Predictors of Cessation Outcomes Among Older Adult Smokers Enrolled in a Proactive Tobacco Quitline Intervention

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Objectives. To identify predictors of older adults' likelihood of quitting following engagement in a proactive tobacco quit line.

Methods. Older (≥60 years) participants enrolled in a four-session quit line with eight-weeks of nicotine replacement therapy reported demographics, beliefs, and information about tobacco use. Point prevalence abstinence was reported at 3 and 12-months.

Results. In final models, endorsement of quitting to take control of one's life and confidence in quitting were positively associated with 3-month cessation (*OR*=1.74, *95% CI*=1.16, 2.62; *OR*=1.75, *95% CI*=1.21, 2.52, respectively). At 12 months, stronger endorsement of quitting to take control of one's life and decreased nicotine dependence were associated with higher cessation (*OR*=1.51, *95% CI*=1.05, 2.17; *OR*=0.84, *95% CI*=0.71,0.99, respectively).

Discussion. For tobacco cessation among older adults, programs should provide additional support to those with higher nicotine dependence, promote quitting self-efficacy, and encourage quitting as means to gain control of life and health.

Keywords: Geriatric health; tobacco cessation; older adult substance use; cessation interventions

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Approximately 14% of the U.S. population (i.e., 34.2 million adults) smoke cigarettes, and this use constitutes the leading cause of disease and preventable death (Cornelius et al., 2020; World Health Organization, 2019). Unlike other age groups, which have shown significant declines in cigarette prevalence since the first Surgeon's General Report in 1964, rates among U.S. adults over age 65 years (hereinafter referred to as older adults) have not decreased [Cornelius et al., 2020; U.S. Department of Health and Human Services (US DHHS), 2014; US DHHS, 2020]. The lack of declining cigarette rates among older adults is concerning, given that this age group is more likely to be impacted by tobacco related morbidity and mortality than younger smokers (Mons et al., 2015; US DHHS, 2014). Despite the widely held misperception that quitting smoking does not benefit older adults (Kerr et al., 2006; Yong et al., 2005), smoking cessation has significant short- and long-term health advantages for this age group (Doll et al., 2004; US DHHS, 2020). Smoking cessation can enhance an individual's quality of life by improving the quality of comorbid chronic health conditions and diminishing the financial burden of cigarettes (US DHHS, 2020). At any age, smoking cessation reduces the risk of developing or dying from many types of cancer (e.g., lung, pancreatic, kidney, cervical), as well as cardiovascular disease and stroke (US DHHS, 2020). In fact, cessation at age 60 can increase the life span by approximately three years (Doll et al., 2004).

Tobacco quit lines have been widely used as a cost-effective, telephone-based cessation intervention (Lichtenstein et al., 2010). While quit lines are convenient, diminish logistical barriers to care, and offer access to free cessation counseling (Lichtenstein et al., 2010), older adult smokers are less aware of quit lines than younger smokers (Kaufman et al., 2010; Kulak &

LaValley, 2018) and are less likely to access a quit line compared to those in mid-life (Kulak & LaValley, 2018).

Although personalizing messages within cessation treatment improves quit rates (Krebs et al., 2010; Noar et al., 2007), cessation intervention trials are rarely tailored to older smokers (Chen & Wu, 2015; Doolan & Froelicher, 2008; Smith et al., 2019; Zbikowski et al., 2012). Cessation trials will sometimes examine age group differences in quitting outcomes, but even fewer report outcomes exclusively among older adults (Chen & Wu, 2015; Doolan & Froelicher, 2008; Smith et al., 2019; Zbikowski et al., 2012). Among this limited research, older adult samples typically include a wide age range (50 years of age and older) and rarely do studies examine smokers exclusively over 60 years (Chen & Wu, 2015; Doolan & Froelicher, 2008; Smith et al., 2019; Zbikowski et al., 2012). In summary, although the older adult population is expected to double between 2012 and 2050 (Ortman et al., 2019), the lack of inclusion of older smokers in cessation research is a product of systematic ageism and a barrier to health equity (McAfee et al., 2021).

In order to tailor treatment to be inclusive of the needs of older smokers, it is important to explore individual characteristics that facilitate higher quit rates within this population. Of the limited research in this area, across treatment modalities, factors such as concurrent use of nicotine replacement therapy (NRT), less nicotine dependence, less time smoking, higher educational background, female gender, more concern about health, and identifying more cons and less pros of smoking, are characteristics and beliefs that improved quit success (Chen & Wu, 2015; Ferketich et al., 2012; Hall et al., 2009; Hsu et al., 2018; Ossip-Klein et al., 1997; Tait et al., 2008; van der Aalst, 2012). Because of the changing tobacco landscape with increases in e-cigarettes or ENDS (electronic nicotine delivery system) use (Cornelius et al., 2020; US DHHS,

2016), it is important for more current trials to explore how newer products have impacted beliefs and likelihood of quitting cigarettes in this population. Further, although quit lines are a widely available and a cost-effective resource, no study explored predictors of quitting among older smokers enrolled in this type of intervention.

Thus, this study's primary aim is to examine individual characteristics predicting successful quitting at the 3 and 12-month follow-ups of a tobacco quit line intervention specifically within a subsample of smokers ≥ 60 years of age. Secondly, in order to compare current findings to previous studies (Chen & Wu, 2015; Doolan & Froelicher, 2008; Smith et al., 2019; Zbikowski et al., 2012), we will compare cessation outcomes among older (≥60 years) versus younger (≤59 years) adults. Results aim to provide information about how to tailor cessation interventions, particularly tobacco quit lines, to the unique needs of older adults in order to optimize cessation success in this population.

Methods

Parent Study Overview

The parent study evaluated the effectiveness of a quit line for smoking cessation (2015-2020) among TRICARE beneficiaries. TRICARE is the Department of Defense health care system and includes U.S. military active duty and coast guard, retirees, and family members. For more detailed information please see Little et al., (2017).

Recruitment

Participants were TRICARE beneficiaries (≥ 18 years of age) smoking five or more cigarettes per day for ≥ 1 year and who were able to understand consent procedures. Individuals in basic military training were excluded because this period includes an enforced tobacco ban and telephone access is not easily available. Beneficiaries who were unwilling to discontinue

smoking cessation products [i.e., NRT (nicotine replacement therapy), Wellbutrin, or Chantix] were excluded, along with those who were pregnant, breastfeeding, or planning to become pregnant in the next year. Participants who reported unstable heart conditions or had mailing restrictions were enrolled in behavioral treatment only and not provided NRT.

Procedures

The parent study was approved by the 59th Medical Wing Institutional Review Board of the Department of Defense.

Baseline. At baseline, participants completed questionnaires about demographics, history of cigarette use and quit attempts, past use of cessation resources, current tobacco use, confidence to quit, beliefs about cessation and reasons for quitting. All participants received four proactive telephone sessions with a counselor within an 8-week period. The same counselor provided all four treatment sessions. Participants were also mailed eight weeks of NRT patches (strength determined by smoking frequency at baseline). In four sessions of approximately 40 minutes each, counselors used motivational interviewing strategies to facilitate motivation and self-efficacy for smoking cessation (Miller et al., 2012; Moyers et al., 2010). This collaborative style of intervention has been found to be effective for smoking cessation interventions (Heckman et al., 2010). All counselors received 100 hours of motivational interviewing training and participated in weekly supervision to maintain their skills (Moyers et al., 2010).

Three-month follow-up. At three-months, individuals completed questionnaires about current use of use of nicotine and tobacco products. Those who relapsed or failed to quit (i.e., reported smoking even a puff of a cigarette in the last seven days) were asked to re-engage with the intervention. Those who re-engaged were randomized using individualized block stratification to one of three arms: recycle, reduction, or choice condition. The recycle condition repeated the

intervention with the same counselor with an additional eight weeks of NRT (patch). Those in the rate reduction condition were enrolled in a three-session quit line intervention with the same counselor. These sessions focused on helping the participant to reduce the number of cigarettes smoked by 75% across the three sessions. Additionally, NRT in the form of the gum was provided for up to 16 weeks. Those randomized to the choice condition were informed about the rationale for both the recycle and rate reduction conditions and told they could choose one of the two.

Twelve-month follow-up. All participants who completed measures at baseline, regardless of re-engagement at three-months, were contacted nine months later for the 12-month follow-up and assess current tobacco use.

Current Study Participants

The older adult sample in the current study are those who completed baseline screening of the parent study and are $\geq$ 60 years of age (*n*=186) (Table 1). Among this sample (*n*=186), at 3 months, 88% (*n*=163) completed follow-up measures (Figure 1). Thus, at 3-month follow-up with penalized imputation, 72 participants out of 186 (38.7%) successfully quit and 114 participants out of 186 (61.3%) were classified as continued smokers (i.e., reported still smoking or lost to follow-up). At the 12-month follow-up, 91% (*n*=169) of 186 individuals who completed baseline measures also completed 12-month procedures. Thus, with penalized imputation, at the 12-month follow-up, 36.0% (*n*=67 out of 186) reporting no use (not even a puff) of cigarettes in the past seven days and 64.0% (*n*=119 out of 186) were continued smokers (i.e., reported still smoking or lost to follow-up.

Measures

Baseline Measures

Demographics. Demographics included gender (women, men), race (White/Caucasian, individuals of non-White racial minority backgrounds), ethnicity (non-Hispanic/Latino, Hispanic/Latino), marital status (married/living as married versus widowed, divorced, separated, or never married), and highest level of education (high school diploma/GED versus some college/vocational training/associate degree or higher). Age was measured continuously, as well as categorized as older adults (aged $\geq$ 60 years) and younger adults (age range 18 – 59 years) depending on analysis. Military status was classified as (non-military TRICARE beneficiary and military beneficiary).

Cigarette use history. Participants reported how many years they had smoked cigarettes and completed the Fagerstrom Test for Nicotine Dependence, a six-item validated measure for nicotine dependence (Heatherton, et al. 1991). The six items from this measure were summed with scores ranging from (0) to (10), with higher numbers indicating more dependence.

Quitting history. Participants reported how many times they had tried to quit smoking cigarettes (for 24 hours or more) in the last 12 months. Number of previous quit attempts were classified as *none*, *one time*, *two times* or *three or more*.

Ever use of cessation resources. Participants reported ever use of NRT to help quit smoking (*yes* or *no*). Participants also reported ever use of e-cigarettes to quit smoking (*yes* or *no*). If yes, participants were asked if they were currently (*yes* or *no*) using e-cigarettes to quit. Additionally, participants reported if they had ever used any of the following alternative methods in a quit attempt (*yes* or *no*): Chantix, Zyban/Wellbutrin/Bupropion, group quit program, individual counseling or therapy to quit, internet quit smoking program, another tobacco quit line, or any other method (e.g., acupuncture, hypnosis).

Concurrent tobacco use. Other tobacco users were those who reported concurrent (in addition to cigarettes) past 30-day use of one or more of the following products: smokeless tobacco, snus, e-cigarettes, cigars, cigarillos/little cigars, pipe, hookah/water pipe, roll your own cigarettes.

Beliefs about cessation. Participants were asked, "How beneficial do you think quitting cigarettes is to your health?" Responses ranged from *not at all* to *extremely*. Responses were classified dichotomously as *extremely* versus *all other responses*.

Reasons for quitting. Participants were given options as reasons for cessation: to save money, I am getting pressure from others, so that my hair and clothes won't smell, it is difficult to find a place to smoke, to improve my overall health, to be a good role model for others, so that I can be in control of my life, to improve my overall physical fitness, because smoking may have a negative effect on my career. Participants identified if these reasons were *not at all true* (1) to *extremely true* (5) for a reason they wanted to quit (measured continuously). A summary score of these reasons for quitting was also calculated. Each item was dichotomized (0 = *not at all true* vs. 1= *all other responses*). Each reason endorsed by participants was added cumulatively into a total score with a range of 0 to 9 reasons.

Confidence to quit. Participants were asked "How confident are you that you will quit smoking someday?" and "How confident are you that you will quit smoking in the next six months?" Responses ranged from: *not at all* (1) to *extremely* (5), coded continuously.

Intervention Characteristics

At 3 months, we compared individuals who completed a second dose of treatment versus those who did not (i.e., those who had either quit smoking at 3 months, were lost to follow-up, or refused to re-engage with the study).

Cessation Outcomes

At the 3-month and 12-month follow-ups, we collected point prevalence abstinence by asking participants, "Have you smoked a cigarette (even a puff) in the past 7 days?" Those who responded *no* were coded as those who quit smoking (1). Those who responded *yes* or did not complete follow-up measures, were coded as continued smokers (0). Using penalized imputation to classify those lost to follow-up as continued smokers is a conservative estimate of quitting commonly used in smoking cessation intervention trials (West et al. 2005).

Data Analysis

Descriptive statistics were calculated for predictors (Tables 1-2). Outcomes included cessation at 3-month and 12-months [*smoking cessation* (1) versus *continued cigarette use* (0)]. Our analysis aimed to determine which of baseline variables predicted successful quitting vs. continued smoking. Due to the small number of individuals reporting currently using e-cigarettes for cigarette cessation (n=10), we combined ever and current use of e-cigarettes for cessation into one predictor of outcomes. Initially, each predictor variable (presented in Tables 1-2) was tested in a univariate logistic regression to determine whether it was predictive of outcome at 3 months, significant at p<.10 level. Subsequently, these variables were simultaneously entered as predictors in a multiple logistic regression predicting cessation outcome. A process of backward elimination of nonsignificant variables was used to identify the best set of predictors of quit outcome in the multivariable analysis. For each step, the most nonsignificant predictor (p >.05) was removed, and the regression was recalculated until all nonsignificant (p >.05) predictors were eliminated. The same process was used to evaluate the 12-month outcome; however, we also tested the relationship between receiving a second dose of treatment (compared to those who had quit or refused reengagement) and 12-month quit success. Because receiving a second dose

of treatment was significantly ($p<.10$) related to 12-month outcome, we retained this variable in the final model. In secondary analyses, we determined whether older age ($\geq$ 60 years) was associated with greater quitting than younger age in this cohort. Using the entire sample, we compared age groups (older vs. younger) to predict quitting (1) vs. continued smoking (0) at 3 months and at 12 months with a multivariable logistic regression.

Results

Descriptive Statistics

This sample ranged from 60 to 79 years of age, with a *M* (*SD*) age of 66.5 (4.4) years. The sample is comprised of mostly White (i.e., 83.3% White/Caucasian, 11.3% Black/African American, 5.4% other racial background or multiracial), non-Hispanic (94.6%), military retirees (62.9%) and non-military TRICARE family members (36.6%). One participant reported active-duty military status. Approximately 59% of the sample identified as men and 41% as women. Of these participants, 18.3% had a high school education/GED, 49.5% had some college/Associates degree, 17.2% had a bachelor's degree, and 13.4% attended graduate school. Most of the sample were married or living as married (69.9%), 15.6% were widowed, 11.8% were divorced, 2.2% were never married, and one person was separated. Demographic characteristics of younger adults enrolled in the study and who completed baseline measures (*n*=428) (age range: 19 to 59 years), as well as the total sample (*n*=614) are presented in Table 1.

On average, this sample smoked for 44.0 years (*SD*=11.5) and had a Fagerstrom Test of Nicotine Dependence score of 4.5 (*SD*=2.2) out of 10, indicating a moderate level of dependence (Heatherton & Kozlowski, 1992). Most participants reported that they had tried NRT (76.3%) or an alternative cessation aid (71.7%; i.e., cessation medication, psychotherapy, quit lines, or any other method) and almost half (47.3%; *n*=88) had *ever* tried e-cigarettes to help them quit

smoking. Of these individuals (*n*=88), 10 (5.4% of the sample) were *currently* using these products for cigarette cessation. About 9% (*n*=16) of individuals were using an alternative tobacco or nicotine containing product concurrently with cigarettes at baseline. Of these 16 individuals, 13 (7.0% of sample) were using e-cigarettes. Because a small number (*n*=3) of individuals were poly users of tobacco products (i.e., concurrently using cigarettes and at least two other products in the past month), dual and poly users were combined in subsequent analyses.

Most participants (94.5%) believed that quitting smoking was *extremely* beneficial for one's health. Mean endorsements of reasons for quitting ranged; *because it will have a negative effect on career* was the lowest endorsed reason for quitting (*M*=1.9, *SD*=0.5) and *to improve one's health* was the highest endorsed reason (*M*=5.0, *SD*=0.3). When reasons for quitting were added cumulatively for each individual, on average participants endorsed 7.0 (*SD*=1.7) out of nine. Participants responded with a *M* score of 4.2 (*SD*=1.0) and 4.2 (*SD*=0.9) to confidence in quitting some day and confidence in quitting in the next six months, respectively.

Predictors of 3-Month Cessation

In unadjusted logistic regression models, multiple predictors were associated with 3-month cessation at the $p<.10$ level (Table 3). In the final multivariable model, a one unit increase in endorsing *to take control of one's life* as a reason for quitting was associated with a 74% higher odds of being quit (*OR*=1.74; *95% CI*=1.16, 2.62; *n*=184). A one unit increase in *confidence in quitting someday* was associated with a 75% higher odds of being quit (*OR*=1.75; *95% CI*=1.21, 2.52; *n*=184).

Predictors of 12-Month Cessation

Among older adults who had not quit smoking and were subsequently randomized to receive a second dose of treatment (i.e., re-engaged with the intervention; *n*=43), 18 participants (15.8%) were randomized to the recycle condition, 16 (14.0%) were randomized to the rate reduction condition and 9 (7.9%) were randomized to the choice condition. In a univariate logistic regression model, those who quit smoking or did not receive another round of treatment were significantly more likely to be quit at 12 months (*OR*=0.22; *95% CI*=0.09, 0.55; *p*=.001; *n*=186). In additional unadjusted logistic regression models, multiple predictors were significantly associated with 12-month cessation at the $p<.10$ level (Table 3). In the final multivariable model, each increased score in endorsing *to take control of one's life* as a reason for quitting was associated with a 51% increased likelihood of being quit (*OR*=1.51; 95% *CI*=1.05, 2.17; *n*=171) and each point *decrease* in *nicotine dependence* scores was associated with 19% higher odds of being quit at 12-months (*OR*=0.84; 95% *CI*=0.71, 0.99; *n*=171). Additionally, not receiving a second dose of treatment at 3 months compared to reengagement with treatment was associated with a 4.17 times increased likelihood of being quit at 12 months (*OR*=0.24; 95% *CI*=.09, .63, *n*=171).

Age Group Comparisons of Outcomes Among Entire Sample

In the entire adult sample, age [<59 years (0) vs. $\geq$ 60 years (1)] was not significantly associated with cessation at 3 months (*OR*=1.11; *CI*=0.78-1.59; *p*=.556; *n*=614) or 12 months (*OR*=0.89; *95% CI*=.62 -1.27; *p*=.517; *n*=614). Among those who had failed to quit at 3 months, age (<59 years vs. > 60 years) was not significantly associated with re-engagement (*OR*=0.85, *95% CI*= 0.52-1.40; *p*=.524; *n*=274).

Discussion

This study explored a variety of individual characteristics as predictors of quitting outcomes at 3 and 12 months among older adults enrolled in a proactive tobacco quit line study. The current sample had been smoking for an average of 44 years and reported moderate nicotine dependence (*M*=4.5 on Fagerstrom Test of Nicotine Dependence) (Heatherton & Kozlowski, 1992). Although these were individuals who had smoked for many years, this sample on average was highly motivated to quit. In the past year, they had tried to quit nearly twice (*M*=1.8 times) and had high scores in confidence in quitting some day and the next six months (*M*=4.2, *M*=4.2, respectively, out of 5). The majority had used NRT (76.3%) or some type of alternative aid (71.7%) to quit cigarettes before this study. Although only about 9% of this sample were concurrently using one or more alternative tobacco or nicotine containing product with cigarettes at baseline, notably the overwhelming majority of these individuals (13 out of 16) were using e-cigarettes specifically.

In terms of ENDS product use, about half had *ever* used e-cigarettes to aid in a quit attempt (47.3%), which was higher than a previous study finding only 16% of adults of all ages enrolled in quit lines had ever used e-cigarettes to quit tobacco (Vickerman et al., 2013). However, the higher proportion using e-cigarettes in the current study is not surprising, given that the Vickerman and colleagues (2013) study was conducted eight years ago, and ENDS products have increased in popularity since then (Cornelius et al., 2020; US DHHS, 2016). Among our sample, 7.0% were current users of e-cigarettes, of which 10 (5.4% of sample) were currently using these products specifically for cigarette cessation. Comparatively, Vickerman and colleagues (2021), found that about 15% of adults of all ages enrolled in tobacco quit lines in 2018 were concurrently using ENDS products, although it is unclear what percentage of these

individuals were using these products specifically for cigarette cessation (Vickerman et al., 2021).

Additionally, ever using e-cigarettes for cigarette cessation was also not associated with success in quitting. This finding is dissimilar from Vickerman and colleagues (2013), in which ever use of e-cigarettes for cigarette cessation was associated with poorer quit outcomes among adults in a tobacco quit line (Vickerman et al., 2013). However, ever using a cessation resources to help quit smoking in the current study was associated with a *higher* likelihood of continuing to smoke at 3 months. Perhaps those who had tried to quit prior to this study and had used other resources were individuals who have had more difficulty sustaining cessation. Because of the small sample size of current ENDS product users in this sample (n=13), we were unable to explore how current e-cigarette use and/or current e-cigarette use specifically for cigarette cessation predicted quit outcomes. However, findings do indicate it might be common for older adult smokers to try ENDS products for tobacco cessation at least once. Yet, concurrent use of e-cigarettes, motivated by any reason of use, during the time of accessing a tobacco quit line might be less common.

At 3 months, 38.7% of participants had quit cigarettes and 36.0% had quit at 12 months. Both of these rates are higher compared to quit rates obtained in the general population of adults using tobacco quit lines with free NRT (21% quit success) (Stead et al., 2013) but comparable to the average quit rate (36.7%) obtained from multi-modal randomized clinical trials (i.e., behavioral interventions and pharmacotherapy combined) of older adults (Chen & Wu, 2015). Thus, tobacco quit lines, offer an effective and logistically practical cessation treatment, and can be used to address the high rates of continued cigarette use among U.S. older adults. Clearly, more work is needed to translate the effects observed in research into practice.

Results from final models suggest the most important predictors for quit success included more strongly wanting to quit to take control of one's life, greater quitting self-efficacy, and a lower level of nicotine dependence. Wanting to take control of one's life as a reason for quitting was assessed through the endorsement of a single statement; thus, it would be helpful if future researchers could develop more psychometrically sound measures of this construct. Despite the limitations in the measurement of this construct, the association between wanting to quit to be in control of one's life and subsequent cessation in this study warrants future research. Notably, the three significant predictors of successful quitting in this study (e.g., wanting to be in control of one's life, quitting self-efficacy, and nicotine dependence) all involve constructs of independence and control, which research has shown to decline with age (Infurna et al., 2013; Lachman et al., 2011). Older individuals are more likely to experience uncontrollable age-related constraints on physical health and mobility, as well as to be exposed to ageist beliefs (e.g., that older adults are helpless; Lachman et al., 2011). Importantly, a stronger sense of control, or self-efficacy, in older age is associated with better health outcomes (e.g., longer survival times, improved mental health; Infurna et al., 2011; Infurna et al., 2013; Lachman et al., 2011; Nicolaisen et al., 2018; Turiano et al., 2014). Future cessation studies for older adults might consider assessing and promoting perceived control over cessation and other health goals. Perhaps acquiring agency through self-directed goals can be a strong motivator for older adults in tobacco quit lines, as well as can help improve overall health and wellbeing. Facilitating self-directed and person-centered approaches to attaining cessation goals might help older adults feel more in control of their health.

The current sample of older adults (N=186) was a subpopulation of the larger parent study (N=614); and thus, was not powered to test the efficacy of the three treatment conditions in

relations to quit outcomes. Receiving a second dose of treatment at 3 months was associated with a lower likelihood of quitting at 12 months in our population. However, at the individual level, it is not likely that a second dose of treatment was detrimental for quit success. Results indicate that those who successfully quit at 3 months were also much more likely to be quit at 12 months. In fact, in additional analyses, we did find that those who quit at 3 months were 20 times more likely to be quit at 12 months, compared to those who continued to smoke at 3 months (*OR*=19.93, *95% CI*=9.26,42.88). In general, long-term quit success was most likely to be achieved within the first 3 months of treatment.

In secondary analyses, this study found no difference in 3-month and 12-month quit success between older (≥60 years of age) and younger (<59 years) smokers. This finding is inconsistent with prior research in which older adult smokers had higher quit rate success than those younger (Doolan & Froelicher, 2008). Further, Chen & Wu (2015) found that among older adults, increasing age was associated with increased quit success (Chen & Wu, 2015). However, to our knowledge, no study explored age group differences in quit success among adults in tobacco quit lines with free NRT. Thus, future research is needed to assess age group differences specifically in the effectiveness of this type of intervention. Our study indicates that older adults experience comparable quit success as those younger when engaging in a tobacco quit line.

Limitations. Although anxiety and depressive symptoms have been associated with quit outcomes among older adults in the literature (Ferketich et al., 2012; Tait et al., 2008), this study did not assess mental health symptoms. In addition, poor health factors have been associated with a higher likelihood of cessation among older adults (Choi & DiNitto, 2015; Cohen-Mansfield, 2016; Donzé et al., 2007; Sachs-Ericsson et al., 2009; Shahab et al., 2015; Whitson et al., 2006). However, the current study did not assess specific health information regarding

chronic illness. Secondly, this subsample of older adults was not large enough to analyze quit outcome differences between treatment conditions. Further, our sample was not large enough to explore relationships between patterns of ENDS use and quit outcomes. Future studies should assess large samples of older adults in order to better capture how ENDS products might impact quit outcomes among those trying to quit cigarettes in tobacco quit lines. Because our sample included TRICARE beneficiaries, generalizability might be limited to civilians. However, 36.6% of our sample were civilians (i.e., family members of those in the military). Finally, future studies should explore individual characteristics associated with tobacco quit line outcomes among larger, more diverse samples of older adults.

Conclusion

Despite the aging U.S. population (Ortman et al., 2019), the lack of declining cigarette rates in older age (Cornelius et al., 2020), and this population's higher risk for tobacco morbidity and mortality (Mons et al., 2015; US DHHS, 2014), older adults are underrepresented in cessation research (Chen & Wu, 2015). Aimed at addressing this gap, this study expanded upon the literature by exploring individual characteristics associated with long-term quit success in a tobacco quit line among a sample exclusively of older adults. Findings provide important considerations for how to tailor cessation programs for older adults. Firstly, promoting quitting self-efficacy and perceived control in cessation and health goals might be particularly important for older adults trying to quit cigarettes, given that this age group is more likely to experience a decline in perceived control over life's circumstances. Secondly, older smokers with higher nicotine dependence might need additional support during cessation programs. Although a subsample of these older adults was highly motivated to quit and re-enrolled for a second dose of treatment, they were not abstinent from cigarettes at the one-year follow-up. Normalizing a long

history of cigarette use and quit attempts and facilitating discussions about reasons for unsuccessful quit attempts in the past could be important topics for quit line counselors to broach with older adults. Future tobacco quit line studies should assess patterns of ENDS use and the concurrent use of other tobacco products in relationship to quit success in larger gender and racially/ethnically diverse samples of exclusively older adults.

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Table 1.

Baseline Demographic Descriptives of Older Adult Sample, Younger Adult Sample, and Total Sample

	Older Adults (*N*=186)	Younger Adults (*N*=428)	Total Sample (*N*=614)
	n (%)	*n* (%)	*n* (%)
Gender			
Male	110 (59.1)	237 (55.4)	347 (56.5)
Female	76 (40.9)	191 (44.6)	267 (43.5)
Race			
White/Caucasian	155 (83.3)	341 (79.7)	496 (80.8)
Non-White racial minority	29 (15.6)	85 (19.9)	114 (18.6)
Ethnicity			
Non-Hispanic/Latino	176 (94.6)	374 (87.4)	550 (89.7)
Hispanic/Latino	7 (3.8)	53 (12.4)	60 (9.8)
Education			
High school diploma/GED	34 (18.3)	92 (21.6)	126 (20.7)
Greater than a high school diploma/GED	149 (80.1)	333 (77.8)	482 (78.5)
Marital Status			
Married/living as married	130 (69.9)	301 (70.3)	431 (70.2)
Not married or living as married	56 (30.1)	127 (29.7)	183 (29.8)
Military Status			
Retired military	117 (62.9)	87 (20.3)	204 (33.2)
Non-military TRICARE beneficiary	68 (36.6)	152 (35.5)	220 (35.8)
Active Duty	1 (0.5)	188 (43.9)	189 (30.8)

Note: GED=General Educational Development; Older adult age range: 60 -79 years; Younger adult age range: 19 – 59 years; *N*'s reflect individuals who completed baseline measures.

Table 2.

Descriptives of Predictor Variables

		M	*SD*	Range of responses	*n* (%)	Missing (%)
	Years Smoked	43.96	11.53	5, 67	-	(.00)
	Nicotine Dependence	4.50	2.12	0, 10	-	(.08)
	Past Year Quit Attempts	1.80	3.04	0, 20	-	(.01)
Reasons for Quitting	To save money	3.62	1.50	1,5	-	(.00)
	Pressure from others	2.85	1.67	1,5	-	(.00)
	Hair and clothes won't smell	3.41	1.49	1,5	-	(.00)
	Difficult to find a place	2.19	1.32	1,5	-	(.00)
	To improve health	4.95	0.29	3,5	-	(.00)
	To be a good role model	3.86	1.46	1,5	-	(.01)
	To control one's life	4.41	1.16	1,5	-	(.00)
	To improve physical fitness	4.82	.51	3,5	-	(.01)
	Negative effect on career	1.89	1.39	1,5	-	(.01)
	Summary Score	7.04	1.71	2,9	-	(.02)
Confidence in quitting	Some day	4.19	1.00	1,5	-	(.01)
	In the next six months	4.24	.94	1,5	-	(.02)
Ever use of cessation resources	NRT (yes)	-	-	-	14 (76.3)	(.00)
	E-cigarettes (yes)	-	-	-	88 (47.3)	(.00)
	Alternative cessation medication/resources (*yes*)	-	-	-	132 (71.7)	(.01)
Concurrent tobacco use	Concurrent use of one or more other products (*yes*)	-	-	-	16 (9.4)	(.09)
Cessation health belief	Quitting improves health (response: *extremely*)	-	-	-	171 (94.5)	(.03)

Note: Older adult sample (*N*=186); NRT = nicotine replacement therapy; predictors measured at baseline

Table 3. *Univariate Associations with Baseline Predictors and Cessation Outcomes*

	Baseline Predictor Variables	**3 Month Cessation (continued smoking vs. quit)**		**12 Month Cessation (continued smoking vs. quit)**	
		OR	*CI*	*OR*	*CI*
Demographic & Military Characteristics	Age ‡	1.03	.96, 1.10	1.03	.96, 1.10
	Race (*White* vs. non-White*)	.79	.34, 1.81	1.28	.57, 2.88
	Gender (*women* vs. men*)	.88	.48, 1.60	.72	.39, 1.33
	Marital Status (*married* vs. non-married*)	.53 †	.27, 1.04	.88	.45, 1.69
	Educational background (*high school/GED**)	1.03	.48, 2.22	1.26	.57, 2.78
	Ethnicity (*non-Hispanic* vs. Hispanic*)	.99	.91,1.08	.68	.13, 3.62
	Military Status (*non-military* vs. military*)	1.14	.62, 2.11	1.29	.69, 2.42
Cigarette Use History	Years Smoked ‡	.98 †	.95, 1.00	.97 †	.94, 1.0
	Nicotine Dependence ‡	.83 †	.71, .97	.82 †	.70, .96
Quitting History	Past Year Quit Attempts (*none**)	1.05	.82, 1.34	1.01	.79, 1.30
Ever Use of Cessation Resources	NRT (*no* vs. yes*)	.61	.31, 1.22	.86	.43, 1.73
	E-cigarettes (*no* vs. yes*)	.83	.46, 1.50	.85	.47, 1.56
	Alternative Resources (*no* vs. yes*)	.54 †	.28, 1.03	.63	.33, 1.22
Other Tobacco	Concurrent use of one or more other products (*no**	1.12	.40, 3.17	1.32	.47, 3.75
Belief about	Beneficial for health (*other responses* vs.*	6.24 †	.77, 50.35	5.38	.67, 43.48
Reasons for Quitting	To save money ‡	1.28 †	1.04, 1.58	1.21	.98, 1.49
	Pressure from other ‡	1.15	.96, 1.37	1.04	.87, 1.25
	Hair and clothes won't smell ‡	1.33 †	1.07, 1.64	1.06	.86, 1.30
	Difficult to find a place ‡	1.27 †	1.01, 1.59	1.18	.94, 1.47
	To improve health ‡	1.29	.43, 3.85	.69	.25, 1.88
	To be a good role model ‡	1.37 †	1.10, 1.72	1.03	.84, 1.26
	To control one's life ‡	1.95 †	1.29, 2.93	1.53 †	1.09, 2.15
	To improve physical fitness ‡	1.60	.82, 3.14	.98	.54, 1.77
	Negative effect on career ‡	1.12	.91, 1.38	1.18	.90, 1.38
	Summary Score ‡	1.34 †	1.12, 1.67	1.14	.95, 1.37
Confidence in Quitting	Some day ‡	1.94 †	1.34, 2.80	1.27	.92, 1.75
	Next six months ‡	1.66 †	1.15, 2.37	1.41 †	.99, 2.00

Note: * Referents for dichotomous and ordinal predictors; ‡ continuous predictor; † $p<.10$; Outcome coded as continued smoking=0, quit=1

Figure 1.

Overview of Older Adult Participation in Proposed Study