Age and pre quit-day attrition during smoking cessation treatment

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Abstract

The present study aimed to replicate the finding that younger age predicts higher pre quit-day attrition. Our second aim was to explain this relation by examining empirically and theoretically informed age-related risk factors for low smoking cessation treatment engagement. 136 participants (M_{age} = 44.2 years, SD = 11.3 years; age = 22–64 years) were randomized to 15-weeks of either 1) an exercise intervention (n = 72) or 2) a wellness education control condition (n = 64). First, a logistic regression analysis was employed to test whether younger adults were more likely than older adults to drop prior to quit date. Next, we assessed whether smoking related health concerns, social expectancies, and/or perceived severity of craving affected the strength of the relation between age and attrition, by adding these three variables to the logistic regression along with age. The logistic regression model indicated that younger age and treatment condition were significantly related to the odds of dropping from treatment prior to the scheduled quit date. Further, health concerns, social expectancies, and/or perceived severity of cravings did not

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account for the effect of age on pre quit-day attrition. These findings highlight the importance of identifying empirically and theoretically informed variables associated with the pre quit-day attrition problem of young smokers.

Keywords

Smoking cessation; age; attrition; youth

Introducthion

Despite the large effort to develop effective smoking cessation interventions, approximately 20% of adults between the ages of 25–44 in the United States remain cigarette smokers (Jamal et al., 2016). Importantly, smokers aged 25–44 express the most interest in quitting smoking with 73% expressing interest, compared to 54% of smokers over the age of 65 and 62% of those between the ages of 18 and 24 expressing interest in quitting (Jamal et al., 2016). Although more than half of all current smokers attempt to quit annually, young adults approach quitting differently than older adults (Suls et al., 2012). Specifically, younger adults are less inclined to seek help from mental health professionals and less likely to complete standard smoking cessation interventions (cognitive behavioral therapy [CBT] and nicotine replacement therapy [NRT]) than older adults (Solberg et al., 2007). Likewise, research suggests that college students rely primarily on quitting cold turkey and see little need to seek help from health care professionals (DeBernardo et al., 1999; Hines, 1996; Morrison et al., 2003).

Furthermore, there is evidence to suggest that even when younger adults choose to participate in cessation services they are significantly more likely than older adults to discontinue treatment (Audrain-McGovern et al., 2007; Brorson et al., 2013; Cosci et al., 2011; Ferguson et al., 2005; Leeman et al., 2006). Among clinical trial participants, older age was a significant predictor of increased treatment adherence (Audrain-McGovern et al., 2007; Brorson et al., 2013; Cosci et al., 2011; Ferguson et al., 2005; Leeman et al., 2006). Health (i.e. the severity of health concerns related to smoking), social (i.e., number of friends who smoke, bar attendance), and craving (i.e., perceived severity of cravings) related motivations have been frequently cited as contributing to the inverse relationship existing between age and attrition (Dietz et al., 2013; Doolan & Froelicher, 2008; Villanti et al., 2016; Walker & Loprinzi, 2014).

Social Cognitive Theory (SCT) (Bandura, 1977), a cornerstone theory in clinical and health psychology (Luczczynska & Schwarzer, 2005), posits that behavior change occurs as a result of dynamic, reciprocal, and transactional processes between individuals and their environments. Within this theoretical framework, behavior change, including beliefs/thoughts about change, motivation to change, and expectancies related to change, are thought to be products of an individual's environment and social context (Bandura, 1986). SCT has been frequently cited as a theoretical basis for understanding the underlying reasons related to variable success when quitting smoking (Bandura, 1997; Luczczynska & Schwarzer, 2005). Moreover, SCT posits that outcome expectancies related to the potential

consequences of quitting smoking greatly influence one's decision to make an attempt. Specifically, smokers who expect more positive health and social outcomes are more likely to take actions in line with quitting goals (Bandura, 1997; Dijkstra et al., 1997; Luczczynska & Schwarzer, 2005). For example, smokers placing more emphasis on the positive health expectancies of quitting smoking (i.e., increased energy, blood circulation, and immune system functioning) vs. the negative health expectancies associated with withdrawal experiences (i.e., cravings, fatigue, anxiety, headaches/dizziness) are more likely to adhere to a quit attempt. Research demonstrates that younger adults are more likely to fear cravings, dread quit day, and be less concerned with the severity of smoking related health concerns, as compared to older adults (Dierker & Mermelstein, 2010; O' Loughlin et al., 2003; Villanti et al., 2016; Walker & Loprinzi, 2014). In other words, younger adults are more likely than older adults to experience negative health expectancies (i.e., cravings) associated with quitting smoking. Conversely, as older adults are likely more concerned with severe smoking related conditions (i.e., heart disease, cancer), it is also likely that older adults place more emphasis on the long-term positive health expectancies (i.e., decreased risk for lung cancer) vs. the relatively short-term negative health expectancies (i.e., cravings). In light of research suggesting that positive health expectancies are more significant than negative health expectancies in behavior change associated with quitting smoking, it can be hypothesized that younger adults are less likely to take action quitting smoking partly as a result of comparatively heightened negative physical health outcome expectancies.

Additionally, SCT purports that positive social expectancies are related to an increase in action-oriented behaviors (Bandura, 1997). For example, smokers who expect support from social groups are more likely to make an attempt than those who expect disapproval from smoking friends or negative social consequences (Luczczynska & Schwarzer, 2005). Younger adults are more likely to have a greater number of friends who smoke and attend bars more frequently (Dietz et al., 2013). Similarly, younger adults appear to be less likely to quit smoking when peers continue to smoke (Chen et al., 2001; Tucker et al., 2002b, 2002a). Therefore, in line with SCT and related empirical findings, it can be hypothesized that younger adults are more likely to have negative social expectations associated with quitting smoking, and thus may be less likely to perform actions in line with quitting goals (i.e., adhere to cessation treatment). However, these relationships are currently poorly understood and it is clear that further work is needed in order to replicate these findings and identify additional theoretically salient variables associated with attrition among this population.

Of treatment phases involved in smoking cessation interventions—the pre-cessation phase, cessation phase, and maintenance phase—the pre-cessation phase is the period in which most smokers discontinue treatment (Baker et al., 2011; Collins et al., 2011; Shiffman et al., 2006). The pre-cessation phase is comprised of the several weeks prior to the target quit date in which participants spend time preparing for their quit attempt. The target quit date immediately precedes the cessation phase, or the several weeks following the quit attempt. The maintenance phase is defined as the period of time which typically involves cessation monitoring and support via study staff, intervention procedures, and collection of outcome assessments (Baker et al., 2011; Collins et al., 2011; Powers et al., 2016; Smits et al., 2012). Of these phases, the pre-cessation, or pre-quit phase, is particularly relevant due

to the alarming rate at which smokers discontinue treatment during this phase (Ahluwalia et al., 2002; Borrelli et al., 2002; Evins et al., 2008; Jacquart et al., 2017; Woods et al., 2002). The few studies that speak to younger smoker attrition rates suggest that younger adults are even more likely than older adults to suspend treatment prior to the prescribed quit date, and even before randomization (Ahluwalia et al., 2002; Woods et al., 2002). Given the treatment resistant nature of young smokers in combination with their empirically demonstrated vulnerability to the pre-quit period, there is a need to understand the factors involved in this complex relationship. Extant literature fails to provide clinical researchers with suitable information regarding reasons behind younger smoker pre-quit attrition. As a result, researchers are uninformed as to how to correct the problem and ensure that young smokers successfully achieve their cessation goals and ultimately reach their scheduled quit day.

Using data from a randomized controlled trial examining smokers with elevated anxiety sensitivity (Smits et al., 2016), the current study is a secondary analysis examining the relation between age and attrition during the pre-quit phase. Our first aim was to replicate the common finding that younger age predicts pre quit-day attrition. Our second aim was to explain the relationship between younger age and pre quit-day attrition by examining empirically and theoretically informed age-related risk factors for low smoking cessation treatment engagement: smoking related health motivation (i.e., heart disease, lung cancer), social expectancies (i.e., smoking facilitates relaxed conversation and social engagement), and expected severity of cravings (Dietz et al., 2013; Doolan & Froelicher, 2008; Villanti et al., 2016; Walker & Loprinzi, 2014).

Method

Participants

Eligible participants were 136 (M_{age} = 44.2 years, SD = 11.3 years; *age range* = 22–64 years) adult smokers with elevated levels of anxiety sensitivity (M_{ASI-3} = 18.37, SD = 11.58), who consented to a treatment study comparing the effects of an exercise augmented smoking cessation treatment and a wellness education augmented treatment on smoking cessation outcomes (see Table 1 for participant baseline and demographic characteristics). A full overview of eligibility criteria is presented in Smits et al. (2012).

Interventions

All participants were prescribed a standard smoking cessation treatment consisting of seven weekly 60-minute sessions of cognitive behavioral therapy and nicotine replacement therapy (NRT). In addition, participants were randomized to either a vigorous-intensity exercise intervention or a wellness education intervention, each involving three weekly 45-minute sessions for 15 weeks. Each session consisted of treatment (exercise or wellness education), study staff support, and NRT in the form of transdermal patches. The exercise condition involved a program in which participants were asked to attend three exercise sessions a week. Study clinicians educated participants on the implications of anxiety sensitivity in smoking maintenance and presented exercise as a means for interoceptive exposure to these bodily sensations. Over the first couple of weeks, participants worked to increase the

intensity of their exercise to reach 77% to 85% of their maximum heart rate. The wellness education condition incorporated a program in which participants engage with lectures, videos, handouts, and discussions regarding healthy lifestyle changes (i.e., healthy eating, time management). Participants were informed these education sessions were included to encourage smoking cessation by fostering a generally healthier lifestyle. For an in-depth description of study procedures see (Smits et al., 2012).

Defining attrition

Participants were asked to make a quit attempt on week 6 of the intervention (Smits et al., 2012). Therefore, participants who discontinued treatment during or prior to week 6 were considered pre-quit drops, and participants were correspondingly coded as either *Droppers* (n = 42, 30.9%) or *Non-Droppers* (n = 94, 69.1%) before the quit date in this 15-week program.

Measures

Anxiety sensitivity index- 3—(*ASI;* Taylor et al., 2007). The ASI is an 18- item measure in which individuals indicate the severity of concern related to perceived negative consequences of anxiety-related physical sensations. The ASI-3 has been validated among smokers (Farris et al., 2015).

Test for nicotine dependence—(*TND;* Fagerström, 2012). The TND is a 6-item measure utilized to demonstrate the severity of an individual's daily dependence on nicotine.

Brief smoking consequences questionnaire-A—(*BSCQ-A;* Rash & Copeland, 2008). The BSQ-A is a 25-item questionnaire assessing negative and positive smoking outcome expectancies. For the purpose of this study, we employed the Social Facilitation subscale to assess social expectancies related to smoking and the Craving/Addiction subscale to assess expectancies related to craving satisfaction.

Reasons for quitting smoking—(*RFQ;* Curry et al., 1990). The RFQ is a 20-item self-report measure utilized to assess motivation for quitting smoking. In the present sample, we examined the Health Concerns subscale to measure cessation motivations related to current or potential health problems. In line with our theoretical basis for selecting relevant variables, we selectively included the Health Concerns subscale to assess physical health expectancies.

Data analytic plan

First, we tested the hypothesis that younger adults were more likely than older adults to drop before their quit date during a smoking cessation trial, using logistic regression (Droppers = 0, Non-Droppers = 1) in SPSS 25. Next, we assessed whether smoking related health motivations, social expectancies, and perceived severity of cravings affected the strength of relation between age and attrition, by adding these three variables to the logistic regression along with age. We tested whether the relation between age and dropout was significantly reduced by accounting for these psychological variables, and whether these variables were

significantly related to dropout. The significance of the decrease in the regression coefficient for age when accounting for the additional variables was tested using the McGuigan & Langholtz method (MacKinnon et al., 2002). Finally, since the reasons of dropout might be different in the two very different treatment conditions (vigorous exercise vs. wellness education), we explored whether treatment condition moderated the relations between the four variables (age and the psychological variables) and dropout.

As there was a significant difference in the proportion of participants who were Droppers in the two treatment groups (vigorous-intensity exercise intervention: n = 29 droppers out of 72 participants [40.3% of "exercise" participants] vs. wellness education intervention: n = 13 droppers out of 64 participants [20%]), treatment condition was included as a covariate in all analyses (see Jacquart et al., 2017). Additionally, baseline anxiety sensitivity (ASI; Taylor et al., 2007) and baseline nicotine dependence (TND; Fagerström, 2012) were also included as covariates in all analyses. The ASI-3 and TND were included because they have been previously related to smoking cessation (Breslau et al., 2001). Finally, sensitivity analyses were also performed.

Results

Correlations between age, health concerns, social expectancies, and expected severity of cravings were calculated using Pearson's r (Figure 1). Results indicated that age and health motivation were not significantly related, $r(135) = 0.11$, $p =.23$. However, higher age was significantly related to lower social expectancies, $r(135) = -0.30$, $p = <.001$, and to lower expected severity of cravings, $r(135) = -0.18$, $p = .045$.

Relation of age to dropout

Controlling for baseline ASI, baseline TND, and treatment condition, higher age was significantly related to lower log odds (and hence lower probability) of dropping out, $b = .046$, Wald $\chi^2(1) = 5.71$, $p = .017$, $OR = 1.05$, $95\%CI$: [1.01, 1.09] (see Figure 2). In this analysis, treatment condition was also significantly related to dropout, with participants assigned to vigorous-intensity exercise having higher log odds of dropping out than those assigned to wellness education, $b = .97$, Wald $\chi^2(1) = 5.38$, $p = .020$, $OR = 2.65$, $95\%CI$: [1.16, 6.03]. Neither ASI nor TND were significantly related to dropout (ps > .44).

Effects of health concerns, social facilitation, and cravings on dropout

To determine whether health concerns, social facilitation, and/or cravings accounted for the effect of age on dropout, these three variables were added to the logistic regression predicting dropout. None of these variables was significantly related to dropout (all $ps>.44$), and the Nagelkerke R^2 of this model (.145) was only modestly higher than that for the model without these three predictors (.133). Further, age remained significantly related to dropout when controlling for these additional variables, $b = .047$, Wald $\chi^2(1) = 5.10$, $p = .024$, $OR = 1.05$, $95\%CI$: [1.01, 1.09], and the regression coefficient for age actually *increased* (if very slightly) in this model. Since the regression coefficient for age actually *increased* when accounting for health concerns, social facilitation, and cravings, it made no sense to test whether it significantly *decreased* when accounting for these variables in this model. As in

the previous model, treatment condition remained significantly related to dropout, $b = 1.03$, Wald $\chi^2(1) = 5.36$, $p = .021$, $OR = 2.80$, $95\%CI$: [1.17, 6.71], but ASI and TND were not related to dropout (ps > .61).

Exploratory analysis: treatment condition moderating the effects of health concerns, social facilitation, and cravings on dropout

To investigate treatment condition as a moderator of the effects of the psychological variables on outcome, we added the interaction of treatment condition and each of the three psychological variables to the model. None of the interactions was significant (ps > .08).

Sensitivity analyses

Because the effect of age on dropout might be different for the two different treatment conditions, the interaction of age and treatment condition was added to all the above analyses and the models were recomputed. The age x treatment condition interaction was not significant in any of the analyses (ps>.73), and the other results from those analyses were not changed by adding this interaction to those analyses. Other sensitivity analyses examined whether the relation between age and dropout was quadratic by adding a quadratic term to the analyses. The quadratic terms were not significant in any analysis.

In further sensitivity analyses, all analyses were repeated using survival analyses which examined whether our variables were related to *time* to dropout (rather than to dropout yes/no). Results of these sensitivity analyses, using Cox Regression, were identical (in terms of which variables were significant) to those of our logistic regressions.

Discussion

The current study aimed to examine the relationship between age and pre quit-day attrition in a smoking cessation intervention. We found older smokers had a significantly greater likelihood of continuing with treatment past quit day than younger smokers. These results are consistent with evidence that found younger age was also related to greater odds of dropping early from smoking cessation treatment while older age was related to increased odds of attending smoking cessation treatment (Audrain-McGovern et al., 2007; Brorson et al., 2013; Cosci et al., 2011; Ferguson et al., 2005; Leeman et al., 2006). This relationship may exist for a number of logistical, treatment related, and/or other reasons. Younger smokers may be less likely to commit to treatment, have less time and energy to devote toward a scheduled quit day, and be more likely to lose motivation to quit as the scheduled quit-day approaches.

Research and theory suggest there are several reasons older adults may be more likely to adhere to cessation programs past quit day than younger adults (Dietz et al., 2013; Doolan & Froelicher, 2008; Luczczynska & Schwarzer, 2005; Villanti et al., 2016; Walker & Loprinzi, 2014). First, persistent smoking behavior among young adults has been strongly associated with self-identified status as a smoker and social lifestyle variables which may make approaching quit day more difficult (Dietz et al., 2013). Specifically, young people with a high frequency of visiting bars and clubs, consuming alcohol, and socializing with other smokers are four times less likely to quit smoking (Dietz et al., 2013). Further, social

factors appear to negatively predict levels of treatment engagement and subsequent treatment success among young adults as opposed to older adults (Dietz et al., 2013). The lack of predictive relation between social facilitation expectancies and treatment attrition in our study suggests that social facilitation may relate to smoking cessation but apparently plays a small role in pre quit-day attrition rates, at least in this sample. Even though younger adults are more likely than older adults to fear negative social consequences when quitting smoking (i.e., social awkwardness, feeling as if one does not belong, nervousness in social situations), these social factors were not significantly involved in pre quit-day attrition in the current study. It is possible that social facilitation expectancies are better suited to describe which young smokers are motivated to seek cessation treatment. Younger smokers who feel their identity is largely tied to their status as a smoker may be less likely to seek cessation treatment in the first place. Therefore, while younger smokers may be more likely than older smokers to fear negative social evaluation, this particular construct appears unrelated to an individual's likelihood of adhering to prescribed treatment beyond quit day.

Secondly, previous research suggests that older adults are more likely to endure uncomfortable smoking related cravings than younger smokers because younger adults perceive cravings to be acutely uncomfortable, and are thus more fearful of quit day (Dierker & Mermelstein, 2010; O' Loughlin et al., 2003; Villanti et al., 2016; Walker & Loprinzi, 2014). Although it is true that younger smokers in the current sample were more likely to perceive greater challenges for the designated quit date due to expected unmanageable cravings, craving aversion did not contribute to pre quit-day attrition rates. Similarly, although younger smokers in the current sample did report less concern about the health consequences of smoking than the older smokers, these concerns were not related to dropout in the current sample. These results may be related to the fact that the current sample was selected based on elevated anxiety sensitivity. Future research should investigate whether our findings replicate in a sample of smokers who do not have elevated anxiety

It is important to consider the present findings in light of several limitations. The original study was not designed to test for age specific differences and did not target specific age-cohorts (Smits et al., 2012); therefore, we do not have extensive information regarding age relevant social and environmental variables potentially involved in quit day preparation. Additionally, the nature of our sample presents its own set of limitations. Although our sample included a large range of ages (Non-Dropper: age range = 22–64; Dropper: age range = 22–60), there is room for future studies to examine an even broader range of ages. Including individuals younger than 22 and older than 64 may help to better refine and augment smoking cessation treatments. Further, this study examines the effects of a rather unique intervention, involving 6-weeks of lifestyle modification (i.e., exercise and wellness education) preceding the quit date and includes individuals belonging to a subgroup of smokers of whom express relatively high levels of anxiety sensitivity. Given these specifics, it is important to consider that the present findings may not be generalizable to wider clinical populations. In order to sufficiently describe trends existing between age and pre quit-day attrition, future research should include larger samples, investigate the effects of an array of smoking cessation interventions, and measure variables that may be explicitly implicated in the relationship between age and pre-quit attrition.

The current findings support existing research that highlights younger age as it relates to elevated pre quit-day attrition rates in smoking cessation trials. However, this study fails to adequately explain the relationship between younger age and increased pre quit-day attrition. Importantly, future research should seek to understand the pre-quit attrition problem existing amongst younger smokers. Extant research does not provide a plausible explanation for the root of this problem and clinical researchers are accordingly uninformed on how to develop evidence-based pre-treatment interventions to effectively address it. Future research should examine the extent to which other theoretically informed variables related to positive behavior change, such as perceived self-efficacy, goal setting, and social encouragement, predict adherence to smoking cessation interventions. Given this knowledge and considering the current and impending negative public health implications, it is critical that future research identifies the variables related to pre quit-day attrition during smoking cessation trials amongst the young adult population.

Funding

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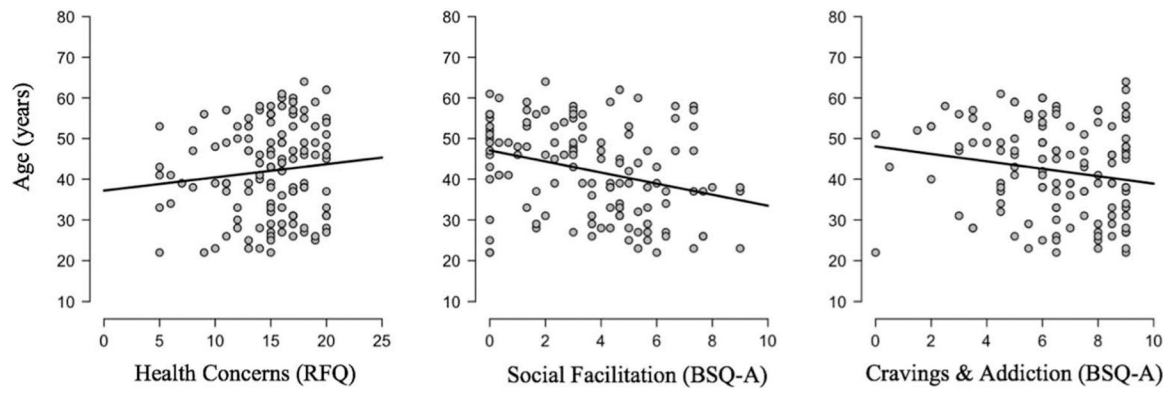**Figure 1.**

Correlations between age and a) health motivation (Pearson's r = 0.11, p =.23), b) social expectancies (Pearson'sr= −0.30, p <.001*), and c) expected severity of cravings (Pearson'sr= −0.18, p =.045*).
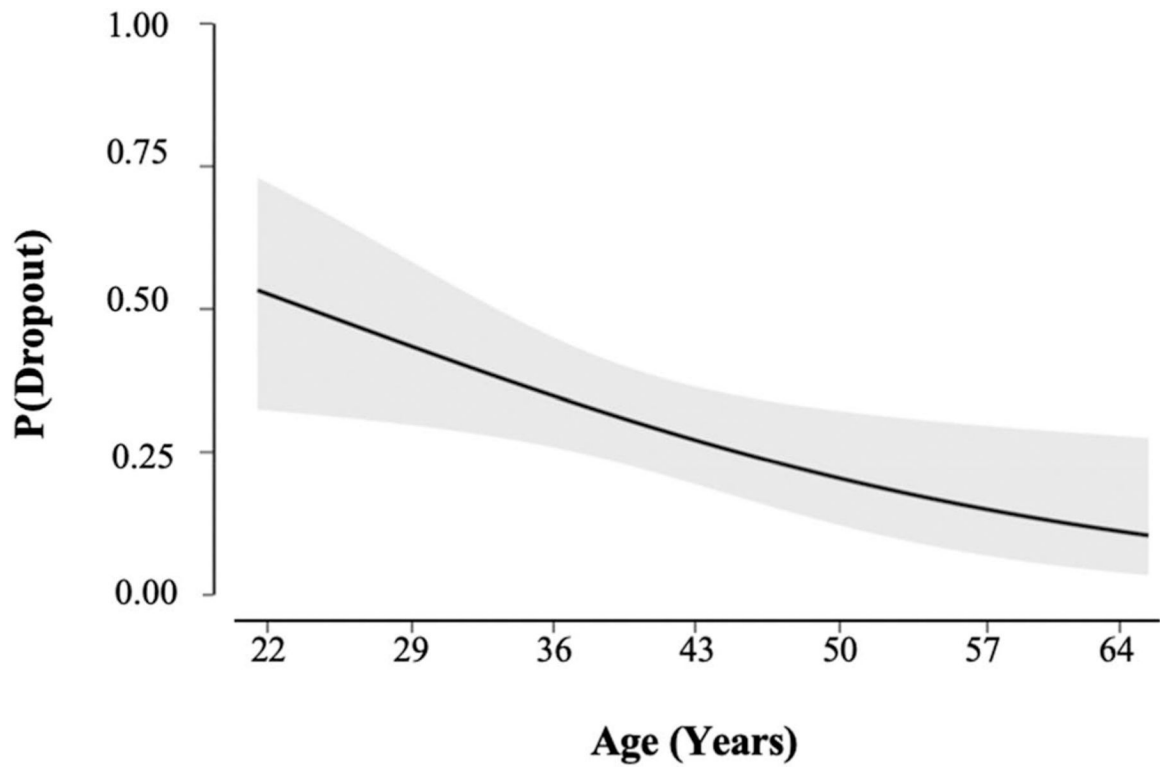
Figure 2.
Age and Pre-quit dropout rates. The probability of a participant dropping out of treatment before quite date decreases with age. The grey shaded area around the line represents the 95% confidence interval.

Table 1.

Baseline and demographics characteristics.

	Non-Droppers ($n = 94$)		Droppers ($n = 42$)	
	n	M (SD)	*n*	M (SD)
Age (years)	94	43.83 (11.01)	42	38.71 (11.05)
TND	86	5.36 (1.91)	39	5.43 (2.00)
ASI-3	94	18.11 (11.80)	42	18.95 (11.20)
Health Concerns (RFQ)	83	14.71 (3.88)	38	14.95 (3.85)
Social Facilitation (BSCQ-A)	86	3.58 (2.54)	38	3.63 (2.29)
Craving & Addiction (BSCQ-A)	86	6.33 (2.14)	38	6.64 (2.41)
	n (%)		*n* (%)	
Treatment Condition (Vigorous- Intensity Exercise Intervention)	43 (45.7)		29 (69.0)	
Sex (Females)	47 (50.0)		24 (57.1)	
Education (Graduate School)	68 (72.3)		35 (83.3)	
Marital Status (Single)	50 (53.2)		28 (66.7)	
Ethnicity (Hispanic or Latino)	8 (8.5)		3 (7.1)	
Race				
White	64 (68.1)		28 (66.7)	
Black or African American	17 (18.1)		11 (26.2)	
Asian	3 (3.2)		0 (0.0)	
Other or Not reported	4 (4.3)		1 (2.4)	

M = mean; SD = standard deviation; TND = Test for Nicotine Dependence; ASI-3 = Anxiety Sensitivity Index-3; RFQ = Reasons for Quitting (Curry et al., 1990); BSCQ-A = Brief Smoking Consequences Questionnaire- A (Rash & Copeland, 2008).