while enduring nicotine withdrawal symptoms and conditioned cravings. However, it may be difficult to sustain ARME over time.

With respect to convergent and discriminant validity, ARME demonstrated the predicted correlation with a more traditional measure of global cessation motivation, yet, as predicted, only the ARME was associated with length of abstinence.

Additionally, ARME was unrelated to coping self-efficacy and independently predicted length of abstinence, even after controlling for smoking variables and recruitment method. Together, these findings provide initial support for ARME as an independent construct.

The ability of the ARME to distinguish between ex-smokers engaged in the quitting process via ongoing smoking Web site participation and a community sample was tested to further establish construct validity. The observed patterns were as we hypothesized. Participants who were recruited from smoking cessation Web sites reported higher ARME scores. However, the direction of causality cannot be determined from this cross-sectional study. These results suggest that ongoing interventions might help to sustain ARME and might enhance the maintenance of abstinence. Alternatively, those ex-smokers who are already relatively high in ARME may simply be more likely to seek the additional support that is provided via online forums.

We acknowledge that the results presented herein provide only preliminary support for the ARME construct and assessment instrument. The study was limited by recruitment of only two types of ex-smoker samples and by the demographic and smoking-related differences between the groups (although hypotheses were supported even when these differences were controlled statistically). The fact that a priori hypotheses regarding ARME were supported, however, strengthens confidence in the findings. Nevertheless, subsequent studies should include different, and more diverse, samples of ex-smokers. Most critical, however, is to examine change in ARME longitudinally by following a sample of smokers for several months following initial cessation. Such a design would provide a much stronger test of the hypothesis that ARME tends to decline after cessation, and it would allow for more detailed mapping of the time course of any decline. Moreover, it would allow for the examination of variables that may be predictive of ARME and changes in ARME, as well as testing whether ARME levels (either absolute or change) are predictive of smoking relapse. If so, ARME may serve as both a marker of relapse risk as well as a target variable for relapse prevention interventions, bridging the all too common gap between assessment and treatment of tobacco dependence (Shadel & Shiffman, 2005). There appears to be little cost associated with using the short form (ARME-SF) rather than the full ARME, and the former may be more feasible for longitudinal multi-assessment studies, such as those utilizing ecological momentary assessment (Stone & Shiffman, 1994).

In summary, the present study provided initial support for the construct of ARME and offers two versions of a reliable instrument for assessing this construct. Future research will determine the parameters and utility of the construct and the instrument.

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Declaration of Interests

None declared.

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