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Electronic Cigarette Harm and Benefit Perceptions and Use among Youth

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Abstract

Introduction.—The purpose of the present study is to examine adolescent perceptions of harm and benefits associated with electronic cigarettes (e-cigarettes) and their associations with use.

Methods.—Data from the 2016 Florida Youth Tobacco Survey were analyzed in 2017. Participants who were in high school aged 14–17 were included (n=22,884). Logistic regression analyses were used to compare e-cigarette use groups on perceived harm and benefits of e-cigarettes.

Results.—Less than one-half of the sample reported that e-cigarettes are harmful to their health and less than two-thirds reported that individuals can get addicted to e-cigarettes. Susceptible never users and all e-cigarette use groups were less likely to report that e-cigarettes were harmful to their health, people can get addicted to e-cigarettes, and that smoke from other's e-cigarettes were harmful than committed never users. Furthermore, susceptible never users and all use groups were more likely to report that it would be easy to quit using e-cigarettes than committed never users. Susceptible never users and all use groups were also more likely to perceive benefits of e-

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cigarette use including having more friends, looking cool or fitting in, feeling more comfortable in social situations, and stress relief compared to committed never users.

Conclusions.—Youth who are susceptible to use, currently use, or have used e-cigarettes are less likely to report harm and more likely to perceive benefits associated with e-cigarette use compared to committed never users. Addressing harm and benefit perceptions may be important for interventions designed to reduce e-cigarette use among adolescents.

Introduction

The use of e-cigarettes has grown in recent years, with the prevalence surpassing traditional cigarette use among adoelscents.[1] In 2016, national data showed that 11.3% of high school youth reported using e-cigarettes in the past 30-days, while 8% reported using cigarettes. Despite a decline from 2015 to 2016, the use of e-cigarettes increased rapidly, with rates of lifetime and past 30-day use tripling from 2011 to 2015 among high school students.

E-cigarette use among adolescents is concerning for several reasons.[1,2] First, e-cigarettes contain chemicals, some of which are known carcinogens. Emerging evidence also suggest that e-cigarette vapor may have negative cardiovascular and pulmonary effects.[3–6] Furthermore, the majority of adolescents report using e-liquids with nicotine.[7] Nicotine is addictive and can have long-lasting negative effects on brain development.[8] Finally, longitudinal studies have found that adolescents using e-cigarettes are more likely to initiate the use of combustible tobacco products than youth who do not use e-cigarettes.[9,10]

Understanding factors that lead to initiation of e-cigarettes is critical for tobacco prevention. Previous research has shown the importance of harm and benefit perceptions on initiation of cigarettes. A prospective study by Song et al. showed that adolescent smoking initiation was directly related to harm and benefit perceptions associated with cigarette smoking.[11] Harm and benefit perceptions of e-cigarettes may be particularly important because studies show that adolescents perceive e-cigarettes to be safer than cigarettes.[12,13] In one study, 60% of high school youth reported that e-cigarettes were safe or had minimal health hazards.[14]

Only a few studies have examined the relationship between harm and benefit perceptions and use of e-cigarettes among high school youth.[13,15] Findings from the 2012 National Youth Tobacco Survey showed that perceiving e-cigarettes as less harmful than cigarettes was associated with e-cigarette use.[13] Similarly, Hammig et al. found that youth who perceived e-cigarette as less harmful and addictive were also more likely to have initiated use.

In the present study adolescent perceptions of harm and benefits of e-cigarettes were assessed, as well as how these perceptions were associated with use. This study contributes to the literature in several ways. First, the study adds to the dearth of studies on adolescent perceptions of harm and benefits of e-cigarettes, and provides a current assessment of these perceptions. The few studies that have been conducted are based on data collected between 2012 and 2014. It is important to assess current perceptions, given the increase in prevalence and awareness of e-cigarettes in the past several years. Harm and benefit perceptions were also examined for a range of e-cigarette use groups, including never susceptible, lifetime,

and current users. Finally, the current study examines a broader range of harm and benefit questions than previous studies, providing a more comprehensive examination of how these perceptions relate to use.

Methods

Florida Youth Tobacco Survey (FYTS) Overview

The FYTS is a school-based survey administered in January and February of each year by the Florida Department of Health.[16] The sample includes middle and high school students across the state, using a two-stage cluster probability design. A random sample of public middle and high schools is selected and then a random sample of classrooms is selected from each school. All students in the selected classrooms are invited to participate.

Current Study

Data from the 2016 FYTS were analyzed in 2017. The present study focuses on high school students because e-cigarette use was low among middle-school students and did not provide an adequate sample. The survey was administered to 33,558 high school students (74% student participation rate) within 339 high schools (96% school participation rate) across all 67 counties in Florida. Participants between the ages of 14 and 17, in 9th through 12th grade, who did not report using e-cigarettes with marijuana oil (or hash oil), bath salts (or flakka), or spice (or k2) were eligible, as well as youth who reported being susceptible to e-cigarette use, or not using any tobacco products in their lifetime (n=23,615). Participants who reported using tobacco products other than e-cigarettes were not eligible, since the focus of the present study is on e-cigarette perceptions and how they relate to use. Participants were excluded from the study if they had missing values for tobacco use. The final sample for the study was 22,884. This study is a secondary data analysis on deidentified data and thus determined by the George Washington University to be exempted from the review of IRB.

E-Cigarette Use Group.—Participants were categorized into one of six e-cigarette use groups: committed never users (never used e-cigarettes or any other tobacco product, and were not susceptible to e-cigarette use), susceptible never users (never used e-cigarettes or any other tobacco product, but were susceptible to e-cigarette use), lifetime exclusive e-cigarette use (reported using e-cigarettes in lifetime, but not in the past 30 days, and reported no other tobacco use), past 30-day exclusive use (reported using e-cigarettes in past 30-days, but no other tobacco use in lifetime or past 30-days), lifetime e-cigarette plus other product use (denoted lifetime e-cigarette use +; reported using e-cigarettes and other tobacco products in lifetime, but no tobacco use in past 30-days), and past 30-day e-cigarette plus other product use (denoted past 30 day e-cigarette use +; reported using e-cigarettes and other tobacco products in past 30-days). The six groups were based on responses to lifetime and past 30-day use of (1) cigarettes, (2) e-cigarettes (referred to as electronic vapor products on survey), (3) cigars, cigarillos, or little cigars, (4) chewing tobacco, snuff, or dip, and (5) hookah. Intentions to use e-cigarettes soon or in the next year were also assessed. Participants who reported never using tobacco and who had no intentions of using e-cigarettes soon or in the next year were categorized as committed never users. Participants

who reported intentions to use e-cigarettes soon or in the next year, or who were not sure, were categorized as susceptible never users.

Perceptions of Harm.—Five questions were used to assess the harm perceptions of e-cigarettes. Participants answered the following questions: (1) Do you think electronic vapor products (EVPs) are harmful to your health? (yes/no/not sure), (2) Do you think people can get addicted to EVPs? (yes/no/not sure), (3) Do you think it would be easy to quit using EVPs? (yes/no/not sure), (4) Do you think smoke from other people's EVP is harmful to you? (yes/no), and (5) Compared to cigarette smoking, using EVPs are… (more harmful/equally harmful/less harmful/not sure).

Perceptions of Benefits.—Four questions were used to assess perceived benefits. Participants were asked (1) if people who use EVPs have more friends, (2) whether they make young people look cool or fit in, (3) whether they help make people feel more comfortable at parties or in other social situations, and (4) whether they help people relieve stress. Response options to these questions included "Yes", "No", "Not Sure".

Geographic Classification.—Geographic locations were defined by the 2013 National Center for Health Statistics urban-rural classification scheme for counties.[17] The codes are based on the 2013 Metropolitan Statistical Area (MSA), dividing counties into six categories: Noncore (nonmetropolitan counties that did not count as micropolitan), micropolitan (counties in MSAs), small metro (counties in MSAs with <250,000 people), medium metro (counties in MSAs 250,000–999,999), large fringe metro (counties in MSAs greater of equal to 1 million that did not qualify as a central metro) and large central metro (contain the entire population of the largest principal city of the MSA, or have their entire population contained in the largest principal city of the MSA, or contain at least 250,000 inhabitants of any principal city of the MSA). Out of Florida's 67 counties, 16 were noncore, 7 were micropolitan, 9 were small metro, 19 were medium metro, 11 were large fringe metros and 5 were large central metros.

Demographic Characteristics.—Participants indicated their sex (female/male) and age (in years). Participants indicated if they were Hispanic or Latino, and which of the following best described themselves (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, or Other). Responses were recoded into Hispanic, non-Hispanic White, non-Hispanic Asian, non-Hispanic Black, and Other (including American Indian, Alaska Native, Native Hawaiian or Other Pacific Islander).

Data Analytic Strategy—To accommodate the complex sampling procedures, data were analyzed using survey procedures in SAS 9.4. Weighted frequencies were calculated to assess harm and benefit perceptions by e-cigarette group. To assess differences in each harm and benefit perception (dependent variables) by e-cigarette use group (independent variable), separate weighted logistic regression analyses were used while controlling for potential confounders including age, gender, race/ethnicity, and metropolitan county type. A total of nine regression models were computed, one for each perception. Response options 'no' and 'not sure' were collapsed for analytic purposes and each e-cigarette group was compared to

the committed never user group. A supplemental analysis was conducted comparing susceptible users to the e-cigarette use groups.

Results

Sample Characteristics.

Participants included slightly more males than females and the sample was racially and ethnically diverse (Table 1). The majority of participants reported never using any tobacco products and not being susceptible to e-cigarette use (53.5%). A smaller proportion of participants reported some susceptibility to using e-cigarettes (14.2%). The largest use groups included participants who used e-cigarettes exclusively in their lifetime (9.5%), and those who reported lifetime e-cigarette use along with other tobacco product use (18.1%). A minority of youth (<3%) reported exclusively using e-cigarettes exclusively or in combination with other tobacco products in the past 30-days.

Harm and Benefit Perceptions.

The proportion of youth who believed that people can get addicted to e-cigarettes ranged from over two-thirds (68%) among committed never users to one-half (50%) among susceptible never users (Table 2). The proportion of youth who believed that e-cigarettes would be easy to quit ranged from 16% among committed never users to 55% among past 30 day e-cigarette users. Overall less than one-half of the sample reported that e-cigarettes are harmful to their health. Only 15.4% of past 30-day e-cigarette users and 21.7% of past 30-day polyusers reported that e-cigarette use was harmful to their health, compared to 56% of committed never users. Nearly one-half of all participants believed that smoke from another person's e-cigarette was harmful, but ranged from 15% among past 30-day e-cigarette users to 62% among committed never users. The majority of the sample reported that e-cigarettes are less harmful or equally harmful to cigarettes. However, nearly one-third of the sample indicated they did not know how harmful e-cigarettes were compared to cigarettes. The majority of e-cigarette users (64%−80% depending on the group), however, indicated that e-cigarettes were less harmful than cigarettes.

The proportion of youth who endorsed benefits of e-cigarettes varied by the perceived benefit. Overall, only a small proportion of youth (<15%) reported that young people who use e-cigarettes have more friends and make young people look cool or fit in, although approximately one-quarter of the past 30 day polyusers with e-cigarettes perceived these benefits. A slightly higher proportion of youth reported that using e-cigarettes helps people feel more comfortable at parties or in other social situations (28.2%) and that they relieve stress (31.4%). The proportion of youth endorsing these items was higher among past 30-day e-cigarettes users, with up to 64% of past 30-day polyuse with e-cigarette users indicating that the use of e-cigarettes reduces stress. The majority of the sample, regardless of use group, reported that e-cigarette use did not make young people look cool or fit in. Nearly one-third of the sample, however, reported that they weren't sure about the other potential perceived benefits of e-cigarette use including having more friends, feeling more comfortable in social events, and relieving stress.

Harm and Benefit Perceptions and Use.

After controlling for age, sex, race/ethnicity, and metropolitan county type, susceptible never users and all e-cigarette use groups had lower odds of reporting that EVPs were harmful to health (AORs: .14-.38), people can get addicted to e-cigarettes (AORs: .49-.67), and that smoke from other's e-cigarettes were harmful (AORs: .12-.32; Table 3) than committed never users. Furthermore, susceptible never users and all use groups had higher odds of reporting that it would be easy to quit using e-cigarettes (AORs: 1.71–6.19) than committed never users. Susceptible never users and all use groups had higher odds of perceiving benefits of e-cigarette use compared to committed never users including having more friends (AORs: 1.55–3.72; Table 4), looking cool or fitting in (AORs: 2.41–5.19), feeling more comfortable in social situations (AORs: 1.98–4.02) and stress relief (AORs: 1.79–5.78).

With a few exceptions, susceptible never users harm perceptions were different from e-cigarette users' (Table 3). However, susceptible e-cigarette users were similar to lifetime e-cigarette users on several benefit perceptions including having more friends, making young people look cool, and helping make people feel more comfortable at parties or other social events (Table 4). Susceptible never users, however, had lower odds of reporting that e-cigarettes help people relieve stress than all e-cigarette users groups.

Discussion

The goal of the present study was to examine current harm and benefit perceptions of e-cigarettes and how perceptions were associated with use. In the current study, 43% of youth reported that e-cigarettes were less harmful than cigarettes. This proportion is higher than reported in previous studies. Data from the 2012 National Youth Tobacco Survey showed that approximately one-third of adolescents believed that e-cigarettes were less harmful than cigarettes.[12,13] Interestingly, Monitoring the Future Study found an increase in perceived absolute harm of e-cigarette use between 2015 and 2016.[18] The higher proportion reported here may reflect increases in public discourse about e-cigarettes, as well as e-cigarette marketing that focus on e-cigarettes as a safer alternative to cigarettes. Research shows that a large majority of youth are exposed to e-cigarette marketing and that exposure may be associated with perceptions of e-cigarettes.[19,20] A recent study found that youth who are receptive to the marketing are more likely to believe that e-cigarettes are less harmful than cigarettes and are more likely to use e-cigarettes.[19] While marketing of cigarettes near schools is prohibited, no such rules currently exist for e-cigarettes. Reducing adolescent exposure to e-cigarette marketing is an important component for preventing initiation of e-cigarettes.

This study examined several other perceptions that have been less commonly reported in the e-cigarette literature. Of particular concern is that less than one-half of participants reported that e-cigarettes are harmful to their health and nearly 40% of the sample indicated people could not get addicted or were not sure if people could get addicted to e-cigarettes. These results are similar to previous work on cigarettes, in which some adolescents are not aware of the additive nature of cigarette smoking.[21] The US Food & Drug Administration has announced a public health campaign that will begin in 2018 to address the dangers of e-

cigarette use among teens.[2] Including messaging about the risk of nicotine addiction associated with e-cigarette use is a public health priority.

The perceived benefits examined in this study are beliefs that have been associated with traditional cigarette use.[22] Overall, very few youth (<15%) endorsed the notion that e-cigarette users have more friends or make young people look cool. Between one-quarter and one-third of youth, however, endorsed the idea that e-cigarette use helps people feel more comfortable at social events and that e-cigarette use can help people relieve stress. These findings suggest that youth do not perceive many social benefits of e-cigarette use, and thus some of the campaigns to prevent cigarette use may not be beneficial for e-cigarettes. More youth perceived internal benefits (such as relieving stress) from e-cigarette use and campaigns to address these perceived benefits are needed.

The second goal of the current study was to assess how perceptions of harm and benefits were associated with use. E-cigarette use was associated with increased odds of reporting at e-cigarettes were less harmful than cigarettes and lower odds of reporting that people can get addicted to e-cigarettes. Extending these findings, e-cigarette users had a lower odds of reporting that e-cigarette use is harmful to one's health and that smoke from other's e-cigarettes are harmful, and more likely to report that it is easy to quit e-cigarettes. E-cigarette users were also more likely than committed never users to perceive benefits of e-cigarette use including having more friends, making young people look cool, feeling more comfortable at social events, and help relieve stress. It is notable that susceptible users reported harm and benefits perceptions that were different from committed never users. These findings are consistent with various health behavior models (e.g., theory of reasoned action) that suggest changes in attitudes and beliefs occur before changes in actual behavior. Programs are needed that address harm and benefits perceptions of e-cigarettes prior to use, as these programs have the potential to reduce actual initiation of these products.

The present study has several limitations. First, the present study only includes youth from Florida and may not generalize to youth in other states. Second, the present study is cross-sectional and thus, causality cannot be established. Future research should examine how harm and benefit perceptions relate to initiation of e-cigarettes in longitudinal studies. Third, this study was limited to the questions included on the Florida Youth Tobacco Survey. The survey did not assess whether participants used e-liquids with or without nicotine, or which they were using as a reference for answering the harm questions. Fourth, the Florida Youth Tobacco Survey is a school-based survey and the results may not generalize to youth not in school. Finally, the referent group for the harm perceptions varied by item. It is possible that responses may have been directly associated with the referent for the item, especially since previous research indicates that individuals tend to minimize their own risk.[21] However, between-person differences in perceptions should be preserved regardless of the referent group, and therefore should have limited influence on the findings.

Conclusions

This study provides a more in-depth examination of harm and benefit perceptions related to e-cigarettes than found in previous studies. Youth who are susceptible to use, currently use,

or have used e-cigarettes are less likely to report harm and more likely to perceive benefits associated with e-cigarette use compared to committed never users. Addressing harm and benefit perceptions may be important for interventions designed to reduce e-cigarette use among adolescents.

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Table 1.

Demographic Characteristics of the Sample (unweighted n=22,884)

	Weighted %
Gender	
Male	51.2
Female	48.8
Age	
14	13.4
15	29.8
16	30.3
17	26.5
Race/Ethnicity	
Non-Hispanic White	42.0
Non-Hispanic Black	21.8
Non-Hispanic Asian	2.3
Hispanic	30.4
Other	3.5
Metropolitan County Type	
Noncore	9.9
Micropolitan	7.2
Small Metro	6.2
Medium Metro	37.6
Large Fringe Metro	26.7
Large Central Metro	12.4
E-Cigarette Use History	
Committed Never User	53.5
Non-Committed Never User	14.2
Lifetime Exclusive E-Cigarette Use	9.5
Past 30-Day Exclusive E-Cigarette Use	2.0
Lifetime E-Cigarette Use + Other product(s)	18.1
Past 30-Day E-Cigarette Use + Other product(s)	2.7

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Table 2.

Harm and Benefit Perceptions of E-Cigarettes: Percentages for Overall Sample and by E-Cigarette Use Group

	Total	Committed Never User	Susceptible Never User	Lifetime E-Cigarette Use	Past 30 Day E-Cigarette Use	Lifetime E-Cigarette Use	Past 30 Day E-Cigarette Use
Perceptions of Harm							
Harmful to health							
Yes	43.2	55.7	31.8	25.8	15.4	30.4	21.7
No	21.1	10.2	25.0	36.0	54.5	34.0	52.4
Not sure	35.8	34.2	43.2	38.2	30.0	35.6	25.9
Get addicted to e-cigarettes							
Yes	61.5	67.7	50.3	54.8	52.2	55.5	58.9
No	22.4	18.7	20.5	29.3	33.8	28.4	31.4
Not sure	16.1	13.6	29.2	15.9	14.0	16.0	9.7
Easy to quit e-cigarettes							
Yes	26.2	16.0	24.5	38.5	55.2	45.0	55.4
No	43.0	53.1	32.4	33.4	23.8	29.0	27.6
Not sure	30.8	30.9	43.1	28.1	31.0	26.0	17.0
Smoke from other's e-cigarettes harmful							
Yes	47.2	62.4	35.1	26.7	15.9	28.4	23.2
No	52.8	37.6	64.9	73.3	84.1	71.6	76.8
Compared to cigarettes, e-cigarettes are							
More harmful	5.3	6.1	4.7	2.3	1.8	5.1	4.9
Equally harmful	18.9	25.4	13.0	10.8	4.1	11.8	7.9
Less harmful	43.1	28.5	44.6	66.8	79.8	64.1	74.6
Not sure	32.7	40.0	37.7	20.1	14.3	19.0	12.6
Perceptions of Benefits							
Have more friends							
Yes	13.8	11.0	16.1	17.2	20.0	15.9	29.4
No	54.1	58.1	40.6	55.1	46.8	53.4	42.3
Not sure	32.1	30.9	43.2	27.7	33.2	30.7	28.3
Make young people look cool							
Yes	10.3	6.4	14.1	15.3	17.8	14.3	25.2

	Total	Committed Never User	Susceptible Never User	Lifetime E-Cigarette Use	Past 30 Day E-Cigarette Use	Lifetime E-Cigarette Use	Past 30 Day E-Cigarette Use
No	76.9	84.9	58.4	72.4	68.8	71.9	55.6
Not sure	12.8	8.7	27.5	12.4	13.5	13.8	19.2
Feel more comfortable at social events							
Yes	28.2	20.5	33.2	35.3	46.1	39.0	50.0
No	42.1	49.3	26.1	38.3	30.3	36.4	30.1
Not sure	29.7	30.2	40.7	26.4	23.6	24.6	19.8
Help relieve stress							
Yes	31.4	22.8	33.7	38.9	59.4	44.6	63.7
No	37.0	43.9	23.3	32.7	20.7	31.4	22.6
Not sure	31.6	33.3	43.0	28.4	19.9	24.0	13.7

Table 3.

Associations between E-Cigarette Use Groups and Harm Perceptions

	Harmful to Health	Get Addicted	Easy to Quit	Smoke from other's EVPs Harmful	EVPs less harmful than Cigarettes
E-Cigarette Use Group	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Committed Never Use	Ref	Ref	Ref	Ref	Ref
Susceptible Never Use	.38 (.34, .24)[a]	.49 (.44, .54)[a]	1.71 (1.49, 1.96)[a]	.32 (.28, .36)[a]	2.86 (2.46, 3.32)[a]
Lifetime E-Cigarette Use	.27 (.24, .31)[b]	.58 (.52, .64)[b]	3.26 (2.85, 3.72)[b]	.22 (.19, .26)[b]	5.60 (4.73, 6.63)[b]
Past 30 Day E-Cigarette Use	.14 (.10, .19)[b]	.54 (.42, .69)[a]	6.19 (4.81, 7.96)[b]	.12 (.08, .17)[b]	14.46 (8.54, 24.51)[b]
Lifetime E-Cigarette Use+	.34 (.31, .38)[a]	.59 (.53, .65)[b]	4.34 (3.89, 4.84)[b]	.24 (.21, .26)[b]	4.40 (3.80, 5.10)[b]
Lifetime E-Cigarette Use+	.21 (.16, .27)[b]	.67 (.54, .82)[b]	6.10 (4.97, 7.48)[b]	.20 (.16, .25)[b]	6.57 (4.66, 9.26)[b]

[a]Letters in the tables next to the 95% CI are results from analyses using the susceptible never user group as the reference group.

[b]A similar letter to the susceptible never user group indicates no significant difference between the two groups while a different letter indicates a statistically significant difference

Table 4.

Associations between E-Cigarette Use Groups and Benefit Perceptions

	Have More Friends	Make Young People Look Cool	More Comfortable at Social Events	Help Relieve Stress
E-Cigarette Use Group	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Committed Never Use	Ref	Ref	Ref	Ref
Susceptible Never Use	1.55 (1.35, 1.78)[a]	2.41 (2.05, 2.85)[a]	1.98 (1.77, 2.23)[a]	1.79 (1.60, 2.00)[a]
Lifetime E-Cigarette Use	1.74 (1.48, 2.06)[a]	2.72 (2.29, 3.24)[a]	2.17 (1.92, 2.46)[a]	2.16 (1.89, 2.47)[b]
Past 30 Day E-Cigarette Use	2.17 (1.63, 2.88)[b]	3.29 (2.33, 4.66)[a]	3.37 (2.56, 4.44)[b]	5.00 (3.84, 6.52)[b]
Lifetime E-Cigarette Use+	1.55 (1.36, 1.75)[a]	2.51 (2.15, 2.93)[a]	2.44 (2.20, 2.70)[b]	2.72 (2.44, 3.05)[b]
Lifetime E-Cigarette Use+	3.72 (2.89, 4.80)[b]	5.19 (3.95, 6.82)[b]	4.02 (3.23, 5.01)[b]	5.78 (4.59, 7.28)[b]

[a]Letters in the tables next to the 95% CI are results from analyses using the susceptible never user group as the reference group.

[b]A similar letter to the susceptible never user group indicates no significant difference between the two groups while a different letter indicates a statistically significant difference.