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# E-Cigarette Use, Perceptions, and Cigarette Smoking Intentions in a Community Sample of Young Adult Non-Daily Cigarette Smokers

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## Abstract

E-cigarettes have been suggested as a strategy for reducing harm from cigarettes. While e-cigarettes could be a less-harmful alternative to cigarettes for those trying to quit, there may also be costs that outweigh any benefits of reduction. The purpose of the present study was to prospectively investigate perceptions of e-cigarettes, cigarette smoking intentions and their associations with e-cigarette use over time. Community participants (n = 348, 57% male) aged 18–24 were recruited for a longitudinal study of tobacco use. Inclusion criteria included non-daily cigarette smoking for ≥ 6 months with no history of daily smoking. Participants reported e-cigarette use over the past 14 days at baseline and for the past 9 days at 3, 6, and 9 months. Assessments were completed online or via mobile phone. Across the 4 assessments, 22–33% of participants reported recent e-cigarette use. Intent to quit smoking cigarettes and intent to maintain smoking were unrelated to e-cigarette frequency. E-cigarette frequency was positively associated with perceiving e-cigarettes as less harmful than cigarettes and more positive e-cigarette expectancies (*p*s < .05). E-cigarette use was also more frequent among those who smoked cigarettes frequently and who used e-cigarettes to circumvent cigarette bans more often (*p*s < .05). The combination of these findings suggests that, at least among non-daily smoking young adults, other factors may influence frequency of e-cigarette use more than harm reduction. Findings instead seem consistent with the hypothesis that e-cigarettes are more often used to complement ongoing cigarette smoking.

### Keywords

tobacco; e-cigarettes; harm reduction; young adult

Lowering health and mortality risks associated with tobacco use is a substantial U.S. public health goal (Centers for Disease Control Prevention, 2014). Electronic nicotine delivery systems (ENDS or “e-cigarettes”) have been presented as a means to achieve this goal.

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Because e-cigarette use can mimic the action of smoking and deliver nicotine with fewer harmful toxins than cigarettes (Goniewicz et al., 2014), some have posited that e-cigarettes could be a viable substitute and cessation aid for cigarette smokers (Cahn & Siegel, 2011; Levy et al., 2016; West & Brown, 2014). Relatively little research has directly addressed e-cigarette use for harm reduction or cessation, and evidence is mixed. For example, a recent meta-analysis suggested that e-cigarettes may be associated with less success quitting cigarettes (Kalkhoran & Glantz, 2016); however, only two of the 20 studies included were clinical trials, and many of the cohort studies compared lifetime e-cigarette users, including those who had only tried e-cigarettes once, to non-users. Therefore, use of e-cigarettes as a harm reduction strategy is controversial and efficacy is uncertain (Grana et al., 2014; Hajek et al., 2014; Kalkhoran & Glantz, 2016; Polosa et al., 2013).

A primary concern is that e-cigarettes may have costs that outweigh potential benefits (Kalkhoran & Glantz, 2015; Levy et al., 2016). Any negative consequences of e-cigarette use are likely to disproportionately impact youth and young adults because their use of e-cigarettes is rapidly rising (McMillen et al., 2015) and because these stages are formative periods for development of habits that affect long-term health (Chassin et al., 1996; Nelson Laska et al., 2009). To the extent that e-cigarettes are attractive to these populations, they may spread beyond smokers who have been unable to quit and ultimately promote cigarette uptake/progression and nicotine dependence among light or non-smokers (Kalkhoran & Glantz, 2015). Non-daily smokers are the most likely to experiment with and continue to use e-cigarettes (Sutfin et al., 2013), suggesting they may be particularly vulnerable to any negative impact of e-cigarettes. While it is unknown how intention to alter cigarette use relates to e-cigarette use among young adult non-daily smokers specifically, this question has been examined in other populations. A study of college smokers found that intent to quit cigarettes was independent of e-cigarette use (Sutfin et al., 2013). In contrast, other studies have suggested that cigarette smokers who also use e-cigarettes (Dautzenberg et al., 2013), or who use other tobacco products including e-cigarettes (Lee et al., 2014), have less intent to quit smoking compared with cigarette-only users. These findings suggest that factors other than harm reduction may influence e-cigarette use among young adult non-daily smokers.

Previous research suggests many young adults hold positive beliefs about the sensory satisfaction (e.g., appealing flavor options), harmfulness, and social acceptability of e-cigarettes (Choi & Forster, 2013, 2014; Kong et al., 2015), which may affect e-cigarette use. In fact, the perception that e-cigarettes are less harmful than cigarettes has been associated with greater odds of lifetime e-cigarette use and initiation (Choi & Forster, 2013, 2014). Furthermore, young adults in focus groups have listed additional beliefs and perceptions, including that e-cigarettes are fun and recreational, affect regulating (negative reinforcement), and convenient (Choi et al., 2012; Kong et al., 2015; Pokhrel et al., 2015). Some of these attitudes and perceptions suggest e-cigarettes may be harm enhancing. Based on evidence from cigarette research, individuals with affect regulation beliefs may be at risk for progression and nicotine dependence (Baker et al., 2004; Kassel et al., 2007; Weinstein & Mermelstein, 2013). Furthermore, emerging evidence suggests that flavors may increase reinforcement from e-cigarettes, thus heightening the potential for abuse and dependence (Audrain-McGovern et al., 2016). Finally, because e-cigarettes are often not subject to

smoking bans (Lempert et al., 2014), many dual users report using e-cigarettes as a convenient way to alleviate nicotine cravings in contexts in which smoking is not permitted (Choi et al., 2012; Kong et al., 2015; Pokhrel et al., 2015). One of the ways that clean indoor air laws reduce harm is by limiting opportunities to smoke, and this has been associated with lower smoking rates (Fichtenberg & Glantz, 2002; Song et al., 2015). Using e-cigarettes to circumvent such restrictions undermines those efforts. While these potentially harm enhancing perceptions and beliefs have been previously reported, little research has examined whether they are linked to actual behavior.

The present study examined perceptions of e-cigarettes, intent to quit or maintain cigarette use, and their prospective associations with e-cigarette use in a community sample of young adult non-daily smokers. We expected e-cigarette use would not be primarily related to the desire to reduce harm from cigarettes. Our primary hypothesis was that e-cigarette frequency would be inversely associated with intent to quit cigarettes and positively associated with intent to maintain or increase cigarette use. In other words, we expected that those not intending to quit cigarettes would be more frequent e-cigarette users. Finally, we predicted those with more positive expectancies about e-cigarette use, those who indicated using e-cigarettes to circumvent smoking bans more often and those who perceived e-cigarettes as less harmful than cigarettes would use e-cigarettes more frequently.

## Methods

### Participants

Participants (n = 348, 56.6% male) were recruited for a longitudinal study of non-daily cigarette smoking and were 18–24 years old (M =20.5, SD =1.8). In terms of race/ethnicity, 42.5% identified as non-Hispanic Caucasian, 25.6% as Hispanic/Latino, and 22.1% as non-Hispanic Asian American and 9.8% as from multiple or other backgrounds. Parent study eligibility criteria included monthly cigarette smoking for six months, never having smoked daily for ≥ one month, and California residency. Because assessments were conducted online or via mobile phone app, participants were also required to either own a smartphone or have regular internet access.

### Procedure

Participants were recruited primarily via paid Facebook posts that targeted individuals who were aged 18–24 and located in California. Recruitment ads were posted approximately once per month between May and October 2015. Additionally, 27 participants were recruited via referrals from a total of 21 other participants; in all, 44 participants were part of 18 referral clusters. Those interested in the parent study, which focuses on the natural progression of non-daily cigarette smoking, completed an eligibility screening online using SurveyMonkey that was reviewed by research staff. Eligible individuals were emailed individualized web links, and those who were interested provided informed consent and completed the baseline assessment online or using a mobile phone app (Opinionmeter International, San Leandro, CA). At 3, 6 and 9 months post baseline, participants completed brief daily assessments for 9 days. Because recruitment was ongoing over the course of six months, some participants were asked to complete these assessments during holiday breaks.

However, because participants could complete assessments via computer or mobile phone, no adjustments were made to the assessment schedule. Participants received $25 for completing the baseline assessment and up to $40 each for the quarterly 9-day assessments. The University of California, San Diego Institutional Review Board approved all procedures. Data were collected between March 2015 and June 2016.

## Measures

**Demographic characteristics—**Demographic variables assessed included age, sex, race/ethnicity and current student and employment status. From a list of racial/ethnic background options, participants chose each category that applied to them or specified another racial/ethnic background. Due to small cell sizes for some groups, we collapsed race/ethnicity into non-Hispanic Caucasian (n = 148; 43%), Hispanic or Latino, which consists of those who chose Hispanic or Latino only or in addition to Caucasian, (n = 89; 26%), non-Hispanic Asian American (n = 77; 22%), and other/multiple backgrounds (n = 34; 10%). Participants also chose their current employment and student status from a list of options. For analyses, this item was collapsed into a binary variable comparing full-time students (60%) versus others (40%). Finally, to allow the respondent-driven sampling analyses described below, participants estimated the number of 18–24 year-olds personally known to them.

**Cigarette and e-cigarette use—**Participants reported the number of days they used cigarettes and e-cigarettes in the past 14 at baseline using the Timeline Followback (Sobell & Sobell, 1992, 1996). At 3, 6, and 9 months, participants reported whether they used cigarettes and e-cigarettes on each of 9 consecutive days, with each assessment beginning on a Saturday and ending the following Sunday, to include 5 weekdays and 4 weekend days. Because participants reported use for 14 days at baseline and 9 days at the three follow-ups, we calculated the proportion of days on which participants used each product for each assessment period. Additionally, prior to baseline participants reported whether they had used e-cigarettes during the past 6 months.

**Use of e-cigarettes to circumvent smoking bans—**At baseline, one item asked “When you have used e-cigarettes, how often was it in place of cigarettes because you were in a situation in which cigarette smoking was restricted?” This item was rated on a scale from 1 (rarely/never) to 4 (most or all of the time). Participants were asked to select “not applicable” if they had never used e-cigarettes (n = 56); these responses were not included in analyses.

**Harmfulness of e-cigarettes vs. cigarettes—**Perception of harmfulness was measured at baseline with one item on a scale from 1 (cigarettes much more unhealthy) to 5 (e-cigarettes much more unhealthy).

**E-cigarette expectancies—**At baseline, participants completed 8 items assessing expectancies for negative health consequences, positive reinforcement (e.g., buzz), negative reinforcement (e.g., stress relief), and social facilitation (e.g., help me look cool) from e-cigarette use, which we have previously found to be associated with likelihood and

frequency of recent e-cigarette use (Doran & Brikmanis, 2016). Items were rated on a scale from 1 (not at all) to 4 (very much), and all were coded such that higher values reflected more positive expectancies. The 8 items were summed to create a total expectancy score.

**Intention to quit smoking—**Participants completed two items at baseline rating their intent to quit cigarettes over the next month and the next year. Both items were rated on a scale from 0 (no intent to quit) to 4 (very determined to quit).

**Intent to maintain or increase smoking—**Participants were asked to their intent to "keep smoking as much or more than you currently do" over the next month and year at baseline. Both items were rated on a scale from 0 (very unlikely) to 4 (very likely).

### Analytic plan

Bivariate tests were used to assess relationships between demographic and predictor and outcome variables; demographic variables that were associated with variables of interest were included as covariates in subsequent analyses. Given that participants were encouraged to refer others to the study, we conducted respondent-driven sampling (RDS) analyses using Stata's *rds* module (Schonlau & Liebau, 2012). This approach uses information on participants' estimated network size (i.e., the estimated number of 18–24 year-olds they know) and size and membership of their referral chains (i.e., other participants who they referred or were referred by) to generate weights reflecting the extent to which each participant is representative of the population. Individualized weights for outcomes were derived from the RDS analysis, and primary analyses were performed using both weighted and unweighted outcomes. Hypothesis tests were performed by fitting separate longitudinal models for each predictor (expectancies, use of e-cigarettes to circumvent smoking bans, perceived harmfulness, intent to quit cigarettes, intent to maintain/increase cigarettes) using the generalized estimating equations (GEE) approach (Liang & Zeger, 1986; Zeger et al., 1988). Continuous predictors were mean-centered. Because the outcome variable was the proportion of days on which e-cigarettes were used, the number of assessment days completed was included as a covariate in each hypothesis test. Binary e-cigarette use prior to baseline was also included as a covariate. The use of a proportion as a GEE outcome variable is relatively uncommon but, relative to dichotomization, provides more valid effect estimates (Huh et al., 2012). No assumptions or imputations were made for missing data. Each model initially included terms for both time and time X predictor (e.g., time X intent to quit cigarettes), and treated time as a continuous variable. When interactions were not significant, they were removed and the model re-fit. All analyses were conducted using Stata IC 13 (StataCorp LP, College Station, TX), with $\alpha = .05$.

## Results

### Missing data

Of the 408 participants, 60 (14.7%) dropped out after the baseline assessment and were excluded from further analyses. Those who did not complete any follow-up assessments did not differ significantly with regard to age, race/ethnicity, sex, student status, or frequency of cigarette or e-cigarette use. Among the 348 participants who were included in subsequent

analyses, 2.9% were missing 3 month data, 12.6% 6 month data, and 16.1% 9 month data. Overall, the 348 participants included in the analyses below completed 92.1% of possible assessments.

## Preliminary analyses

Demographic and clinical characteristics are shown in Table 1. Recent e-cigarette use was common, with 33% reporting any use at baseline, 30% at 3 months, 26% at 6 months, and 22% at 9 months. Those who used e-cigarettes reported doing so on an average of 38–50% of days across timepoints.

Compared to Hispanic participants, non-Hispanic Caucasian participants reported greater intent to maintain/increase smoking cigarettes over the next month ($F = 4.61$, $p = .032$). E-cigarette use was less common among students and more common among those who reported more frequent cigarette use ($ps < .05$). Consequently, sex, race/ethnicity, student status, proportion of cigarette use days for each timepoint, and proportion of cigarette use days X time were included as covariates in subsequent hypothesis tests.

## E-cigarette frequency

Weighted and unweighted models produced similar results, thus only the former are reported below. GEE models are summarized in Tables 2 and 3. For simplicity, Table 2 depicts the final model of the association between intent to maintain/increase cigarette use over the next month and time-varying e-cigarette use. Because all models included the same covariates and outcome, covariate associations with e-cigarette use were virtually identical across models. Thus, Table 3 depicts only the effects of hypothesized predictors and significant interactions with time for subsequent analyses. Sex, race/ethnicity, and assessment days completed were non-significant in all models. There was a significant main effect of cigarette frequency in all models ($ds$ 0.11– 0.12, $zs$ 2.08 – 2.21, $ps < .05$), indicating that those who smoked cigarettes more frequently also used e-cigarettes more frequently. This association did not change over time. Student status was a significant predictor of e-cigarette use in all models except the expectancies and circumvention models ($ds$ −0.13– −0.11, $zs$ −2.48 – −2.03, $ps < .05$), indicating that students used e-cigarettes less frequently.

None of the four measures of cigarette-related intentions was prospectively associated with e-cigarette use. As shown in Table 2, intent to maintain or increase cigarette use over the next month was not significantly associated with e-cigarette use ($d = 0.10$, $z = 1.79$, $p = .074$), but the effect was in the expected direction. The remaining cigarette intent items, including intent to maintain or increase over the next year ($d = 0.06$, $z = 1.02$, $p = .307$), intent to quit over the next month ($d = −0.07$, $z = −1.25$, $p = .210$), and intent to quit over the next year ($d = −0.09$, $z = −1.41$, $p = .158$) were in the expected direction but not significant (Table 3). None of the predictor X time interactions in these models were significant, indicating that the relationship between baseline assessments of intent and e-cigarette use did not change over time.

Frequency of using e-cigarettes to circumvent smoking bans was also a significant predictor ($d = 0.24$, $z = 4.08$, $p < .001$), such that those who reported doing so more often tended to use e-cigarettes more frequently. The model testing the effect of perceived harmfulness of e-

cigarettes versus cigarettes yielded a significant main effect of perceived harmfulness ($d$ = −0.10, $z$ = −1.97, $p$ = .049), suggesting that those who perceived a greater safety advantage for e-cigarettes tended to use e-cigarettes more frequently. Similarly, the model evaluating the prospective effect of e-cigarette expectancies yielded a significant main effect of expectancies ($d$ = 0.37, $z$ = 6.89, $p$ < .001) as well as a significant expectancies X time interaction ($d$ = −0.12, $z$ = −2.19, $p$ = .029). This pattern also indicates that more positive baseline expectancies were associated with more frequent e-cigarette use at each assessment, but that the slope of the effect became more negative over time.

### Supplementary analyses

GEE models of predictors of a time-varying binary e-cigarette outcome variable were conducted to determine whether associations were better explained by whether participants used e-cigarettes at all at each timepoint. A model with frequency of using e-cigarettes to circumvent smoking bans as a predictor was not conducted because this item was only completed by e-cigarette users. Sex, race/ethnicity, and student status were non-significant in all models. The model evaluating the prospective effect of e-cigarette expectancies yielded a significant main effect of expectancies ($d$ = 0.26, $z$ = 4.60, $p$ < .001) as well as a significant expectancies X time interaction ($d$ = −0.16, $z$ = −3.07, $p$ = .002). The models evaluating harmfulness and intentions were nonsignificant.

## Discussion

The present study examined the extent to which intent to change cigarette use and perceptions of e-cigarettes prospectively predicted e-cigarette use in a sample of young adults who smoked cigarettes intermittently. Neither intent to quit cigarettes in the next month or year nor intent to maintain/increase over the next month or year were associated with e-cigarette use. Additionally, e-cigarette use was more frequent among those who had more positive e-cigarette expectancies, indicated using e-cigarettes to circumvent smoking bans more often, and perceived e-cigarettes as less harmful than cigarettes. The present study is one of the first to examine e-cigarette use among young adult non-daily smokers over time.

While measures of future cigarette smoking intent did not predict e-cigarette use over time, it is notable that the effects of all intention measures were in the expected direction. That is, in general, we observed heavier e-cigarette use among participants who intended to continue and not quit smoking cigarettes. Because frequency of cigarette use was covaried in all models, our analyses also demonstrated that more frequent cigarette smokers consistently used e-cigarettes more often over time. These findings are at odds with use of e-cigarettes as a means of limiting the negative impact of cigarettes. If participants were using e-cigarettes to reduce harm, one would expect more frequent users to report greater intent to quit and lower intent to maintain cigarette smoking in the future. To the extent that e-cigarettes are beneficial for harm reduction, one would also expect the association between e-cigarette and cigarette use to tend toward an inverse association over time. Instead, participants appeared to be using e-cigarettes for recreation and affect regulation, as indicated by the association between e-cigarette use and expectancies. Furthermore, because e-cigarette use was more

frequent among more frequent cigarette smokers, it is plausible that non-daily smokers who also use e-cigarettes may be have greater nicotine exposure and thus greater risk of dependence compared to non-daily smokers who do not use e-cigarettes.

Positive e-cigarette expectancies prospectively predicted e-cigarette use, which is consisted with previous research (Doran & Brikmanis, 2016; Pokhrel et al., 2014). While further research on e-cigarette expectancies is needed, cigarette research suggests that more positive expectancies are related to greater nicotine dependence, increasing consumption, lower intent to quit, and lower cessation success (Brandon & Baker, 1991; Copeland & Brandon, 2000; Doran et al., 2013; Heinz et al., 2013; Kristjansson et al., 2011). In other words, individuals with more positive e-cigarette expectancies may be at greater risk for nicotine dependence and long-term use. This may be particularly true of those who use e-cigarettes at least partly for affect regulation (Baker et al., 2004; Kassel et al., 2007; Weinstein & Mermelstein, 2013). These potential consequences suggest e-cigarette use could be antithetical to harm reduction.

The finding that those who reported using e-cigarettes in situations where cigarette smoking was not permitted tended to use e-cigarettes more frequently overall echoes previous reports that smokers use e-cigarettes to bypass smoking restrictions (Adkison et al., 2013). Previous studies have found that smoke-free environments are associated with lower smoking prevalence and reduced cigarette consumption (Fichtenberg & Glantz, 2002; Song et al., 2015). Therefore, using e-cigarettes in order to bypass smoking restrictions would be counterintuitive to harm reduction efforts. Using e-cigarettes when cigarettes are restricted or not available is consistent with a desire to avoid nicotine withdrawal.

The association between e-cigarette use and the perception that e-cigarettes are less harmful than cigarettes is consistent with earlier studies (Choi & Forster, 2014). This suggests that young adults may not be deterred by fears of negative health consequences of e-cigarette use to the same extent as with cigarettes. Although e-cigarettes are too new a product for the long-term consequences to be well-understood, safety research to date suggests that this is a reasonable belief, and that negative health effects are unlikely to approach those of cigarettes (Goniewicz et al., 2014; Grana et al., 2014). However, being safer than cigarettes is an extraordinarily low bar. It is important that the tobacco research community develop a thorough understanding of the consequences of e-cigarette use, both direct and indirect (e.g., e-cigarettes may increase health risks by increasing risk of other tobacco use). To the extent that negative consequences are uncovered, this information can be used to educate youth and young adults about the risks of e-cigarettes, which may help to prevent or reduce their use.

The magnitude of the effect of e-cigarette expectancies on e-cigarette frequency decreased over time. Expectancies were assessed at baseline, and evidence indicates that expectancies change as use patterns change (De Leeuw et al., 2008; Wahl et al., 2005). This suggests that participants' expectancies during follow-up assessments may have differed from their baseline responses more as the interval between baseline and follow-up assessments increased. Consequently, the baseline expectancy and perceived harmfulness values were weaker predictors of e-cigarette frequency at 6- and 9-months than e-cigarette frequency at baseline and 3-months.

Overall, the combination of these findings suggests that other factors may influence frequency of e-cigarette use more than harm reduction in this sample. However, given that the strength of the associations between predictors and e-cigarette frequency was stable over time, other interpretations are plausible. For example, findings could reflect long-term stability of e-cigarette use that impacted predictors rather than vice versa, although to some extent this possibility is mitigated by the fact that analyses included pre-baseline use as a covariate. Alternatively, the associations between e-cigarette frequency and predictor variables could be bidirectional or explained by an unmeasured factor.

The current study has limitations. First, because this was a secondary analysis, some of the predictors consisted of single items that may not fully capture the desired constructs. Second, it is unknown whether participants' initial nicotine exposure was via cigarettes, e-cigarettes, or another product, precluding us from evaluating the extent to which predictors may have been impacted by previous experience with cigarettes and e-cigarettes. Third, because one item evaluating future cigarette intent did not differentiate between maintaining and increasing cigarette consumption, it is not clear whether participants were responding to consistent interpretations of the item. Finally, the sample was primarily recruited online and was composed of young, non-daily cigarette smokers who were California residents; thus, it may not be representative of all e-cigarette users, including never- and heavy cigarette smokers. However, the present sample is comparable to studies of non-daily smokers in terms of e-cigarette use prevalence (McMillen et al., 2015) as well as quantity and frequency of cigarette smoking (Berg, 2014; Harrison & McKee, 2008; Schauer et al., 2014).

Findings from this study may not be consistent with using e-cigarettes primarily to reduce harm from cigarette smoking among young adult non-daily smokers. Instead, findings suggest e-cigarettes may be more often used to supplement cigarette smoking. Including e-cigarettes under smoking restrictions and educating young adults about potential long-term consequences may help prevent and reduce e-cigarette use. Longitudinal research is needed to better understand the motives for dual use of cigarettes and e-cigarettes, as well as whether use of both products leads to different outcomes than use of cigarettes alone.

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**Table 1**

Demographic and clinical characteristics.

| Variable | Proportion or Mean (SD) |
|---|---|
| N | 348 |
| Age | 20.5 (1.8) |
| Sex, % male | 56.6% |
| Race/ethnicity, % non-Hispanic Caucasian | 42.5% |
| Student status, % full time student | 59.5% |
| Cigarette smoking days in past 2 weeks, baseline | 5.6 (4.0) |
| E-cigarette days in past 2 weeks, baseline | 1.8 (3.6) |
| Using e-cigarettes to circumvent smoking bans | 1.5 (0.9) |
| Perception of harmfulness of e-cigarettes compared to cigarettes | 1.9 (1.0) |
| E-cigarette expectancies | 2.1 (0.6) |
| Intention to quit smoking in the next month, baseline | 1.4 (1.3) |
| Intention to quit smoking in the next year, baseline | 1.9 (1.3) |
| Intent to maintain or increase smoking over the next month, baseline | 2.1 (1.3) |
| Intent to maintain or increase smoking over the next year, baseline | 1.8 (1.2) |

**Table 2**

GEE model of the association between intent to increase or maintain cigarette consumption over the next month and e-cigarette use over time.

| Predictor | Coefficient | Standard Error | z-score | p-value | d |
|---|---|---|---|---|---|
| Assessment days | −0.01 | 0.01 | −0.33 | .738 | −0.02 |
| Sex | −0.01 | 0.02 | −0.05 | .963 | −0.01 |
| Race/ethnicity[1] | | | | | |
| Hispanic | 0.03 | 0.03 | 1.04 | .297 | 0.06 |
| Asian | −0.01 | 0.03 | −0.18 | .854 | −0.02 |
| Other race/ethnicity | 0.02 | 0.04 | 0.49 | .627 | 0.03 |
| Pre-baseline e-cigarette use | 0.14 | 0.03 | 4.35 | <.001 | 0.23 |
| Cigarette frequency | 0.05 | 0.02 | 2.13 | .033 | 0.11 |
| Student status | −0.06 | 0.02 | −2.38 | .017 | −0.13 |
| Time | −0.01 | 0.01 | −1.08 | .278 | −0.06 |
| Intent to maintain/increase cigarettes in the next month | 0.02 | 0.01 | 1.79 | .074 | 0.10 |

[1] Caucasian was the reference category.

**Table 3**

Summary of GEE models of e-cigarette use over time.

| Predictor | Coefficient | Standard Error | z-score | p-value | d |
|---|---|---|---|---|---|
| Intent to maintain/increase cigarettes in the next month | 0.02 | 0.01 | 1.79 | .074 | 0.10 |
| Intent to maintain/increase cigarettes in the next year | 0.01 | 0.01 | 1.02 | .307 | 0.06 |
| Intent to quit cigarettes in the next month | −0.01 | 0.01 | −1.25 | .210 | −0.07 |
| Intent to quit cigarettes in the next year | −0.01 | 0.01 | −1.41 | .158 | −0.09 |
| Use of e-cigarettes to circumvent smoking bans | 0.06 | 0.01 | 4.08 | <.001 | 0.24 |
| Harmfulness of e-cigarettes vs. cigarettes | −0.02 | 0.01 | −1.97 | .049 | −0.10 |
| Expectancies | 0.15 | 0.02 | 6.89 | <.001 | 0.37 |
| Expectancies X time | −0.17 | 0.01 | −2.19 | .029 | −0.12 |