



## Sexy, trashy, cool: Perceptions of electronic cigarette users across sociodemographic groups and E-cigarette use among United States Air Force Airmen

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### ABSTRACT

E-cigarette use has increased in recent years. Military personnel have higher rates of e-cigarette use than civilian populations, with 15.3% of Air Force recruits using e-cigarettes. The current study assessed associations between perceptions of e-cigarette users and current use of e-cigarettes, and differences in sociodemographic characteristics to determine if there were different beliefs among different groups to inform intervention development among these straight-to-work young adults. Participants ( $N = 17,314$ ) were United States Air Force Airmen (60.7% White, 29.7% women) who completed a survey during their first week of Technical Training. Regression results indicated that identifying as a man ( $B = 0.22$ ,  $SE = 0.02$ ), identifying as Black ( $B = 0.06$ ,  $SE = 0.02$ ), reporting younger age ( $B = -0.15$ ,  $SE = 0.02$ ), having less education ( $B = -0.04$ ,  $SE = 0.02$ ), and current e-cigarette use ( $B = 0.62$ ,  $SE = 0.02$ ) were associated with endorsing more positive e-cigarette user perceptions. Identifying as a woman ( $B = -0.04$ ,  $SE = 0.02$ ) and being younger ( $B = -0.06$ ,  $SE = 0.02$ ) were associated with endorsing more negative perceptions of e-cigarette users. Current e-cigarette use was inversely associated with negative e-cigarette user perceptions ( $B = -0.59$ ,  $SE = 0.02$ ). Differences across groups were found for individual e-cigarette user characteristics. Future intervention strategies among Airmen may benefit from addressing e-cigarette user perceptions to change use behaviors, as these perceptions may result in stigmatized beliefs related to e-cigarette users.

### 1. Introduction

Electronic cigarette (e-cigarette) use has increased in recent years in the United States (U.S.), particularly among young adults (Dai & Leventhal, 2019), who exhibit the highest rate of e-cigarette use (9.3%; Cornelius et al., 2020) compared to other age groups. This is concerning given that e-cigarette use is associated with uptake of combustible cigarettes (Bold et al., 2018; Hammond et al., 2017; Loukas et al., 2018; Soneji et al., 2017). This concern extends to military personnel, who have even higher rates of use than civilian populations, with 15.3% of Air Force recruits reporting current e-cigarette use (Little et al., 2020a). Thus, it is important to understand variables that drive e-cigarette use among young adults, particularly straight-to-work (i.e., individuals who do not attend college and enter the workforce) young adults such as military personnel.

Research has been conducted related to harm perceptions and expectancies among e-cigarette users, finding widespread beliefs that e-cigarettes are less harmful than other combustible tobacco products and can be used for cigarette cessation (Case et al., 2016; Choi & Forster, 2014; Coleman et al., 2016; Cooper, Harrell, & Perry, 2016; Donaldson et al., 2021; Hammett et al., 2017; Hendricks et al., 2015; Navas-Nacher et al., 2020; Trumbo & Harper, 2013; Vu et al., 2019). Similar results have been found among military samples (Chin et al., 2018; Kozłowski et al., 2017) and straight-to-work adults (Gowin et al., 2017). Additionally, research has shown that individuals often expect positive effects from using e-cigarettes, such as alleviating stress (Napolitano et al., 2020), helping concentration (Cooper et al., 2016), being satisfying and enjoyable (Coleman et al., 2016), or that they can be used for weight control (Hammett et al., 2017; Morean & L'Insalata, 2017; Napolitano et al., 2018), even among U.S. Air Force personnel (Fahey et al., 2021).

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Existing literature also describes beliefs that e-cigarettes are more socially acceptable than traditional cigarettes (Coleman et al., 2016) or can aid in “fitting in” to smoking groups when an individual does not wish to use cigarettes (Hammett et al., 2017; Little et al., 2020b), and there has been high perceived acceptability of use within social networks (Leavens et al., 2019; Pebley et al., 2020; Wallace & Roche, 2018).

Further, research has found differences in beliefs about e-cigarettes among individuals of different racial backgrounds. Specifically, individuals who identify as Black or African American were less likely to believe that e-cigarettes are harmful to health or addictive compared to individuals who identify as White or Latino/a/x (Hooper & Kolar, 2017). This is particularly important given historical differences in tobacco use and consequences among individuals of color, and targeted advertising that contributed to these disparities (Barbeau et al., 2005; Food and Drug Administration, 2013).

Most current research has focused on beliefs related to consequences of using e-cigarettes, but less about characteristics associated with using e-cigarettes, or what people think about the person using the product. These perceptions may be important because it addresses the schema or “prototype” (McKelvey et al., 2018) a person has assigned users of these products. Past studies related to smoking and alcohol use have shown that young individuals with positive prototypes of someone using a substance are more likely to use themselves (Aloise-Young et al., 1996; Blanton et al., 1997). One study that inspired the current work and used almost identical questions to those in the current study found that youth ages 14–20 who reported higher willingness to try e-cigarettes or had tried them previously were more likely to report positive attributes of e-cigarette users (McKelvey et al., 2018), demonstrating the impact prototypes may hold for e-cigarette users. These attributes have not, to our knowledge, been examined among young adult e-cigarette users (e.g., above age 20), across different sociodemographic groups, or among young adult military populations at higher risk for tobacco use. Thus, additional work is needed to better understand how these prototypes influence use across different sociodemographic groups given the historical differences in tobacco use among people of color, individuals of different gender identities, age groups, and other identities. This is particularly important in the current population, given that the U.S. military has been targeted by tobacco companies, including e-cigarette brands such as JUUL (Fahey et al., 2020), and research has shown that individuals exposed to targeted marketing prior to joining the military reported more tobacco use one year after enlistment (Pebley et al., 2022). Additionally, military-peer and role model influences (e.g., military training leaders) have previously been shown to predict subsequent tobacco use among young adults during their advanced training phase (Dunkle et al., 2019; Green et al., 2008; Little et al., 2019).

Prototypes of e-cigarette users may also contribute to stigmatized beliefs about those who use the product. While efforts are being made to reduce stigma against individuals using substances generally, altering norms and perceptions of individuals using tobacco products has been instrumental in the past to reduce use (Castaldelli-Maia et al., 2016). Cigarettes were once associated with “luxury and glamour” (Castaldelli-Maia et al., 2016), but anti-smoking campaigns shifted societal perceptions in many places so that cigarette use was seen as undesirable, and thus increasing stigma (Castaldelli-Maia et al., 2016). Increased smoking stigma has been associated with increased desire and intention to quit, although this stigma comes with a cost of increasing false self-reported smoking cessation (Castaldelli-Maia et al., 2016). However, past studies with cigarette users have shown that smoking identity may also be associated with nicotine product use behaviors, with individuals with a smoking identity (i.e., identifying as a smoker) being less likely to make a quit attempt (van den Putte et al., 2009). These identities may play a role in shaping perceptions of people who use tobacco products such as e-cigarettes. Thus, knowing more about how people view users of e-cigarettes may help researchers, clinicians, and policymakers alike understand how to best create an environment where recreational e-

cigarette use is undesirable, but does not preclude disclosure and help-seeking behaviors.

## 2. The current study

The current study aimed to assess associations between perceptions of individuals who use e-cigarettes and current use (i.e., past 30-day use) of e-cigarettes among U.S. Air Force Airmen. Roughly 145,000 new recruits entered the military during the 2022 fiscal year alone (Department of Defense, 2022) and, overall, the military employs approximately 3 million people (Defense Manpower Data Center, 2019). Given that approximately 250,000 service members leave the military annually, with many of them continuing their nicotine and tobacco product use when they transition to being civilians (Difficult transitions, 2014), addressing tobacco use among military personnel is an important public health concern. Additionally, we aimed to determine if there were differences in sociodemographic characteristics in the endorsement of positive and negative characteristics of individuals who use e-cigarettes to determine if there may be unique considerations for different groups when planning and implementing prevention and intervention programs.

We hypothesized that endorsing positive characteristics of individuals who use e-cigarettes would be associated with current e-cigarette use, and endorsing negative characteristics would be associated with not currently using e-cigarettes. We also hypothesized that younger individuals would be more likely to endorse positive characteristics related to e-cigarette users and current e-cigarette use. Given the lack of previous literature assessing racial, ethnic, and gender differences and education status, these analyses remained exploratory.

## 3. Materials and methods

### 3.1. Participants and procedures

Airmen ages 18 and older at four Technical Training Air Force bases were recruited between October 2019 and February 2022 as part of a study assessing tobacco use and influences among military personnel. Importantly, Airmen are banned from tobacco use during Basic Military Training (BMT) and the first four weeks of Technical Training (TT), which occurs immediately after BMT. During the first week of TT, 19,622 trainees were given information related to the study, and 17,314 provided informed consent and completed baseline surveys via paper and pencil. All study procedures were approved by the 59th Medical Wing Institutional Review Boards. Participants were not compensated.

### 3.2. Measures

Participants answered questions about their demographics (see Table 1), e-cigarette use, and beliefs about characteristics of e-cigarette users. Participants were asked to report their frequency of e-cigarette use in the 30 days prior to BMT, with answer options of *every day*, *some days*, and *not at all*. “Every day” and “some day” e-cigarette users were classified as e-cigarette users.

To assess perceptions of e-cigarette users, participants were asked “How much do the following characteristics describe a typical e-cigarette user in the military?” The question was adapted to reflect perceptions of users in the military given that these were new military personnel in TT. This was followed by a list of ten characteristics, including “clean,” “immature,” “healthy,” “cool,” “sexy,” “inconsiderate,” “attractive,” “disgusting,” “smart,” and “trashy.” Answer options for these characteristics included *not at all*, *a little bit*, *somewhat*, *quite a bit*, and *very much*. These items were derived from the work of McKelvey and colleagues (2018). Also consistent with McKelvey et al. (2018), characteristics were collapsed into “positive” and “negative” categories.

**Table 1**  
Participant Characteristics.

Variable	N (%)
<b>Gender</b>	
Woman	4812 (29.69%)
Man	11,398 (70.31%)
<b>Race</b>	
American Indian/Alaskan Native	152 (0.94%)
Asian	836 (5.17%)
Native Hawaiian or Pacific Islander	173 (1.07%)
Black/African American	2703 (16.73%)
White	9799 (60.65%)
Other Race	1090 (6.75%)
Multiple Races	1403 (8.68%)
<b>Education</b>	
High school/GED	9508 (58.50%)
Higher than high school/GED	6745 (41.50%)
<b>Age</b>	
Under 21 years	10,287 (62.74%)
21 years or older	6109 (37.26%)
Mean (SD)	21.03 (4.07)
<b>Past 30-day E-Cigarette Use</b>	
Yes	2482 (15.36%)
No	13,672 (84.64%)

Note. SD = standard deviation.

### 3.3. Data analysis

#### 3.3.1. Principal components analysis

A principal components analysis (PCA) was used to determine the factor structure of the questions related to e-cigarette characteristics. This was done because, although an almost identical questionnaire has been used previously, one question was slightly altered in our version. McKelvey and colleagues (2018) reported in text that they asked participants about perceptions that e-cigarettes are “attractive,” but reported results on opinions that e-cigarettes were “unattractive.” We opted to follow the in-text description, and thus our study asked if e-cigarettes were “attractive.” We also altered the question to specify e-cigarette users in the military, as described previously. Responses regarding characteristics of e-cigarette users were treated as continuous variables. The PCA allowed us to find a total score for subscales within the measure and use this value as a continuous outcome variable in the following regression analyses. Varimax rotation was used.

#### 3.3.2. Regression analyses

Linear regressions were used to determine the association between current e-cigarette use, demographic characteristics, and perceptions about individuals who use e-cigarettes. Significant demographic characteristics were then included in subsequent regression analyses to determine if there were differences across groups in the association between current e-cigarette use and characteristics of individuals who use e-cigarettes. Analyses were conducted using SAS version 9.4.

## 4. Results

### 4.1. Participant characteristics

Table 1 displays participant characteristics. Most participants identified as a man (70.31%) and 62.74% were under age 21. Most participants had a high school education/GED (58.50%), 60.65% identified as White, and 16.73% identified as Black or African American. About 15.36% reported using an e-cigarette in the past 30 days.

### 4.2. Principal components analysis

The PCA analysis revealed two factors in the e-cigarette perceptions questionnaire, with one representing positive perceptions of e-cigarettes

users and the other representing negative perceptions. Table 2 displays the factor loadings for each item. Cronbach’s alphas ranged from 0.57 to 0.88, indicating acceptable to very good reliability among the items.

### 4.3. Positive E-cigarette user perceptions

Table 3 displays results from the adjusted regression models. Identifying as a man ( $B = 0.22$ , standard error [SE] = 0.02,  $p < 0.0001$ ) and reporting Black racial background ( $B = 0.06$ ,  $SE = 0.02$ ,  $p = 0.009$ ) were significantly associated with endorsing more positive e-cigarette user perceptions. Additionally, younger age ( $B = -0.15$ ,  $SE = 0.02$ ,  $p < 0.0001$ ) and having a high school diploma/GED ( $B = -0.04$ ,  $SE = 0.02$ ,  $p = 0.03$ ) was associated with endorsing more positive e-cigarette user perceptions, compared to those who were older and had more education. Lastly, current e-cigarette use was associated with positive e-cigarette user perceptions ( $B = 0.62$ ,  $SE = 0.02$ ,  $p < 0.0001$ ). However, participants reporting Asian racial background endorsed fewer positive e-cigarette user perceptions ( $B = -0.08$ ,  $SE = 0.03$ ,  $p = 0.02$ ).

### 4.4. Negative E-cigarette user perceptions

Table 3 displays results from the adjusted regression models. Identifying as a woman ( $B = -0.04$ ,  $SE = 0.02$ ,  $p = 0.02$ ) and being younger ( $B = -0.06$ ,  $SE = 0.02$ ,  $p = 0.003$ ) were associated with endorsing more negative perceptions of e-cigarette users. Additionally, individuals from Black ( $B = -0.10$ ,  $SE = 0.02$ ,  $p < 0.0001$ ) and multiracial ( $B = -0.08$ ,  $SE = 0.03$ ,  $p = 0.002$ ) backgrounds endorsed fewer negative perceptions of e-cigarette users compared to White individuals. Lastly, current e-cigarette use was inversely associated with negative e-cigarette user perceptions ( $B = -0.59$ ,  $SE = 0.02$ ,  $p < 0.0001$ ), such that individuals who endorsed fewer negative perceptions had an increased chance of using e-cigarettes.

### 4.5. Individual E-cigarette characteristics

Table 4 displays the means for each e-cigarette characteristic (range from 0 to 4). Men and women were significantly different in all perceptions ( $p < 0.05$ ) except that e-cigarette users are “immature” and “inconsiderate” ( $p > 0.05$ ). Men had higher endorsement of each of the positive characteristics (i.e., “sexy,” “cool,” “clean,” “smart,” “healthy,” “attractive”), while women had higher endorsement of negative characteristics of “trashy” and “disgusting.”

All characteristics, except for “disgusting” and “inconsiderate,” were significantly different between people from different racial backgrounds (Table 4). White and multiracial individuals had the highest endorsement that e-cigarettes users were “clean” and individuals from other racial identities had the lowest endorsement. Multiracial participants also had the highest endorsement that e-cigarette users are “healthy,” while individuals from other racial identities had the lowest endorsement. Participants who reported Black racial identity had highest

**Table 2**  
Rotated Factor Pattern Obtained Using Principal Factor Analysis.

Individual component	Positive factor	Negative factor	h <sup>2</sup>
e-Cigarettes: sexy	0.88	0.08	0.78
e-Cigarettes: attractive	0.88	0.05	0.78
e-Cigarettes: cool	0.82	0.003	0.68
e-Cigarettes: smart	0.68	-0.13	0.47
e-Cigarettes: healthy	0.68	-0.23	0.51
e-Cigarettes: clean	0.57	-0.32	0.42
e-Cigarettes: trashy	-0.10	0.83	0.70
e-Cigarettes: disgusting	-0.11	0.82	0.69
e-Cigarettes: inconsiderate	-0.06	0.78	0.61
e-Cigarettes: immature	-0.02	0.61	0.38

Note. h<sup>2</sup> = final communality estimates (proportion of each variable’s variance that can be explained by the factors).

**Table 3**  
Adjusted Model Results for Positive and Negative Perceptions of E-Cigarettes.

Variable	Positive Perceptions		Negative Perceptions	
	B (SE)	p	B (SE)	p
<b>Gender</b>				
Men vs Women	0.22 (0.02)	<0.0001	-0.04 (0.02)	0.02
<b>Education</b>				
>High school/GED vs High school/GED	-0.04 (0.02)	0.03	0.03 (0.02)	0.14
<b>Age</b>				
21 or older vs Under 21	-0.15 (0.02)	<0.0001	-0.06 (0.02)	0.003
<b>Race<sup>a</sup></b>				
Black or African American	0.06 (0.02)	0.009	-0.10 (0.02)	<0.0001
American Indian/Alaskan Native	-0.07 (0.08)	0.38	-0.07 (0.08)	0.39
Asian	-0.08 (0.03)	0.02	-0.06 (0.03)	0.08
Native Hawaiian/Pacific Islander	-0.05 (0.07)	0.46	-0.06 (0.07)	0.42
Multiracial	0.04 (0.03)	0.18	-0.08 (0.03)	0.002
Other racial background not listed	-0.05 (0.03)	0.13	-0.06 (0.03)	0.05
<b>Current E-Cigarette User</b>				
Current user vs Not current user	0.62 (0.02)	<0.0001	-0.59 (0.02)	<0.0001

Note. The second named response option for each variable is the reference category. A = White is the reference category.

endorsement that e-cigarette users are “sexy,” “cool,” “smart,” and “attractive.” Lastly, White individuals had the highest endorsement that e-cigarette users are “trashy” and “immature.”

Individuals under the age of 21 also had higher endorsement that e-cigarette users were “sexy,” “cool,” “clean,” “smart,” “healthy,” “attractive,” “trashy,” “immature,” and “disgusting” than those 21 years or older ( $p < 0.05$ ). Participants with lower levels of education (i.e., a high school diploma or GED) had higher endorsement of all positive

**Table 4**  
Comparing Individual E-Cigarette Characteristics.

	Positive					Negative				
	Sexy	Cool	Clean	Smart	Healthy	Attractive	Trashy	Immature	Disgusting	Inconsiderate
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
<b>Overall</b>	1.41 (0.85)	1.58 (0.95)	2.54 (1.08)	1.92 (1.02)	1.98 (0.99)	1.44 (0.85)	2.37 (1.31)	2.67 (1.20)	2.41 (1.33)	2.44 (1.24)
<b>Gender</b>										
Male	1.48 (0.90)	1.66 (0.99)	2.60 (1.07)	1.98 (1.03)	2.07 (1.00)	1.51 (0.91)	2.33 (1.28)	2.67 (1.18)	2.34 (1.30)	2.38 (1.21)
Female	1.25 (0.68)	1.38 (0.80)	2.41 (1.07)	1.77 (0.98)	1.75 (0.93)	1.27 (0.69)	2.47 (1.36)	2.67 (1.22)	2.57 (1.38)	2.60 (1.29)
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	0.84	<0.0001	0.0547
<b>Race</b>										
White	1.41 (0.85)	1.57 (0.93)	2.60 (1.07)	1.91 (1.01)	2.01 (0.99)	1.44 (0.85)	2.40 (1.31)	2.72 (1.19)	2.41 (1.32)	2.44 (1.22)
Black	1.45 (0.87)	1.64 (1.00)	2.45 (1.09)	1.99 (1.06)	1.93 (0.98)	1.47 (0.89)	2.31 (1.31)	2.49 (1.21)	2.45 (1.35)	2.47 (1.28)
Other	1.37 (0.83)	1.54 (0.93)	2.36 (1.09)	1.84 (1.00)	1.86 (0.98)	1.39 (0.83)	2.34 (1.31)	2.66 (1.19)	2.40 (1.35)	2.46 (1.26)
Multiracial	1.41 (0.85)	1.57 (0.93)	2.60 (1.07)	1.93 (1.03)	2.03 (0.99)	1.44 (0.85)	2.29 (1.26)	2.68 (1.17)	2.33 (1.28)	2.40 (1.21)
p-value	0.004	<0.0001	<0.0001	<0.0001	<0.0001	0.01	<0.0001	<0.0001	0.16	0.68
<b>Age</b>										
under 21	1.45 (0.88)	1.62 (0.97)	2.60 (1.08)	1.97 (1.03)	2.03 (1.00)	1.47 (0.88)	2.40 (1.31)	2.72 (1.18)	2.43 (1.33)	2.45 (1.23)
21+	1.36 (0.79)	1.51 (0.89)	2.45 (1.07)	1.83 (1.00)	1.88 (0.96)	1.38 (0.81)	2.32 (1.29)	2.59 (1.21)	2.38 (1.32)	2.43 (1.25)
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.07
<b>Education</b>										
HS/GED	1.45 (0.88)	1.62 (0.97)	2.59 (1.08)	1.97 (1.03)	2.03 (1.00)	1.48 (0.88)	2.38 (1.31)	2.67 (1.18)	2.41 (1.33)	2.43 (1.23)
>HS/GED	1.36 (0.80)	1.52 (0.91)	2.48 (1.07)	1.84 (1.00)	1.90 (0.97)	1.39 (0.81)	2.36 (1.30)	2.67 (1.21)	2.41 (1.33)	2.46 (1.25)
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.30	0.93	0.69	0.82
<b>Current e-cigarettes use</b>										
No	1.34 (0.77)	1.49 (0.88)	2.42 (1.04)	1.83 (0.97)	1.88 (0.95)	1.36 (0.78)	2.50 (1.32)	2.75 (1.20)	2.54 (1.34)	2.56 (1.25)
Yes	1.85 (1.12)	2.06 (1.15)	3.21 (1.06)	2.41 (1.11)	2.55 (1.02)	1.89 (1.10)	1.68 (0.95)	2.24 (1.05)	1.67 (0.95)	1.84 (0.99)
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Note. The current table display comparisons between groups related to perceived attributes of individuals who use e-cigarettes.

characteristics (i.e., “sexy,” “cool,” “clean,” “smart,” “healthy,” “attractive”) than those with a higher level of education (i.e., more than a high school education or GED). Lastly, current e-cigarette users had stronger perceptions regarding all positive characteristics and weaker perceptions regarding all negative characteristics than those who did not report currently using e-cigarettes ( $p < 0.05$ ).

### 5. Discussion

Previous studies have shown that perceptions of harm influence e-cigarette use (Case et al., 2016; Chin et al., 2018; Choi & Forster, 2014; Coleman et al., 2016; Cooper et al., 2016; Donaldson et al., 2021; Gowin et al., 2017; Hammett et al., 2017; Hendricks et al., 2015; Kozlowski et al., 2017; Navas-Nacher et al., 2020; Trumbo & Harper, 2013; Vu et al., 2019). However, this study is novel in that it explores traits and characteristics attributed to the e-cigarette users themselves, and how these characteristics are associated with e-cigarette use among a high-risk population given that e-cigarette use among Airmen is so high (Little et al., 2020a). Interestingly, younger age was associated with both positive and negative perceptions of e-cigarette users. Rates of e-cigarette use are high among young adults (Cornelius et al., 2020), and differential perceptions of these products may be attributable to the extent of e-cigarette use and external messaging to which individuals are exposed. For example, recent studies have shown that exposure to e-cigarette content on social media or television is associated with use (Alpert et al., 2019; Collins et al., 2019; Farrelly et al., 2015; Pokhrel et al., 2018). However, younger individuals may be exposed to anti-e-cigarette campaigns and messaging such as the Truth Campaign ads, which has been associated with decreased use (Farrelly et al., 2009). Thus, exposure to each type of messaging may result in positive, negative, or mixed perceptions related to e-cigarette users. These messaging exposures, in addition to potential exposure to a high volume of other e-cigarette users given high rates of use, may contribute to receipt of mixed messages. There may also be stigmatized internal beliefs that stem from messaging exposure and influence behaviors, or perhaps a higher sense of smoking identity that contributes to perpetuated use. One study previously found that young people with a smoking identity

were more resistant to anti-tobacco messaging (Freeman, Hennessy, & Marzullo, 2001). Thus, there are potentially complex and dynamic spheres of influence that may contribute to e-cigarette behaviors among younger individuals. More research is needed to better untangle the relationship between age and perceptions of e-cigarette users.

People from different racial backgrounds also differentially endorsed e-cigarette perceptions, with individuals identifying as Black endorsing more positive perceptions than White individuals. This is consistent with previous studies showing that Black individuals have lower endorsement that e-cigarettes are harmful or addictive (Hooper & Kolar, 2017), but is inconsistent with actual rates of use, which are lower than their White counterparts (Cornelius et al., 2020). However, there is evidence to suggest that pro-e-cigarette-related messaging is increasing among Black individuals (e.g., radio and television ads; Baumann et al., 2015). Given the history of racial targeting by tobacco companies (Barbeau et al., 2005; FDA, 2013; U.S. Department of Health and Human Services, 1998), it may be the case that history is repeating itself. Tobacco control policy efforts ensuring that communities of color are not targeted by e-cigarette companies via advertisements, promotions, and increased availability may be helpful to reduce use, given that these behaviors historically are associated with increased tobacco use in communities of color (Barbeau et al., 2005; FDA, 2013; U.S. Department of Health and Human Services, 1998). Additionally, interventions may benefit from addressing the “transfer point” of information about e-cigarettes by providing corrective information. One study found that individuals of Latino/a/x or multiracial identities in the U.S. Air Force were more likely to use nicotine products after exposure to positive social messages (e.g., from friends, family, social media) about tobacco products (Pebley et al., 2022). It may be important to identify the sources that influence perceptions about e-cigarettes and direct intervention efforts to prevent misinformation spread. Policies may be needed to prevent further pro-tobacco messages that may not be factually correct from being delivered among youth and young adults, while community or individual interventions within the Air Force may help curb spread of or counteract existing pro-tobacco ideas particularly among friends, family, and social media.

Results also identified differences in endorsement of individual characteristics of e-cigarette users, which means that future interventions may benefit from tailoring their messaging accordingly. These findings are potentially important given that positive and negative perceptions of e-cigarette users were found to be significantly associated with current e-cigarette use. For example, if one group endorsed more positive perceptions of e-cigarette users, then addressing these individual perceived positive characteristics may be prudent. However, if another group endorsed more negative perceptions related to e-cigarette users, then bolstering those specific perceptions may be important to ensure these groups continue to not use these products. This messaging may serve to alter the injunctive norms of the individual (e.g., the acceptability of the behavior to others), which has previously been associated with substance use (Arbour-Nicitopoulos et al., 2010; Borsari & Carey, 2003). The timing of TT may be a unique opportunity to deliver interventions to Airmen given the enforced bans during BMT. By providing programs to Airmen to promote changes in perceptions of e-cigarette users after an extended period of time without being allowed to use these products, perhaps those delivering the programs could capitalize on this time without use.

### 5.1. Strengths and limitations

The current study had several strengths, including a large sample of military personnel who were banned from using tobacco during BMT and the first four weeks of TT. Asking about their perceptions of e-cigarettes users during this period of enforced abstinence may help to identify who is likely to initiate or reinstate once the ban is lifted. However, we only measured a finite number of possible perceptions of e-cigarette users based on a measure used in previous research, and future

research may identify further perceptions that play a role in e-cigarette use. However, the current study used a large sample of young adults, including a large proportion who have used e-cigarettes in the past 30 days, to explore the role that perceptions of e-cigarette users may play in decisions to use e-cigarettes and identify sociodemographic groups potentially at higher risk. Additionally, the study utilized a cross-sectional sample; future research should explore how perceptions of e-cigarette users influence future initiation and cessation among young adults. Finally, our study included mostly younger adults (62.74% under the age of 21 years). However, given that initiating smoking before the age of 21 is associated with higher odds of nicotine dependence and decreased likelihood of trying to quit (Ali et al., 2020), our study that focused on largely young adults provides valuable information that can be used to design e-cigarette prevention and cessation programs for young adults who have the highest rates of e-cigarette use compared to any other adult population (Cornelius et al., 2020).

## 6. Conclusions

In sum, we found that different groups endorsed different perceptions related to e-cigarette users, with men, participants with lower levels of education, and participants reporting Black racial identity endorsing more positive perceptions of e-cigarette users. These groups may require different approaches to prevention and intervention efforts than groups who endorse negative perceptions of e-cigarette users. Interestingly, younger adults were more likely to endorse both negative and positive perceptions related to e-cigarettes, and more research is needed to determine how age may influence e-cigarette perceptions and use behaviors.

## 7. Disclaimer

The opinions expressed on this document are solely those of the authors and do not represent an endorsement by or the views of the United States Air Force, the Department of Defense, the United States Government or the National Institutes of Health.

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## CRediT authorship contribution statement

**K. Pebley:** Conceptualization, Writing – original draft, Writing – reviewing and editing. **I. Mallawaarachchi:** Formal analysis, Writing – reviewing and editing. **R. Krukowski:** Supervision, Writing – reviewing and editing. **J. Morris:** Writing – reviewing and editing. **M. Little:** Data curation, Investigation, Methodology, Project administration, Supervision, Writing – reviewing and editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

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