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Reasons for quitting cigarette smoking and electronic cigarette use for cessation help

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Abstract

Despite the lack of clarity regarding their safety and efficacy as smoking cessation aids, electronic or e-cigarettes are commonly used to quit smoking. Currently little is understood about why smokers may use e-cigarettes for help with smoking cessation compared to other, proven cessation aids. This study aimed to determine the reasons for wanting to quit cigarettes that are associated with the use of e-cigarettes for cessation help versus the use of conventional Nicotine Replacement Therapy (NRT) products (e.g., gums). Cross-sectional, self-report data were obtained from multiethnic 1988 current daily smokers [M age = 45.1 (SD = 13.0); 51.3% Women] who had made an average lifetime quit attempts of 8.5 (SD = 18.7) but were not currently engaged in a cessation attempt. Reasons for wanting to quit smoking were assessed by using the Reasons for Quitting (RFQ) scale. Path analyses suggested that among reasons for quitting cigarettes, “immediate reinforcement,” a measure of wanting to quit cigarettes for extrinsic reasons such as bad smell, costliness and untidiness, was significantly associated with having tried e-cigarettes for cessation help, and “concerns about health” was associated with having tried NRT-only use. E-cigarettes appear to provide an alternative “smoking” experience to individuals who wish to quit cigarette smoking because of the immediate, undesirable consequences of tobacco smoking (e.g., smell, ash, litter) rather than concerns about health. Provided that the safety of e-cigarette use is ensured, e-cigarettes may be effectively used to reduce tobacco exposure among smokers who may not want to quit cigarettes for intrinsic motivation.

Keywords

Electronic cigarettes; smoking; cessation; motivation

INTRODUCTION

Electronic or e-cigarette use is rapidly increasing, especially among cigarette smokers (King, Alam, Promoff, Arrazola, & Dube, 2013). In the U.S., 32% adult current smokers are likely to have tried e-cigarettes and almost 50% adult current smokers are likely to be susceptible to future e-cigarette use (Zhu, Gmst, Lee, Cummins, Yin, & Zoref, 2013). Smoking cessation or reduction is one of the primary reasons why cigarette smokers use e-cigarettes (Zhu et al., 2013; Etter & Bullen, 2011; Goniewicz, Lingas, & Hajek, 2012). At present, e-

cigarettes are not strictly regulated by the U.S. Food and Drug Administration (FDA), either as therapeutic devices [e.g., similar to Nicotine Replacement Therapy (NRT)] or as tobacco products (e.g., similar to cigarettes). The FDA intends to regulate those e-cigarettes that are not marketed as therapeutic devices as “tobacco products” under the Family Smoking Prevention and Tobacco Control Act (FDA, 2014). Currently it is unclear how different e-cigarette products are being marketed and what surveillance mechanisms the FDA has in place in order to monitor the marketing of e-cigarette products. Recent empirical studies (Caponetto, Campagna, Cibella, Morjaria, Caruso, & Russo, 2013; Bullen et al., 2013; Etter & Bullen, 2014) as well as commentaries (Benowitz & Goniewicz, 2013; Faerstrom & Bridgman, 2014) have stressed the need to effectively employ e-cigarettes as smoking cessation aids. Moreover, the lay perceptions of e-cigarettes as smoking cessation aids appear to be increasingly prevalent (Ayers, Ribisl, & Brownstein, 2011; Zhu et al., 2013).

Currently little is known about the reasons why smokers who wish to quit smoking cigarettes may choose e-cigarettes for help with smoking cessation compared to NRT (e.g., gums, patches), which are regulated by the FDA and have stronger evidence in support of their efficacy as cessation aids. E-cigarettes are comparable to NRT because both types of products deliver nicotine and may be purchased over-the-counter. Increased knowledge regarding the reasons that motivate the use of e-cigarettes versus NRT as cessation aids may help better apply e-cigarettes in tobacco control efforts. One way to study the reasons why smokers choose e-cigarettes for smoking cessation would be to ask current e-cigarette users who are former cigarette smokers what motivated them to switch to e-cigarettes (Etter & Bullen, 2011). Another less direct yet effective approach would be to determine the associations between reasons for wanting to quit cigarettes and e-cigarette use for cessation help. This latter approach could be used to empirically determine the types of reasons or motivation for smoking cessation that are likely to predict e-cigarette use for smoking cessation among current smokers. Thus, this approach can help profile current smokers wishing to quit cigarettes who may switch to e-cigarettes.

Smokers report various reasons for wanting to quit smoking, concerns about health being the main reason (McCaul, Hockemeyer, Johnson, Zetocha, Quinlan, & Glasgow, 2006). The majority of smokers who are aware of e-cigarettes tend to believe that e-cigarettes are safer than cigarettes (Zhu et al., 2013; Pepper & Brewer, 2013). Thus, concerns about health may be one obvious reason why smokers use e-cigarettes for smoking cessation. But there may be other reasons as well as to why some smokers may find e-cigarettes more attractive as cessation aids than most conventional NRT products, primarily because e-cigarettes closely simulate the experience of smoking without involving some of the immediate, undesirable consequences of cigarette smoking (e.g., ash, smell, litter).

Systematic study of reasons for wanting to quit smoking has been relatively rare compared to research on reasons or motives for smoking [e.g., the Wisconsin Inventory of Smoking Dependence Motives (WISDM); Piper et al., 2004]. Curry, Wagner, & Grothaus (1990) developed a conceptual model of reasons for quitting based on theories of self-determination (Deci & Ryan, 1985), protection motivation (Rogers, 1975) and operant conditioning (Skinner, 1938) and guided by knowledge from previous research on psychosocial predictors of smoking cessation (e.g., social influence). The model incorporates reasons for

quitting cigarettes within the framework of intrinsic and extrinsic motivation for smoking cessation, which posits that smokers wish to quit smoking for rewards that are internal to themselves (intrinsic) and rewards that are external to themselves (extrinsic). The assumption is that smoking cessation is an outcome of a complex goal-directed behavior influenced by motivations rooted in the need for self-determination, fear of negative health consequences, and immediate positive and negative reinforcements (e.g., saving money, stopping complaints).

Based on the intrinsic-extrinsic model, Curry et al. (1990) first validated their four-factor Reasons for Quitting (RFQ) scale among smokers who volunteered to participate in smoking cessation trials. The four factors represent health concerns and self-control as intrinsic motivation dimensions and immediate reinforcement and social influence as extrinsic motivation dimensions. The self-control construct represents the need for self-determination. Immediate reinforcement refers to the immediate, tangible rewards of smoking cessation such as increased saving or the absence of the need to deal with the smell of tobacco smoke, cigarette ash or litter. The social influence construct represents the tendency to want to quit cigarettes due to various forms of social pressure such as perceived societal disapproval of smoking and constant nagging by family members. Curry, Grothaus, & McBride (1997) further validated the four-factor model of RFQ in a population-based sample of smokers (as opposed to participants self-selected into smoking cessation trials), replicating the psychometric properties established in the previous study and generating further evidence of the construct validity of the RFQ dimensions. Later studies (McBride et al., 2001; Zvolensky et al., 2007; Marshall et al., 2009) have confirmed, in diverse populations, the factor structure of RFQ as well as the construct validity of the intrinsic and extrinsic dimensions assessed by the scale in diverse populations. In addition, a number of studies (Curry, McBride, Grothaus, Lando, & Pirie, 2001; Kahler, Strong, Niaura, & Brown, 2004) have successfully studied RFQ constructs as potential mediators or predictors of smoking cessation.

To date, RFQ has not been studied in the context of cessation aid use. There is a particular relevance for studying the RFQ dimensions in relation to e-cigarette and NRT use. Relative to extrinsic reasons, intrinsic reasons for quitting such as health concerns have been found to be stronger predictors of future smoking cessation (Curry et al., 1997; Hammond, McDonald, Fong, Brown, & Cameron, 2004). Thus, association of intrinsic and/or extrinsic reasons with e-cigarette use for smoking cessation may be important in understanding e-cigarettes' potential roles in tobacco control efforts. For example, association of intrinsic reasons with e-cigarette use for cessation would emphasize the need to test the effectiveness and safety of e-cigarettes as cessation aids. Association of extrinsic reasons with e-cigarette use for cessation would suggest that e-cigarettes may provide an alternative to smokers not wishing give up cigarette for intrinsic reasons. Hence, this study employed path analysis on data collected from a multiethnic sample of smokers to simultaneously test the relationships between the RFQ dimensions and 1) having ever-tried e-cigarettes, but not NRT, for smoking cessation; 2) having ever-tried NRT, but not e-cigarettes, for smoking cessation; and 3) having tried both e-cigarettes and NRT for help with smoking cessation.

METHODS

Participants

Participants were 1988 current daily smokers who completed the baseline survey of a longitudinal study conducted to test alternative stage models of smoking cessation. Table 1 summarizes participant characteristics in terms of demographic and other study variables. Participants represented almost equal numbers of men and women. Participants' ethnic distribution was similar to the ethnic distribution of smokers in Hawaii (CDC, 2011), hence the higher proportions of Whites and Native Hawaiians who are highly represented among smokers in Hawaii. The majority of the participants reported lower socio-economic status, as may be expected among smokers in the U.S. (Hughes & Callas, 2010). Approximately 14.7% ($n = 292$) of the participants had ever tried e-cigarettes for help with smoking cessation; 5.6% ($n = 112$) had tried e-cigarettes but not NRT; 9.1% ($n = 180$) had tried both e-cigarettes and NRT; and 27.3% ($n = 542$) had tried NRT but not e-cigarettes.

Procedures

Participants were recruited in Hawaii using advertisements in the local media (e.g., newspaper). Thus, eligible participants from all islands in Hawaii were welcome to participate in the study, even though the primary research site was located on Oahu. Eligible participants: (a) were 18 years or older, (b) were able to read English, (c) had mailing addresses, (d) had smoked at least 100 cigarettes in their lifetime, (e) were current daily smokers who consumed on average at least three cigarettes per day, (f) were not currently engaged in an attempt to quit smoking, and (g) were not seeking smoking cessation treatment. Further, potential participants were not excluded on the basis of past quit attempts in any way.

Potential participants were screened for eligibility requirements over the telephone. After eligible potential participants provided informed consent, they were mailed baseline questionnaires along with stamped and addressed return envelopes. Ninety-three percent of those who received the questionnaire completed and returned the baseline survey ($N = 1988$). Upon receipt of completed questionnaires, participants were mailed \$25 gift cards. The study and its informed consent protocol were approved by the University of Hawaii at Manoa Institutional Review Board.

Measures

Sociodemographic variables—Sociodemographic variables assessed included participants' age, gender, income, and ethnicity. To determine annual household income, participants were asked "What is the approximate total yearly income of your household?" Eleven response options were provided ranging from (1) "\$10,000 or less" to (11) "Over \$100,000." Education was determined in terms of highest level of schooling completed. Participants chose from a list ranging from (1) 8th grade or less to (8) Post-graduate degree.

Ethnicity was determined based on responses to a survey item: "Please select the one ethnic group with which you most strongly identify:" The list of response options included Chinese, Filipino, Hawaiian/Part Hawaiian, Hispanic, Japanese, Korean, White or

Caucasian, African American, and Other. The “Other” option provided space to fill in one’s ethnicity. Because there were relatively small numbers of Chinese ($n = 52$) and Koreans ($n = 26$) in the sample, these ethnicities were combined with Filipinos ($n = 147$) and Japanese ($n = 205$) to form one “Asian” category. Further, participants identifying themselves with ethnicities other than Asian, Hawaiian/Part Hawaiian, or White/Caucasian were combined into a single “Other” category because of their small individual group sizes. The “Other” category was comprised mainly of African-Americans, Hispanics, and Native Americans.

Use of Products for Smoking Cessation—To measure ever use of e-cigarettes for smoking cessation a “yes/no” question was asked: “Have you ever used electronic cigarettes when trying to quit smoking?” The same question was modified according to products to measure ever use of each of the following FDA-approved cessation products: nicotine gum, patch, lozenge, inhaler, and nasal spray.

Nicotine Dependence—Nicotine dependence was assessed using the 6-item Fagerstrom Test of Nicotine Dependence (FTND) scale (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). This measure includes an assessment of the number of cigarettes smoked per day.

Lifetime Quit Attempts—Lifetime quit attempts were assessed based on an open-ended question: “How many times have you quit smoking for 24 hours or more in your life?”

Reasons for Quitting Cigarette Smoking—Intrinsic and extrinsic reasons for quitting cigarette smoking were assessed using the 20-item Reasons for Quitting (RFQ) scale (Curry et al., 1990). Because not all participants were trying to quit smoking, the lead-in to the items asked participants to consider the reasons why they might want to quit smoking even if they were not trying to quit smoking right then. The 20 items that participants responded to were measured on a 5-point scale ranging from “0” (“Not at all”) to 4 (“Extremely True”) and assessed the following 4 motivation dimensions: concerns about health (e.g., “I want to quit smoking cigarettes because I am concerned that I will suffer from a serious illness if I don’t quit smoking”; 5 items; Cronbach’s $\alpha = 0.91$), desire for self-control (e.g., “I want to quit smoking cigarettes to show myself that I can quit smoking if I really want to”; 5 items; $\alpha = 0.89$), social influence (e.g., “I want to quit smoking cigarettes because my spouse, children, or other person I am close to will stop nagging me if I quit smoking”; 5 items; $\alpha = 0.76$), and immediate reinforcement (“I want to quit smoking cigarettes so that my hair and clothes won’t smell”; 5 items; $\alpha = 0.80$). For analysis purposes, corresponding items were summed to create an index representing each of the four motivation dimensions.

Data Analysis

Descriptive analyses were conducted using the SAS statistical software. First, descriptive statistics were computed for each study variable, in terms of mean or proportion, and compared among those who had ever used e-cigarettes while attempting to quit smoking (e-cigarette users), those who had tried one or more NRT products but not e-cigarettes (NRT-only users), and those who had never tried either NRT products or e-cigarettes by conducting analysis of variance (ANOVA) or chi-square test. Multiple comparisons among

means were conducted using Tukey's Studentized Range (HSD) test ($\alpha=0.05$; 2-tailed) which controls the Type I experiment-wise error rate. For variables that showed significant group differences, Tukey style multiple pair-wise comparisons of proportions were conducted using the SAS macro COMPPROP (Elliott & Reisch, 2006; Zar, 1999). Next, we computed zero-order correlations among the key study variables. Ethnicity was dummy-coded with White ethnicity as the reference.

To address the study aims, a path model was tested in Mplus statistical software, with demographic variables, nicotine dependence, and RFQ variables specified as exogenous variables, and e-cigarette-only use for cessation, NRT-only use, and both NRT and e-cigarette use as three criterion variables. Direct paths were specified from all exogenous variables to all criterion variables; all exogenous variables were specified to co-vary between each other and all criterion variables were allowed to co-vary between each other as well. The model was then fit to the data and the statistical significance of the path coefficients was examined. Next, the model was re-estimated with only the statistically significant paths included in the model ($p < 0.05$). Because each criterion variable was categorical, the model was estimated using the weighted least squares means and variance adjusted (WLSMV) estimator. The goodness-of-fit of the model to the data was assessed in terms of an absolute index (i.e., chi-square) and comparative indices such as the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA).

RESULTS

Table 1 shows the characteristics of the participants by e-cigarette or NRT-only use status. Smokers who had used e-cigarettes when attempting to quit smoking were significantly younger than smokers who had used NRT-only or neither. The three groups also showed significant differences in terms of ethnicity in that significantly higher proportion of Whites and lower proportion of Native Hawaiians reported use of cessation aids. The three groups did not show significant differences in other demographic characteristics. Mean lifetime quit attempts and mean scores on reasons for quitting did not differ significantly between those who had tried e-cigarettes for cessation and those who had tried NRT only.

Table 2 shows the zero-order correlations among study variables. Income was positively correlated with age, Asian ethnicity (relative to white), and nicotine dependence and negatively correlated with Native Hawaiian ethnicity. Nicotine dependence was negatively correlated with female gender and Asian ethnicity and positively correlated with income. All four motivation variables were positively and relatively highly correlated among each other, with correlation coefficients ranging between 0.52 and 0.77.

Figure 1 presents the results of the path analysis. Fit indices indicated that the model fitted reasonably well to the data: $\chi^2= 25.55$, $df = 20$, $p = .18$; CFI= 0.99; RMSEA= .013 [95% CI: 0.010–0.024]. Among RFQ variables, immediate reinforcement was associated with having used e-cigarette-only for help with smoking cessation and also with having used both NRT and e-cigarettes. Health Concerns were significantly associated with NRT-only use. Desire for self-control and social pressure were not associated with any of the criterion variables. Higher nicotine dependence was positively associated with NRT-only use and NRT/e-

cigarette use but was inversely associated with e-cigarette-only use. Older age was positively associated with NRT-only use but was inversely associated with NRT/e-cigarette and e-cigarette-only use. Relative to White ethnicity, being Asian-American or Native Hawaiian was inversely associated with NRT-only use. Higher income was positively associated with e-cigarette-only use and NRT/e-cigarette use.

DISCUSSION

Results of the present study indicated differences in correlates between specific use of NRT or e-cigarettes for smoking cessation. Immediate reinforcement was found to be the only RFQ dimension statistically significantly associated with e-cigarette-only use for smoking cessation, (relative to NRT), while concerns about health was the only RFQ dimension found to be associated with NRT-only use (relative to e-cigarettes). Against our expectation, concerns about health were not found to be associated with e-cigarette use for smoking cessation. Younger age, higher income, and lower nicotine dependence were associated with greater likelihood of e-cigarette-only use; while older age, White ethnicity, and higher nicotine dependence were associated with NRT-only use. Similar to e-cigarette-only use, NRT/e-cigarette use (i.e., having tried both e-cigarette and NRT) was associated with immediate reinforcement, younger age, and higher income. However, unlike e-cigarette-only use, NRT/e-cigarette use was associated with higher nicotine dependence. To our knowledge, this is the first study to empirically test the effects of different types of reasons for wanting to quit cigarette smoking on the use of e-cigarettes for cessation help vis-à-vis NRT use.

In this study, immediate reinforcement was assessed using five items that tapped reasons for wanting to quit cigarettes because of relatively minor (compared to health), quotidian problems or inconveniences associated with cigarette smoking: for example, wanting to quit cigarettes because cigarette smoking made one's hair and clothes smell bad, caused one to burn holes in clothing and furniture, made one's house and car unclean, and reduced one's saving in general and because of the money spent on smoking related costs (e.g., dry cleaning). Using e-cigarettes instead of cigarettes would make some of these problems (e.g., smell, burning holes) associated with smoking irrelevant. In fact, previous research shows that e-cigarettes users state bad smell of tobacco smoke and untidiness due to cigarette ash and butts as some of the reasons from switching from cigarettes to e-cigarettes and also state that e-cigarette use is a less expensive habit than cigarette smoking (Etter & Bullen, 2011; Pepper & Brewer, 2013). Thus, the current findings indicate that extrinsic, immediate, undesirable consequences of cigarette smoking are more likely to be predictive of e-cigarette use for smoking cessation than concerns about health.

Further, the current study highlights that even though e-cigarettes are commonly used to quit cigarettes, smokers' motives behind choosing e-cigarettes as cessation aids may differ from choosing other forms of cessation aids such as the conventional NRT products. The fact that e-cigarette use closely resembles the act of smoking cigarettes places e-cigarettes in a different class of nicotine delivery products than conventional NRT products (Fagerstrom & Bridgman, 2014). One unique implication that e-cigarettes may have for smoking cessation is that smokers who quit cigarettes using e-cigarettes may end up substituting cigarettes with

e-cigarettes. In fact, recent research shows that the majority of smokers who use e-cigarettes to quit or reduce cigarette smoking eventually quit or reduce smoking but continue to use e-cigarettes (Etter & Bullen, 2014). The current data suggests that smokers who use e-cigarettes to quit smoking are attracted to e-cigarettes because of their characteristics that may be thought to make “smoking” more pleasant.

Clearly, more studies are needed to understand the cognitive antecedents of e-cigarette use initiation among smokers and the subsequent trajectories of e-cigarette and cigarette use. Previous studies on motivation for smoking cessation suggest that extrinsic motivation variables are poorer predictors of successful smoking cessation compared to intrinsic motivation variables (Curry, Grothaus, & McBide, 1997). If immediate reinforcement is one of the major factors influencing the use of e-cigarettes as smoking cessation aids, then it is likely that smokers who switch from cigarettes to e-cigarettes may continue using e-cigarettes for a long time and may be prone to smoking cigarettes on special occasions.

The association that we found between younger age and e-cigarette use is consistent with previous research (Pepper & Brewer, 2013; Pearson, Richardson, Niaura, Vallone, & Abrams, 2012). Younger individuals tend to find e-cigarettes more appealing, perhaps because of the perceived innovativeness of the products. The link between higher income and e-cigarette use may be explained in terms of the facts that the initial purchase of an e-cigarette set is relatively expensive. In addition, higher income individuals are likely to be more educated, and hence, more likely to be early adopters of new products such as e-cigarettes (Rogers, 2003). Future research is needed to better understand the relationship between nicotine dependence and choice of e-cigarettes as cessation aids. The finding that lower nicotine dependence was associated with greater likelihood of e-cigarette-only use may suggest that smokers who are less dependent on cigarettes are more willing to experiment with e-cigarettes, possibly because they are not as concerned about e-cigarettes' comparative inefficiency in delivering nicotine (Etter, 2014). It is important for future research to resolve whether e-cigarettes promote dual use of e-cigarettes and cigarettes and nicotine dependence among less nicotine dependent, light smokers or whether e-cigarettes are particularly helpful in helping light smokers quit.

Although the present study included smokers who had tried both e-cigarettes and NRT for smoking cessation, because of the lack of relevant data, it could not be ascertained whether e-cigarette use among these smokers followed NRT use. The similarities in findings between e-cigarette-only use and NRT/e-cigarette use may be interpreted to suggest that e-cigarette use was more recent among NRT/e-cigarette users. It is possible that certain smokers who are younger and try and find conventional NRT products unsatisfying are attracted to e-cigarettes as cessation aids.

In regard to the study of motivational correlates of e-cigarette use for smoking cessation, this study should be considered preliminary. Although past studies have found the RFQ scale to be generally valid, past application of the instrument has been mostly limited to predicting smoking cessation outcomes or stages of change towards smoking cessation. Thus that the application of RFQ scale in the present study was subject to limitations should be acknowledged. For example, the fact that we did not find social pressure or desire for self-

control associated with any of the criterion variables may be interpreted to suggest that these variables are not good predictors of the use of cessation aids. A more detailed understanding of the reasons for using e-cigarettes, conventional NRT, or other tobacco products marketed as “reduced exposure” for smoking cessation or reduction would likely need a comprehensive measurement instrument designed specifically to assess motivational factors associated with choice of smoking cessation aids. The findings of the present study imply that such instruments would help understand the specific reasons why smokers attempting to quit or reduce smoking may be attracted to the products marketed as smoking cessation aids or safer alternatives to tobacco smoking. The present findings can act as point of departure for future research attempting to develop such an instrument, especially by highlighting that intrinsic and extrinsic motivation may distinguish between choices of cessation aids.

There are other limitations to the current study that need to be considered. First, this was a cross-sectional study. Hence, the findings of the path analysis should not be interpreted as causal. However, the current findings are novel and provide an important direction for future research interested in testing the causal relationships implied herein. Second, the facts that the present data are from one state in the U.S. and are based on smokers who self-selected into the study may raise questions about the generalizability of the current findings. But because the focus of the current study was psychological and behavioral rather than socio-cultural, the threat to external validity is likely to be minimal. Further, it should be noted that the present sample is comparable to adult U.S. smokers in terms of SES and smoking-related indicators (Hughes & Callas, 2010). Third, e-cigarette use is a phenomenon that is rapidly increasing and any data on e-cigarette use face the risk of becoming old too soon. The e-cigarette use prevalence rate of 14.7% in the present data may be low compared to the prevalence rates of e-cigarette use in the populations of current cigarette smokers at present. Fourth, although our analysis model accounted for the effects of smoking (e.g., nicotine dependence) and demographic characteristics, it did not account for factors beyond the individual (e.g., friends', family members' e-cigarette use, media) that could potentially influence both e-cigarette or NRT use and reasons for quitting cigarettes. Fifth, our participants were current smokers who had not successfully quit smoking despite their use of e-cigarettes or NRT. Therefore, the implications of the present findings are limited to experimentation with e-cigarettes or NRT or both. Had our participants been successful quitters, the present findings, and by extension, our conclusions, could be different. It may be of interest to future research to investigate how the choices of cessation aids may mediate the relationships between reasons for quitting and quitting success. Lastly, the present study only assessed ever-use of cessation products. It did not assess current use or receptivity towards different cessation products. The effects of reasons for quitting on receptivity towards various cessation products represent another area in need of future research. Understanding the determinants of cessation product receptivity may help match cessation products to smokers' personal needs.

Despite the limitations, however, the present study is significant for initiating research regarding factors that may influence uptake of e-cigarettes as cessation aids. We demonstrated that immediate reinforcement, a measure of wanting to quit cigarettes for reasons such as bad smell, higher expense and untidiness, emerged as the only statistically significant correlate of e-cigarette ever-use for smoking cessation when included in a path

model simultaneously with other reasons for quitting smoking, including health and social pressure. Thus, this may be the first study to suggest that smokers who want to quit smoking for immediate, extrinsic rewards may be attracted to use e-cigarettes to stop smoking cigarettes than smokers who want to quit smoking for intrinsic reasons such as health concerns. In conclusion, e-cigarettes appear to provide a “smoking” alternative to a section of cigarette smokers who may not quit smoking for health reasons. Public health efforts may need to consider employing e-cigarettes to promote tobacco-related harm reduction.

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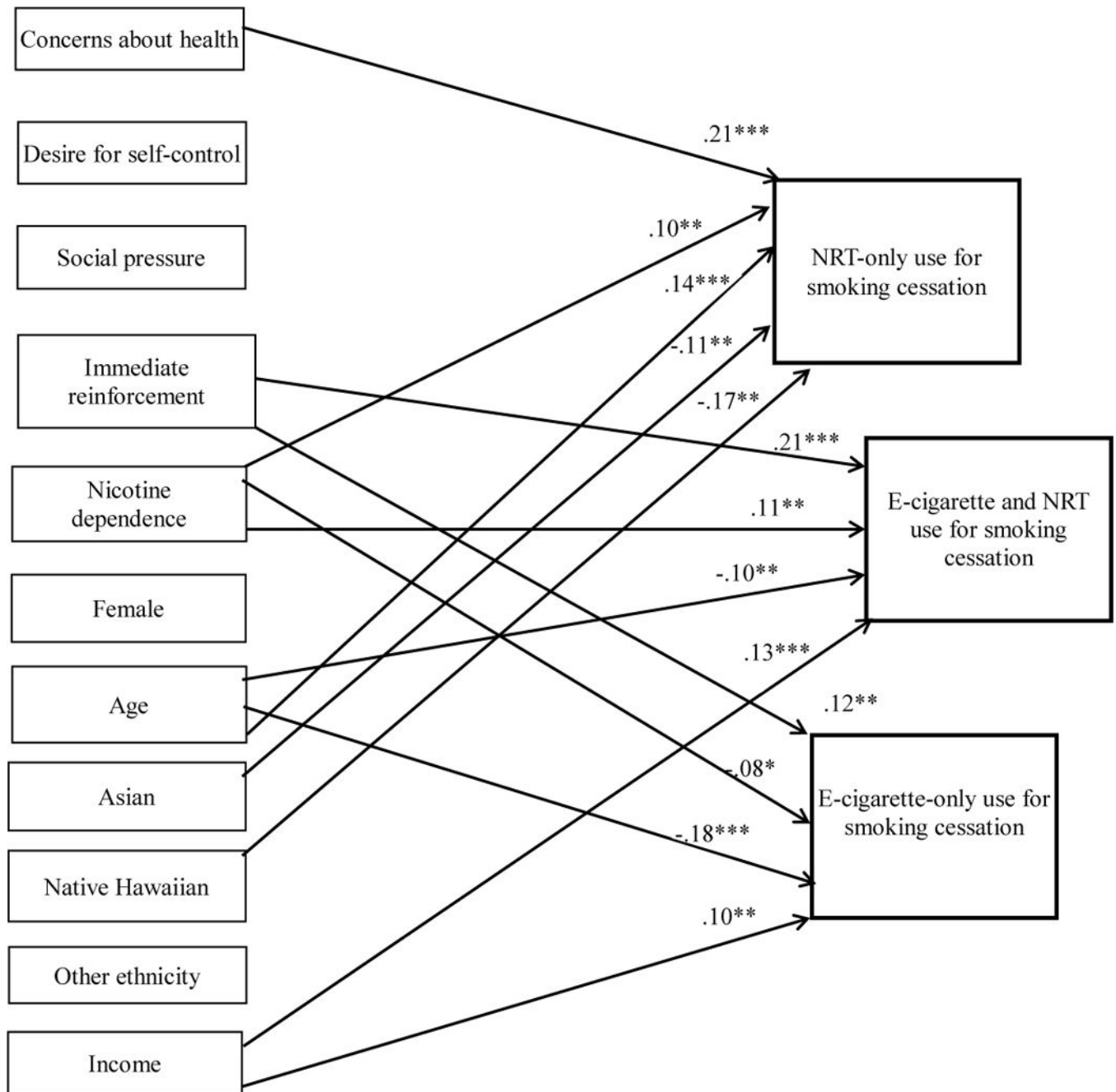


Figure 1. Path model showing the relationships among demographic variables, reasons for wanting to quit smoking, and e-cigarette use for smoking cessation ($N = 1988$). Single-headed arrows represent regression paths. Values represent standardized coefficients. For clarity of presentation, only statistically significant ($p < 0.05$; 2-tailed) paths are shown. Co-variances were specified between all exogenous variables but co-variance estimates are not presented for clarity (correlations are presented in Table 2).

Table 1

Participant characteristics (N = 1988)

	Total (N = 1988)	E-cigarette users (n = 292)	NRT-only users (n = 542)	None (n = 1154)
		Mean (SD)/Frequency (%)		
Age***	45.1 (13.0)	42.0 (14.6) _a	47.8 (11.9) _b	44.6 (13.0) _c
Sex				
Male	48.7%	49.4%	50.2%	49.1%
Female	51.3%	50.6%	49.8%	50.9%
Ethnicity***				
White	32.6%	33.2% _a	45.8% _b	26.2% _c
Asian	21.6%	25.0% _a	18.6% _a	22.2% _a
Native Hawaiian	32.5%	29.5% _a	22.7% _a	37.9% _b
Other	13.3%	12.3% _a	12.9% _a	13.8% _a
Income				
Over \$40,000	13.7%	22.0%	16.9%	18.0%
\$20,001–\$40,000	25.2%	22.7%	18.8%	20.9%
\$20,000 or below	61.1%	55.4%	64.3%	61.1%
Nicotine dependence	4.9 (2.4)	5.0 (2.4) _{ab}	5.2 (2.3) _a	4.9 (2.5) _b
Lifetime quit attempts*	8.5 (18.7)	12.0 (21.9) _a	9.0 (17.4) _{ab}	7.5 (18.3) _b
Reasons for quitting***				
Health concerns	10.1 (6.5)	11.6 (5.8) _a	11.7 (6.2) _a	8.9 (6.6) _b
Self-control	8.0 (6.2)	9.5 (5.9) _a	9.1 (5.9) _a	7.2 (6.3) _b
Social pressure	3.7 (4.1)	4.4 (4.4) _a	4.2 (4.1) _a	3.2 (3.9) _b
Immediate reinforcement	8.2 (5.3)	9.6 (4.9) _a	9.4 (5.0) _a	7.2 (5.4) _b

Note. NRT = Nicotine Replacement Therapy; E-cigarette users/non-users = smokers who ever-used/never-used e-cigarettes for help with smoking cessation. Different letter subscripts across row (e.g., a, b, c) indicate pairwise comparisons significant at the alpha = 0.05 level using Tukey's Studentized Range (HSD) Test which controls for the Type I experimentwise error rate involved in multiple comparisons.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 2

Zero-order correlations among key study variables (N = 1988).

	Age	Female	Income	Asian	Hawaiian	Other	ND	Health	SC	Social	IR
Age	1										
Female	-.07**	1									
Income	.10***	-.05*	1								
Asian	.06**	-.07*	.11***	1							
Hawaiian	-.20***	.13***	-.12***	-.36***	1						
Other	-.03	-.06*	-.06**	.19***	.26**	1					
ND	.01	-.09**	-.11***	-.05***	.03	.01	1				
Health	.07**	.04	-.02	-.03	-.04	.01	-.11***	1			
SC	.03	.03	-.06***	-.05*	-.01	.03	-.12***	.76***	1		
Social	.02	.04	-.03	-.02	.02	.03	-.002	.52***	.59***	1	
IR	.03	.08**	-.05*	-.04	-.05*	.01	-.08**	.74***	.77***	.61***	1

Note. ND = nicotine dependence; SC = Self-control; IR = Immediate reinforcement; Hawaiian = Native Hawaiian

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$