



# Treatment-seeking young people enrolled in a United States vaping cessation intervention trial report high frequency of use and nicotine dependence

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## ABSTRACT

**Objective:** This study examines characteristics of participants enrolled in a vaping cessation intervention trial and study generalizability of the treatment-seeking sample to the broader population of young people interested in quitting vaping to evaluate dissemination of an evidence-based treatment program.

**Methods:** Data was obtained from 697 treatment-seeking participants (aged 13–24 years) from a vaping cessation intervention trial conducted between February and March 2023 with This is Quitting and 665 participants who expressed intent to quit vaping in the Truth Longitudinal Cohort, a nationally representative longitudinal study of United States youth and young adults (aged 15–24 years), collected October 2022 to February 2023. Comparisons were made using two-sample Pearson Chi-square tests and t-tests.

**Results:** Treatment-seeking young people were younger, less racially diverse, more diverse in sexual orientation, and reported higher psychological distress, frequency of e-cigarette use, and nicotine dependence, relative to the nationally representative sample of young people expressing intentions to quit vaping.

**Conclusions:** Participants enrolled in treatment reported higher levels of dependence and use frequency than the broader population, suggesting that many young e-cigarette users with lower dependence who want to quit might not be reached by current treatment dissemination efforts. The implication of these findings is that communications for vaping cessation programs may need to be adjusted to have broader appeal among young people.

## 1. Introduction

E-cigarettes remain the most commonly used nicotine-containing product among young people in the United States (Cooper et al., 2022). In 2022, 3.3 % of middle and 14.1 % of high school students report current use (e.g., on at least 1 day of the past 30 days) of e-cigarettes (Cooper et al., 2022) and 11.0 % of young adults, aged 18–24 years, reported using e-cigarettes “every day” or “some days” (Cornelius, 2022). The most commonly used e-cigarette device types used are disposable e-cigarettes, followed by prefilled or refillable pods or cartridges, and tanks or mod systems (Birdsey, 2023).

This is concerning as currently popular e-cigarette devices have been found to deliver nicotine more effectively to users than previous e-cigarette products (Voos et al., 2019). Additionally, it is important to

note that there is no mandated limit on nicotine concentration in e-cigarettes sold in the United States - where this study was conducted. E-cigarettes sold in the United States now contain nicotine concentrations that are more than twice that allowed in Canada and Europe, on average (Wang et al., 2023a). As the amount of nicotine in popular e-cigarette devices has increased (Ali et al., 2023; Diaz et al., 2023), so has the intensity of use and level of addiction among adolescents (Glantz et al., 2022), who may be using stronger e-liquids to satisfy their nicotine cravings (Wang et al., 2023a).

Exposure to nicotine during adolescence has been linked to cognitive deficits, increased impulsivity, and impairment in short-term memory and executive function (Jones and Salzman, 2020). More specifically, nicotine exposure during youth has been associated with reductions in total cortical area and volume and cerebral white matter volume in areas

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of the brain that influence cognition, emotional regulation, and affective processing (Dai et al., 2022). Adolescent nicotine exposure has been found to alter reward processing in the nucleus accumbens (Castro et al., 2023). Nicotine exposure has also been associated with lower cognitive performance in oral reading recognition, pattern comparison processing speed, and picture vocabulary tests (Dai et al., 2022).

A considerable proportion of young users of e-cigarettes express interest in quitting (Cuccia et al., 2021; Graham et al., 2021, 2020) – an estimated 54.0 % of current e-cigarette users (aged 15–36 years) (Cuccia et al., 2021). Young people report many reasons for wanting to quit vaping, including health concerns, financial cost, social influence, and experiencing severe signs of dependence (Amato et al., 2021). Harm perceptions, dependence, and daily use have also been positively associated with intentions to quit vaping (Cuccia et al., 2021). Meanwhile, social barriers, such as peer pressure and environmental influences, may make quitting difficult (Kong et al., 2021).

Despite strong demands for vaping cessation resources by youth and young adults, there is limited vaping cessation intervention research (Berg et al., 2021; Sanchez et al., 2022). Existing research suggests that young people are receptive to obtaining peer mentoring in social media-based cessation interventions (Lyu et al., 2022). Young people also have expressed preferences for being able to access digital vaping cessation programs (Garey et al., 2021).

Truth Initiative launched This is Quitting® (TIQ) to meet the need for digital vaping cessation programs for young people (Graham et al., 2021). TIQ is a free, nationally available text message-based vaping cessation program designed for people aged 13 to 24 years. Since launching in 2019, more than 660,000 young people have enrolled in TIQ. Furthermore, TIQ has been found to be effective in promoting abstinence among young adult e-cigarette users. Specifically, in a randomized clinical trial of 18- to 24-year-olds, abstinence rates were 24.1 % among participants assigned to TIQ and 18.6 % among participants assigned to an assessment-only control group, 7 months post randomization (Graham et al., 2020). Overall, these findings suggest that TIQ is both appealing and effective among young people.

To expand the reach and impact of digital vaping cessation programs, such as TIQ, more research is needed to understand characteristics of young people who will seek treatment for vaping cessation. To fill this research gap, the current study examines the sociodemographic characteristics, perceived social norms, psychological distress, and e-cigarette use behaviors of youth and young adults enrolled in a vaping cessation intervention trial. In efforts to determine the generalizability of the treatment-seeking sample to the broader population of young people interested in quitting and evaluate the dissemination of an evidence-based treatment program, the characteristics of the treatment-seeking sample are compared to a nationally representative sample of youth and young adult e-cigarette users with expressed intentions to quit vaping. Information from this study may be helpful in identifying potential mass media targets for public health education campaign strategies and inform how vaping cessation program interventions can be tailored to different groups to encourage healthy treatment-seeking behaviors.

## 2. Materials and methods

### 2.1. This is Quitting x Discord (TIQ x Discord) sample

A youth and young adult vaping cessation trial (“This is Quitting x Discord”, or “TIQ x Discord”) was developed to assess the potential benefit of adding an online forum via the Discord platform to an existing text message-based vaping cessation intervention, This is Quitting (“TIQ”). TIQ is an automated, tailored, interactive text message intervention for vaping cessation designed for teens and young adults. TIQ is anchored in social cognitive theory (Bandura et al., 1977), with a key focus on social support. Social support is executed in its design - the intervention uses first-person language and responds as if it is a

nonjudgmental, supportive friend. User-submitted content is incorporated into TIQ messages to add empathy, credibility, and unique advice, as peers best understand and reflect the difficulties of quitting nicotine. TIQ has shown effectiveness for young adults in a clinical trial (Graham et al., 2021) and an effectiveness evaluation for adolescents is currently underway.

Discord (<https://discord.com/>) is an instant message platform originally released in 2015 to facilitate communication for the online gaming community. Since then, it has expanded into one of the most popular communication methods among young people with over 560 million registered users (“U.S. users who have a Discord account by age, 2022,” 2022). The TIQ Discord online forum allows users to communicate with others who are former or current e-cigarette users in real-time. A moderator monitors the conversations among users and posts questions to facilitate discussions. Users can participate as much, or as little, as they would like. For example, users can stay on TIQ Discord past their quit date, choose to only read and not post, or react to posts others have made with emoji responses.

#### 2.1.1. Eligibility criteria, sample recruitment, and enrollment

Participants were recruited by inviting new users of TIQ to participate in a research study. Potential users of TIQ learn about the program through a variety of channels, including social media ads, partner organizations, and educational programs. Upon enrollment in TIQ during the recruitment period, new users received the standard intervention for one day, then on their second day received a text message invitation to the research study. The invitation contained a link to a screener survey that assessed eligibility and decisional capacity to provide informed consent. A waiver of parental consent was requested, based upon recommendations by the American Psychological Association Resolution on Support for the Expansion of Mature Minors’ Ability to Participate in Research, which identifies parental consent as a potential barrier to studying high-risk behaviors (APA, 2018), such as e-cigarette use. Study protocols and the waiver of parental consent were approved by Advarra Institutional Review Board (Pro00069204).

To be included in this research study, participants had to: enroll in TIQ between February 16, 2023 to March 23, 2023; be between 13 and 24 years of age; report use of e-cigarettes within the past 30 days; pass the decisional capacity screener; and, provide informed consent at baseline. Potential participants who passed eligibility then completed an online baseline survey and were randomized to a treatment condition (e.g., TIQ only or TIQ and an invitation to participate in the TIQ Discord online forum) and then asked to complete a 1-month follow-up survey online between March 19, 2023 and April 23, 2023. Participants that were invited to the TIQ Discord were not required to join. Both surveys were administered using the survey platform, Qualtrics.

Participants who were invited to the TIQ Discord were provided with an introductory video explaining the potential benefits of the community and a link to join the TIQ Discord. Users were then asked to provide their Discord username to confirm their participation. During the duration of this study recruitment, access to the TIQ Discord was limited to only those who were invited through study participation. Fig. 1 shows the CONSORT diagram for recruitment, eligibility, and enrollment into the study.

### 2.2. Truth Longitudinal Cohort (TLC) sample

Analytic comparisons were made between the TIQ x Discord sample and the Truth Longitudinal Cohort (TLC) sample. The TLC is a probability-based, nationally representative cohort of youth and young adults (15–24 years old at baseline). Recruitment for the TLC started in 2014, primarily through address-based sampling. Subsamples were also recruited through random digit dialing and from Ipsos’ Knowledge Panel. In addition to regular refreshment samples at each wave, there was a large refreshment sample recruited in 2020 to compensate for attrition over time and for cohort participants that had aged out

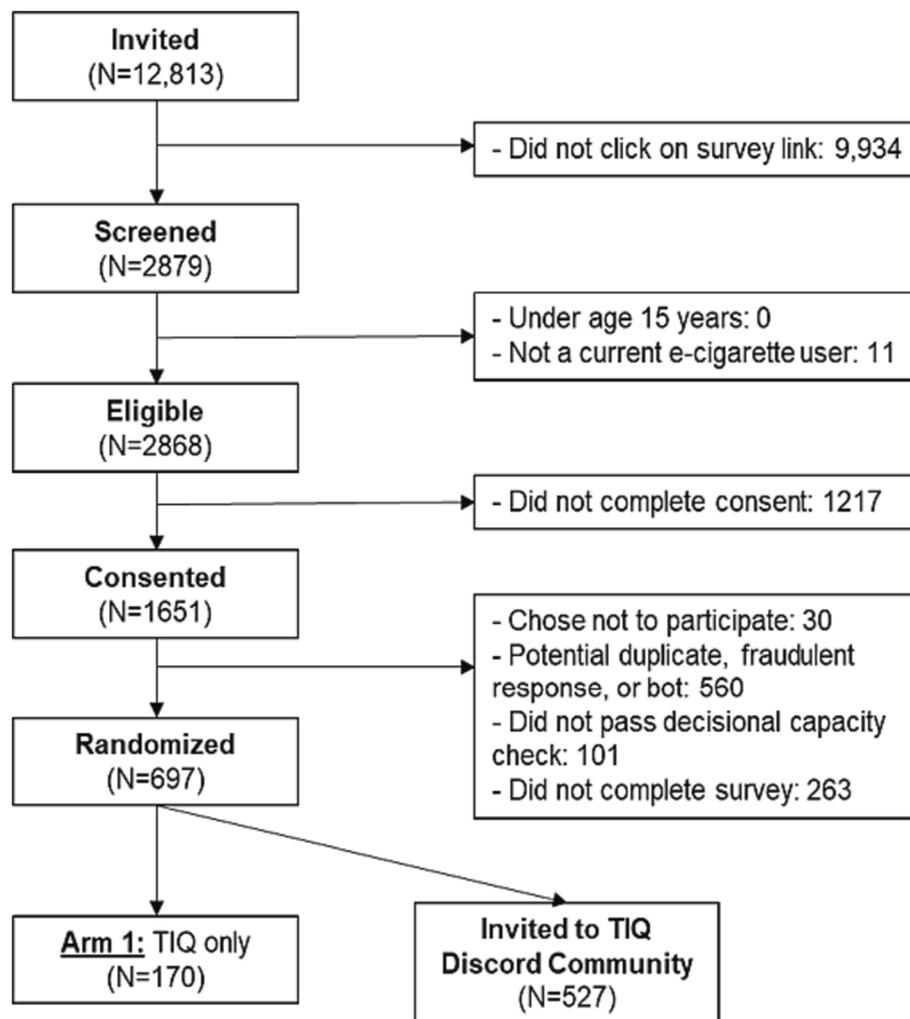


Fig. 1. CONSORT Diagram for United States Youth and Young Adults Participating in This is Quitting (TIQ) x Discord (2023). Note. TIQ = This is Quitting. TIQ x Discord = This is Quitting x Discord.

(Cantrell et al., 2018). The sample used in this analysis consisted of participants who provided data collected from October 2022 to January 2023, who also reported having used e-cigarettes in the past 30 days, and intentions to quit using e-cigarettes (at any time and within the next 30 days). As the TLC is an observational, longitudinal cohort study, participants are not required to engage in any prescribed cessation programs in order to participate in this study.

### 2.3. Measures

Analyses focus on data collected during the eligibility screening and baseline assessment from TIQ x Discord that overlap with measures in the TLC. Measures included sociodemographic characteristics (e.g., age, gender identity, race/ethnicity, sexual orientation, and perceived financial situation); e-cigarette use behaviors; concurrent use of other substances; perceived social norms around tobacco use; and psychological distress. E-cigarette use behavior was measured by frequency of use, or how often participants used e-cigarettes in the past 30 days. Participants were also asked what flavors they used most regularly now (tobacco; menthol; mint; clove or spice; fruit; alcoholic drink (such as wine, cognac, margarita, or other cocktails); candy, desserts, or other sweets; ice, frost, freeze or cool; unflavored, or some other flavor). Nicotine dependence was measured using the E-cigarette Dependence Scale (4-item) (Morean et al., 2018), which is scored using an average of responses to 4-items: “I find myself reaching for my vape without

thinking about it”, “I drop everything to go out and buy a vape or e-liquid”, “I vape more going into a situation where vaping is not allowed”, and “When I haven’t been able to vape for a few hours, the craving gets intolerable”. Responses to each of these items ranges from 0 to 4 (never, rarely, sometimes, often, almost always).

Concurrent use of other substances was measured using the question: “Have you used any of the following products within the past 30 days?” with responses of: cigarettes, large cigars, little cigars/cigarillos, hookah/shisha/waterpipe (e.g., hookah tobacco), smokeless tobacco (e.g., chew, dip, snuff, snus), nicotine pouches, heat-not-burn products (i.e., IQOS), vaped marijuana/cannabis, used marijuana/cannabis (excluding vaping), and alcohol. Responses were dichotomized (yes/no).

Perceived social norms included two measures: one asking respondents to indicate how many people their age vape / use e-cigarettes and another asking respondents to report on their household tobacco use. Psychological distress was measured using the Kessler-6 Scale (Kessler et al., 2010), a validated instrument that is scored such that higher scores are indicative of higher levels of psychological distress.

### 2.4. Statistical analyses

Descriptive statistics, including frequencies and percentages, were used to summarize baseline characteristics of vaping cessation intervention trial participants. Baseline comparisons were made across sociodemographic characteristics, e-cigarette use behaviors,

dependence, social norms, quitting behaviors, and co-use of other substances between the two study conditions (e.g., participants who received TIQ only and participants who received TIQ and invited to the TIQ Discord), using t-tests, Chi-square tests, and Fisher’s exact tests.

Then, a series of analyses were conducted to assess generalizability. Specifically, the overall TIQ x Discord sample – inclusive of participants who were randomly assigned to receive TIQ only and participants who received TIQ and invited to the TIQ Discord – was compared to current e-cigarette users expressing intentions to quit from the TLC using two-sample Pearson Chi-square tests and t-tests across the same socio-demographic characteristics, e-cigarette use behaviors, dependence, social norms, quitting behaviors, and co-use of other substances.

Comparisons were made against two sets of TLC participants. Following Cuccia et al. (2021), a broader set included all TLC participants who indicated any general intention to quit (n = 665), while a more restrictive subset included only participants who indicated a strong intention to quit (n = 109), operationalized as intention to quit within the next 30 days. All analyses were conducted using STATA SE 17. While comparisons against both sets are reported in the Tables, the Results and Discussion sections of this manuscript focus on comparisons against the broader set, which are more robust due to the larger sample size.

2.5. Ethical considerations for human subjects research

Both studies were approved by Advarra Institutional Review Board and were conducted in accordance with the ethical standards, as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

3. Results

Table 1 shows comparisons across sociodemographic characteristics, e-cigarette use behaviors, dependence, social norms, quitting behaviors, and co-use of other substances between the two study conditions. No statistically significant differences across sociodemographic characteristics, e-cigarette use behaviors, dependence, social norms, quitting behaviors, and co-use of other substances between participants who received TIQ only and participants who received TIQ and invited to the TIQ Discord.

As shown in Table 2, a majority of the TIQ x Discord sample were female (64.4 %), Non-Hispanic White (64.8 %), and straight/heterosexual (65.0 %). About one-third (33.8 %) had indicated that they lived comfortably when asked about their perceived financial situation. Compared to current e-cigarette users intending to quit in the TLC, the TIQ x Discord sample was generally younger, less diverse in terms of race/ethnicity, and more diverse in terms of sexual orientation.

On average, TIQ x Discord respondents reported using e-cigarettes on 25.9 (median = 29.0, SD = 7.1) days of the past 30 days (Table 3). Most reported use of fruit/candy, desserts, or other sweets (78.1 %) flavored e-cigarettes. On average, respondents had a score of 3.6 (median = 3.8, SD = 0.8) on the E-cigarette Dependence Scale. In terms of use of other substances, 40.9 % reported use of alcohol, 17.5 % reported use of cigarettes, and 44.8 % reported use of cannabis use (via vaping and/or other intake methods) in the past 30 days.

The TIQ x Discord sample differed from the TLC sample in terms of frequency of e-cigarette use, E-Cigarette Dependence Scale score, regularly vaped flavors, and concurrent substance use. Specifically, the TIQ x Discord sample reported more frequent e-cigarette use (i.e., 25.9 vs. 12.6 days of the past 30 days) and higher scores on the E-cigarette Dependence Scale (i.e., 3.6 vs. 1.1). A greater proportion of the TIQ x Discord reported vaping e-cigarettes that were fruit, candy, sweets; menthol or mint; and ice, frost, or freeze flavored. The TIQ x Discord sample also reported lower levels of concurrent use of cigarettes; large cigars, little cigars, cigarillos; hookah, shisha, waterpipe; smokeless

Table 1

Descriptive Baseline Characteristic Comparisons of United States Youth and Young Adults Participating in This is Quitting (TIQ) x Discord, across the TIQ only and Invited to TIQ x Discord Study Conditions (2023).

	TIQ x Discord (N = 697)	TIQ Only (N = 170)	Invited to TIQ x Discord (N = 527)	t value, p-value
	Median, Mean (SD)	Median, Mean (SD)	Median, Mean (SD)	
<b>Age (years)</b>	20.0, 19.7 (2.5)	20.0, 19.9 (2.5)	20.0, 19.7 (2.5)	1.0, 0.28
<b>Frequency of E-cigarette Use in the Past 30 Days (Range: 1–30 Days)</b>	29.0, 25.9 (7.1)	29.5, 26.7 (6.1)	30.0, 26.0 (6.9)	1.2, 0.24
<b>E-cigarette Dependence Scale (Range: 0–4)</b>	2.8, 2.6 (0.8)	2.5, 2.6 (0.8)	2.7, 2.6 (0.8)	−0.8, 0.42
<b>Kessler-6 Scale (Range: 0–24)</b>	13.0, 12.7 (5.6)	12.0, 12.0 (5.2)	13.0, 12.9 (5.7)	−1.9, 0.06
<b>How many people my age (out of 10) use e-cigarettes?</b>	7.0, 6.3 (2.2)	7.0, 6.3 (2.2)	7.0, 6.3 (2.2)	0.5, 0.62
	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>Chi-square, p-value or Fisher's Exact Test p-value</b>
<b>Age Category (years)</b>				
13–17	147 (21.1)	29 (17.1)	118 (22.4)	
18–20	261 (37.5)	67 (39.4)	194 (36.8)	
21–24	289 (41.5)	74 (43.5)	215 (40.8)	
25 or older	0 (0.0)	0 (0.0)	0 (0.0)	
Missing	0	0	0	
<b>Gender Identity</b>				3.5, 0.32
Male	216 (31.0)	62 (36.5)	154 (29.2)	
Female	448 (64.4)	100 (58.8)	348 (66.2)	
Non-binary/Other	32 (4.6)	8 (4.7)	24 (4.6)	
Missing	1	0	1	
<b>Race/Ethnicity</b>				
White, Non-Hispanic	447 (64.8)	103 (61.0)	344 (66.0)	0.11
Black, Non-Hispanic	51 (7.4)	15 (18.9)	36 (6.9)	0.33
American Indian or Alaska Native, Non-Hispanic	6 (0.9)	2 (1.2)	4 (0.8)	0.62
Asian or Asian American, Non-Hispanic	16 (2.3)	2 (1.2)	14 (2.7)	0.06
Native Hawaiian or Pacific Islander, Non-Hispanic	7 (1.0)	3 (1.8)	4 (0.8)	0.27
Multiracial	69 (10.0)	16 (9.5)	53 (10.2)	0.64
Hispanic/Latino	94 (13.6)	28 (16.6)	66 (12.7)	0.19
Missing (or Preferred Not to Say)	7	1	6	
<b>Sexual Orientation</b>				0.9, 0.93
Straight	445 (65.0)	110 (66.3)	335 (64.5)	
Gay or Lesbian	37 (5.4)	8 (4.8)	29 (5.6)	
Bisexual	157 (22.9)	38 (22.9)	119 (22.9)	
Queer/Questioning/Other	46 (6.7)	10 (6.0)	36 (6.9)	
Missing	12	4	8	
<b>Financial Situation</b>				4.8, 0.31
Don't meet basic expenses	30 (4.5)	58 (35.5)	167 (33.3)	
Just meet basic expenses	145 (21.8)	72 (44.2)	193 (38.4)	

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**Table 1** (continued)

	TIQ x Discord (N = 697)	TIQ Only (N = 170)	Invited to TIQ x Discord (N = 527)	
	Median, Mean (SD)	Median, Mean (SD)	Median, Mean (SD)	t value, p-value
Meet needs with a little left	265 (39.9)	26 (16.0)	119 (23.7)	
Live comfortably	225 (33.8)	7 (4.3)	23 (4.6)	
Missing	32	7	25	
<b>Regularly Vaped Flavor in Last Year</b>				
Tobacco	37 (5.3)	8 (4.7)	29 (5.5)	0.84
Menthol or Mint	336 (48.2)	73 (42.9)	263 (49.9)	0.13
Fruit, Candy, Sweets	544 (78.1)	138 (81.2)	406 (77.0)	0.29
Alcohol	21 (3.0)	5 (2.9)	16 (3.0)	1.00
Ice, Frost, Freeze	310 (44.5)	76 (44.7)	234 (44.4)	1.00
Other flavor	28 (4.0)	3 (2.7)	15 (2.8)	0.54
<b>Substance Use in the Past 30 Days</b>				
Cigarettes	122 (17.5)	92 (17.5)	30 (17.6)	1.00
Large cigars, little cigars, cigarillos	47 (6.7)	36 (6.8)	11 (6.5)	1.00
Hookah, shisha, waterpipe	27 (3.9)	20 (3.8)	7 (4.1)	0.82
Smokeless tobacco (chew, dip, snuff)	18 (2.6)	15 (2.8)	3 (1.8)	0.58
Nicotine pouches	56 (8.0)	47 (8.9)	9 (5.3)	0.15
Heat-not-burn products	3 (0.4)	2 (0.4)	1 (0.6)	0.57
Marijuana / cannabis	312 (44.8)	77 (45.3)	235 (44.6)	0.92
Alcohol	285 (40.9)	215 (40.8)	70 (41.2)	0.93
<b>Household tobacco use</b>				0.8, 0.85
No one I live with uses any tobacco products	291 (41.8)	73 (42.9)	218 (41.4)	
Only E-cigarettes/E-hookah/E-cigars/Vape Pens/Vape Pipes	205 (29.4)	52 (30.6)	153 (29.0)	
Only Cigarettes/Cigar	95 (13.6)	20 (11.8)	75 (14.2)	
Both E-cigarettes and cigarettes/cigar	106 (15.2)	25 (14.7)	81 (15.4)	

Note. TIQ = This is Quitting. TIQ x Discord = This is Quitting x Discord.

tobacco (chew, dip, snuff); heat-not-burn products; and alcohol.

As shown in Table 4, TIQ x Discord respondents reported high levels of psychological distress (mean = 12.7, median = 13.0, SD = 5.6) and believed that on average, 6.3 (median = 7.0, SD = 2.2) of every 10 people their age used e-cigarettes/vapes. About 15.2 % of the sample reported having household family members who used both e-cigarettes and combustible tobacco products (e.g., cigarettes, cigars). The TIQ x Discord sample differed from the population sample in terms of psychological distress and household tobacco use, such that on average, TIQ x Discord respondents scored higher on psychological distress (mean scores = 12.7 vs. 7.3) and reported higher levels of household tobacco use (15.2 % vs. 8.0 % reported household members who used both e-cigarettes and cigarettes).

**4. Discussion**

These results provide insights into the characteristics of treatment seeking youth and young adults who use e-cigarettes. Across study arms (e.g., those receiving TIQ only vs. those receiving TIQ and an invitation to the TIQ Discord), no statistically significant differences were found across sociodemographic characteristics, e-cigarette use behaviors,

**Table 2**

Descriptive Sociodemographic Characteristic Comparisons of United States Youth and Young Adults Participating in This is Quitting (TIQ) x Discord and the Truth Longitudinal Cohort (TLC) in 2023.

	TIQ x Discord (N = 697)	Current E-cigarette Users with Any Intent to Quit (TLC, N = 665)		Current E-cigarette Users with Intent to Quit within the Next 30 Days (TLC, N = 109)
	Median, Mean (SD)	Median, Mean (SD)	t value, p-value	Median, Mean (SD)
<b>Age (years)</b>	20.0, 19.7 (2.5)	22.0, 22.4 (3.9)	11.3, <0.01	23.0, 22.6 (3.9)
	<b>N (%)</b>	<b>N (Wt %)</b>	<b>Chi-square, p-value</b>	<b>N (Wt %)</b>
<b>Age Category (years)</b>			140.0, <0.01	
13–17	147 (21.1)	55 (13.1)		11 (13.3)
18–20	261 (37.5)	214 (20.1)		32 (17.0)
21–24	289 (41.5)	302 (38.3)		44 (30.3)
25 or older	0 (0.0)	94 (28.5)		22 (39.3)
Missing	0	0		0
<b>Gender Identity</b>			11.3, 0.04	
Male	216 (31.0)	260 (50.5)		35 (45.8)
Female	448 (64.4)	386 (46.9)		73 (52.6)
Non-binary/Other	32 (4.6)	19 (2.6)		1 (1.6)
Missing	1	0		
<b>Race/Ethnicity</b>			67.2, <0.01	
White, Non-Hispanic	447 (64.8)	317 (39.6)		50 (47.5)
Black, Non-Hispanic	51 (7.4)	47 (10.0)		8 (6.6)
American Indian or Alaska Native, Non-Hispanic	6 (0.9)	4 (1.1)		0 (0.0)
Asian or Asian American, Non-Hispanic	16 (2.3)	22 (3.5)		4 (2.2)
Native Hawaiian or Pacific Islander, Non-Hispanic	7 (1.0)	0 (0.0)		0 (0.0)
Multiracial	69 (10.0)	157 (19.3)		29 (19.2)
Hispanic/Latino	94 (13.6)	118 (26.5)		18 (24.5)
Missing	7	0		0
<b>Sexual Orientation</b>			10.1, 0.02	
Straight/Heterosexual	445 (65.0)	480 (75.8)		83 (71.8)
Gay or Lesbian	37 (5.4)	36 (5.2)		8 (9.7)
Bisexual	157 (22.9)	111 (14.6)		16 (18.0)
Queer/Questioning/Other	46 (6.7)	36 (4.5)		2 (0.6)
Missing	12	2		0
<b>Financial Situation</b>			7.3, 0.06	
Don't meet basic expenses	30 (4.5)	46 (4.6)		5 (5.7)
Just meet basic expenses	145 (21.8)	170 (23.4)		23 (24.9)
Meet needs with a little left	265 (39.9)	238 (37.1)		39 (34.7)

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**Table 2 (continued)**

	TIQ x Discord (N = 697)	Current E-cigarette Users with Any Intent to Quit (TLC, N = 665)	Current E-cigarette Users with Intent to Quit within the Next 30 Days (TLC, N = 109)
	Median, Mean (SD)	Median, Mean (SD)	t value, p-value
Live comfortably	225 (33.8)	211 (34.9)	42 (34.7)
Missing	32	0	0

Note. TIQ x Discord = This is Quitting x Discord. TLC = Truth Longitudinal Cohort. Wt = weighted. For age, TIQ x Discord included those 13–24 years, while the TLC included those 15–24 years at time of enrollment.

**Table 3**

Descriptive E-cigarette and Substance Use Behavior Characteristic Comparisons of United States Youth and Young Adults Participating in This is Quitting (TIQ) x Discord and the Truth Longitudinal Cohort (TLC) in 2023.

	TIQ x Discord (N = 697)	Current E-cigarette Users with Any Intent to Quit (TLC, N = 665)	Current E-cigarette Users with Intent to Quit within the Next 30 Days (TLC, N = 109)
	Median, Mean (SD)	Median, Mean (SD)	t value, p-value
<b>Frequency of E-cigarette Use in Past 30 Days (Range 1–30 days)</b>	29.0, 25.9 (7.1)	7.0, 12.6 (11.7)	−20.4, <0.01
<b>E-cigarette Dependence Scale (Range: 0–4)</b>	3.8, 3.6 (0.8)	1.0, 1.1 (1.0)	−49.1, <0.01
<b>Regularly Vaped Flavor in Last Year</b>	N (%)	N (Wt %)	Chi-square, p-value
Tobacco	37 (5.3)	52 (9.0)	3.1, 0.08
Menthol or Mint	336 (48.2)	241 (33.5)	19.5, <0.01
Fruit, Candy, Sweets	544 (78.1)	460 (70.8)	13.4, <0.01
Alcohol	21 (3.0)	24 (3.7)	0.2, 0.64
Ice, Frost, Freeze	310 (44.5)	147 (17.8)	75.4, <0.01
Other flavor	28 (4.0)	58 (8.5)	11.9, 0.01
<b>Substance Use in the Past 30 Days</b>	N ( )	N (Wt)	Chi-square, p-value
Cigarettes	122 (17.5)	176 (25.8)	15.5, <0.01
Large cigars, little cigars, cigarillos	47 (6.7)	95 (14.2)	19.9, <0.01
Hookah, shisha, waterpipe	27 (3.9)	63 (12.2)	16.4, <0.01
Smokeless tobacco (chew, dip, snuff)	18 (2.6)	41 (8.5)	9.7, <0.01
Nicotine pouches	56 (8.0)	46 (8.4)	0.5, 0.50
Heat-not-burn products	3 (0.4)	54 (9.4)	48.3, <0.01
Marijuana, cannabis	312 (44.8)	342 (51.5)	5.9, 0.02
Alcohol	285 (40.9)	369 (52.7)	28.8, <0.01

Note. TIQ x Discord = This is Quitting x Discord. TLC = Truth Longitudinal Cohort. Wt = weighted. Frequency of e-cigarette use in the past 30 days had 161 missing for TIQ x Discord, due to skip logic pattern. This question was only asked of those who had indicated that they had used e-cigarettes in the past 30 days.

**Table 4**

Descriptive Characteristic Comparisons of Psychological Distress and Perceived Social Norms of United States Youth and Young Adults Participating in This is Quitting (TIQ) x Discord and the Truth Longitudinal Cohort (TLC) in 2023.

	TIQ x Discord (N = 697)	Current E-cigarette Users with Any Intent to Quit (TLC, N = 665)	Current E-cigarette Users with Intent to Quit in the Next 30 Days (TLC, N = 109)
	Mean, Median, SD	Mean, Median, SD	t-test, p-value
<b>Kessler-6 Scale (Range: 0–24)</b>	13.0, 12.7 (5.6)	6.0, 7.3 (5.9)	−16.8, <0.01
<b>How many people my age (out of 10) use e-cig/vapes?</b>	7.0, 6.3 (2.2)	6.0, 6.1 (2.3)	−1.1, 0.26
<b>Household tobacco use</b>	N (%)	N (Wt %)	Chi-square, p-value
No one I live with uses any tobacco products	291 (41.8)	358 (53.9)	31.6, <0.01
Only E-cigarettes/E-hookah/E-cigars/Vape Pens/Vape Pipes	205 (29.4)	152 (20.4)	9.4, <0.02
Only Cigarettes/ Cigar	95 (13.6)	98 (17.7)	10 (11.0)
Both E-cigarettes and cigarettes/ cigar	106 (15.2)	53 (8.0)	13 (10.5)

Note. TIQ x Discord = This is Quitting x Discord. TLC = Truth Longitudinal Cohort. Wt = weighted. The Kessler-6 Scale is used to measure psychological distress.

dependence, social norms, quitting behaviors, and co-use of other substances. This suggests that study condition randomization worked correctly and that study participants were derived from the same source population (e.g., treatment seeking youth and young adults expressing intentions to quit vaping through their enrollment in TIQ). Compared to a nationally representative sample of youth and young adults expressing intentions to quit vaping, the treatment seeking youth and young adults enrolled in TIQ x Discord were more likely to be female, non-Hispanic White, and of higher income. These demographic characteristics are in line with previous research showing that those that identify as non-Hispanic White, female, and of higher socioeconomic status are more likely to look for health information online (Kontos et al., 2014).

Treatment-seeking youth and young adults in TIQ x Discord reported higher levels of nicotine dependence, greater use frequency, and psychological distress, relative to the general population sample of youth and young adults. Results might indicate that those who actually seek treatment, rather than just reporting intentions to quit, experience higher intensity of use and higher levels of dependence than peers who indicate intention to quit. A greater proportion of the TIQ x Discord sample also indicated that they resided with someone who uses e-cigarettes, cigarettes, or both, which may indicate that those who are not getting support in “real life” are looking for support from digital resources (Lichtenstein et al., 1986; Santo, 2023). Thus, results could suggest that current treatment dissemination efforts might not be reaching many users of e-cigarettes who want to quit but have lower nicotine dependence.

Results might also suggest that social support-based programs are

desired for health behavior change interventions among individuals with certain characteristics. Those with higher levels of psychological distress are more likely to report cigarette, e-cigarette, and dual use (Wang et al., 2023b; Weinberger et al., 2020), greater increases in e-cigarette use frequency over time (Bista et al., 2023), and higher vaping dependence scores (Chaiton et al., 2023). Given that e-cigarette use may be a coping mechanism for those dealing with psychological distress, additional social and emotional support might be needed to reduce and abstain from e-cigarette use (Xie et al., 2022). These factors, in addition to gender, need to be considered when planning for social support-based digital vaping cessation programs since prior studies have found that females report higher psychological distress, compared to males (Cabral, 2022) and that the impacts that emotional and social support have on treatment for psychological distress differ by gender (Martínez-Hernández et al., 2016).

Taken together, results suggest that although many youth and young adults express a desire to quit vaping, the subset who seek digital cessation support are generally characterized by more risk factors and greater levels of addiction. While this phenomenon may reflect the fact that individuals with more risk factors and greater levels of addiction have the greatest need for treatment, it is likely also the case that many individuals with lower dependence and fewer risks would benefit from engagement with treatment. Disseminators of public health interventions like TIQ and TIQ x Discord should explore methods for appealing to a wider segment of the youth and young adults who report wanting to quit vaping in population surveys.

Prior research has suggested that online advertising is a promising approach for cessation programs to appeal to wider audiences, especially among subgroups who may not respond to other forms of advertising (Graham et al., 2008). Given the proliferation of newer message formats available online, there are also more opportunities for potential interactions with individuals seeking out digital vaping cessation programs. For example, future research can look towards the impact of expanding program reach via live programming on streaming and gaming platforms (Durkin et al., 2022). Future studies are also needed to determine optimal strategies for increasing rates of vaping cessation success among certain segments of the population, such as those identified in our study, who may be more likely to seek digital vaping cessation resources (e.g., those who identify as non-Hispanic White, are female, have higher socioeconomic status, report higher levels of psychological distress, greater nicotine dependence, and higher e-cigarette frequency).

## 5. Strengths and limitations

The vaping cessation intervention trial sample reflects a convenient sample, as it includes individuals who enrolled in This is Quitting during a designated timeframe and chose to participate in the research study. Additionally, individuals in the comparison Truth Longitudinal Cohort sample were not asked about prior vaping cessation experiences and treatment utilization. Instead, reported intention to quit was used as a proxy for treatment seeking, which may limit our generalizability. Further studies are needed to determine whether these study results are specific to treatment seekers that desire social support, compared to those who do not. Despite these limitations, this study does focus on a high-risk population – youth and young adults who want to quit vaping – and identifies potentially important differences between the samples. Future studies will examine how engagement with digital vaping cessation program resources and vaping-related intentions and behaviors might differ between study conditions.

## 6. Conclusions

There is a critical need for programs and policies to reduce e-cigarette use among youth and young adults. Our treatment-seeking sample from TIQ x Discord indicated high frequency of e-cigarette use and high

nicotine dependence. These findings show that when compared to a convenience sample of other young e-cigarette users who report intentions to quit from the TLC, there were several differences. Results may indicate fundamental differences between those who report intentions to quit versus those who actually seek treatment to quit. Findings also suggest that reporting intention to quit may not be sufficient to move young people to actually seek treatment. This may have implications for public education campaigns and/or intervention programs, as communications may need to be adjusted to connect the full segment of young people who want to quit vaping with cessation assistance.

## Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

No AI or AI-assisted technologies were used in the writing process.

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## CRediT authorship contribution statement

**Elizabeth K. Do:** Writing – review & editing, Methodology, Writing – original draft, Supervision, Project administration, Data curation, Conceptualization. **Shreya Tulsiani:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Data curation, Conceptualization. **Giselle Edwards:** Writing – review & editing, Writing – original draft, Data curation. **Sarah Cha:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Michael S. Amato:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Elizabeth C. Hair:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The authors of this manuscript are employees of Truth Initiative, a non-profit public health foundation that runs This is Quitting, a text message-based vaping cessation intervention available for youth and young adults aged 13-24 years.

## Data availability

The data that has been used is confidential.

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