



Learning from their experiences: Strategies used by youth and young adult ex-vapers

Mohammed Al-Hamdani^{a,*}, Myles Davidson^b, Danielle Bird^c, D. Brett Hopkins^d, Steven Smith^b

^a Department of Public Health, College of Health Science, QU Health, Qatar University, Doha 2713, Qatar

^b Department of Psychology, Saint Mary's University, Halifax, NS B3H 3C3, Canada

^c Department of Psychology, Mount Saint Vincent University, Halifax, NS B3M 2J6, Canada

^d Department of Community Health and Epidemiology, Halifax, NS B3H 4H8, Canada

ARTICLE INFO

Keywords:

E-cigarette
Vaping
Vaping cessation
Young users

ABSTRACT

Introduction: The prevalence of vaping among youth and young adults (YYAs; 16–18 and 19–24 years old, respectively) is moderate worldwide. Existing vaping cessation evidence lacks input from ex-vapers with a history of regular use and substantial maintenance periods. This study noted cessation strategies, relapse triggers, and recommendations for quitting identified by ex-vapers and assessed differences in outcomes across age and gender groups.

Methods: We recruited ex-vapers ($N = 290$; mean use = 6.5 days/week, $SD = 1.05$) with a minimum maintenance period of 30 days and a history of three months of consecutive use of nicotine-based devices from Nova Scotia, Canada. The ex-vapers responded to open-ended questions regarding vaping cessation strategies, triggers, and recommendations for quit strategies in an online survey. We coded responses to each topic (e.g., triggers) and grouped them into categories (e.g., social influences). We used chi-square tests and Bonferroni correction tests to determine group differences by topic and within each category.

Results: YYA ex-vapers identified cold turkey (28.9 %), self-restriction (27.5 %), and alternative coping mechanisms (19.0 %) as the most common cessation strategies; social influences (35.5 %), mental state (18.3 %), and substance use (15.7 %) as the top triggers; and support systems (29.5 %), apps (17.3 %), and education (11.8 %) as the most useful recommendations for others. A higher proportion of female youth (51.3 %) identified social influences as a relapse trigger than male YAs (21.2 %) and female YAs (30.3 %). Further, male YAs (36.5 %) reported higher proportions of substance use as a relapse trigger than male youth (3.0 %) and female youth (2.6 %). Female youth (23.7 %) and YAs (22.6 %) recommended apps as a useful cessation strategy more often than male YAs (3.8 %).

Conclusions: Input from ex-vapers can help to inform cessation practices, and gender and age differences shed light onto the need to tailor treatments, such as using social-centric behavioral therapy, for female youth and adopting a polysubstance substance use treatment approach for YAs.

1. Introduction

Youth and young adult (YYA) e-cigarette use (“vaping”) varies worldwide, with a moderate global prevalence of 9.2 % (Sun et al., 2022). E-cigarettes are devices that produce an aerosol that is inhaled through a battery-operated system and often contain nicotine and flavors (Dinardo & Rome, 2019). In 2018, 14.6 % of 16–19-year-old Canadians reported having used an e-cigarette within the past 30 days (Fataar & Hammond, 2019), with the prevalence among older Canadians being much lower (3 %; Health Canada, 2020). YYAs who vape

report vaping at least once per week (Camara-Medeiros et al., 2020).

Vaping poses a health issue at any age (Evans-Polce et al., 2018; Ontario Tobacco Research Unit, 2019; Patrick et al., 2016) and is highly addictive (Dinardo & Rome, 2019). E-cigarette exposure affects the pulmonary system (Kalininskiy et al., 2019; Seiler-Ramadas et al., 2020). E-cigarettes are also associated with impaired airway cilia function (Park et al., 2019), oral and gastrointestinal system irritation, and cardiovascular system problems (e.g., increased blood pressure; Seiler-Ramadas et al., 2020). For YYAs, specific concerns include brain and body development (Chadi & Belanger, 2019; Hadland & Chadi,

* Corresponding author at: Department of Public Health, Qatar University, Qatar.

E-mail address: Malhamdani@qu.edu.qa (M. Al-Hamdani).

<https://doi.org/10.1016/j.josat.2023.209038>

Received 25 August 2022; Received in revised form 7 December 2022; Accepted 7 April 2023

Available online 13 April 2023

2949-8759/© 2023 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

2020). E-cigarettes also pose risks to YYAs due to their association with subsequent smoking initiation (Chadi & Belanger, 2019; Osibogun et al., 2020; Owotomo et al., 2020; Stratton et al., 2018).

The motives that drive YYA vaping are well-understood, with the primary reason for initiating e-cigarette use being experimentation/curiosity (Evans-Polce et al., 2018; Kinouani et al., 2020; Margolis et al., 2018; McDonald & Ling, 2015; Patrick et al., 2016). Among reasons for sustaining use of e-cigarettes include flavor and taste (Cooper et al., 2016; Harrell et al., 2019; Kinouani et al., 2020), as well as nicotine rush (Al-Hamdani et al., 2021; Sidani et al., 2019). Entertainment and tricks (e.g., blowing vape clouds) are also common motives for sustained use of e-cigarettes (Cooper et al., 2016; Evans-Polce et al., 2018; Patrick et al., 2016; Pokhrel et al., 2015). The discreetness of vaping devices and the lack of bad odor is appealing to YYAs (Pokhrel et al., 2015), making e-cigarettes more convenient to use (Harrell et al., 2019). Some studies have compared motives for use by age and gender (Al-Hamdani et al., 2021). For example, despite a high motivation for use due to a nicotine rush by all age and gender groups, male youth are distinctly motivated by a nicotine rush when compared to male and female YAs (Al-Hamdani et al., 2021). Research has shown that female youth are driven by tricks, and male and female YAs are motivated by social aspects (Al-Hamdani et al., 2021).

Reasons for discontinuing e-cigarette use include losing interest, an “uncool” perception of e-cigarettes, and concerns about negative health effects (Kong et al., 2015). Discontinuation of e-cigarette use is more common when the reason for e-cigarette use is not goal-oriented (e.g., curiosity) in comparison to goal-oriented use (e.g., to quit smoking; Pepper et al., 2014). Smokers who use e-cigarettes cite failure of e-cigarettes to help with cravings and not wanting to smoke as reasons for discontinuing e-cigarette use (Simonavicius et al., 2017). Reasons for discontinuing e-cigarette use for never smokers include no vaping occurring in specific social settings, not thinking about use, and cost (Berg, 2016). Former smokers’ top reasons for discontinuing e-cigarette use are quitting nicotine/tobacco of any kind and not liking the idea of using any nicotine/tobacco product, whereas current smokers cite using other tobacco products and high cost (Berg, 2016). Among adolescents, tolerance breaks and health concerns are reported as reasons for discontinuing use (Kong et al., 2021), suggesting that education about the effects of vaping, relatable anecdotes, and rewards for quitting may be helpful (Bold et al., 2022).

Unlike the motives that drive YYA vaping or discontinuation of its use, strategies that underlie vaping cessation and vaping relapse triggers are understudied. Some of the limited evidence on vaping cessation suggests that most YYAs do not use pharmacotherapy (e.g., nicotine gum) as a quit vaping strategy (Banks et al., 2020). Readily accessible digital text messaging programs are appealing to youth and have shown some promise (Graham, Jacobs, Amato, Cha, et al., 2020; Graham, Jacobs, & Amato, 2020). A pilot study of a text message cessation program called *This is Quitting* tested the effectiveness of the program with 269 YYAs (aged 18–24 years) and found higher 3-day vaping abstinence rates for program enrollees (16.2 %) versus controls (8.3 %; Graham, Jacobs, Amato, Cha, et al., 2020). A follow-up study of the same program with a larger sample found similar abstinence rates (Graham, Jacobs, & Amato, 2020). A study on social media posts found that e-cigarette users tend to prefer step-down approaches for quitting where nicotine use is gradually reduced over time (Struik & Yang, 2021).

1.1. The current study

Although some studies have identified YYA vaping cessation strategies (Graham, Jacobs, Amato, Cha, et al., 2020; Graham, Jacobs, & Amato, 2020), all have built their strategies on the tobacco cessation literature and input from current YYA vapers (Graham, Jacobs, & Amato, 2020). Other evidence on informing vaping cessation comes from YYAs enrolled in vaping cessation programs (Amato et al., 2020), and only one study provides insights on quit strategies employed by a

sample of adolescents consisting of current and past e-cigarette users without differentiating the strategies based on their vaping status (Kong et al., 2021). Using tobacco cessation evidence as a basis for building vaping cessation strategies is problematic because it may discount the importance of the distinctiveness of vaping from tobacco use. Relying on input from current vapers may inform cessation strategies based on those which have failed; something not helpful when building strategies for quitting vaping. Similarly, relying on cessation information from YYAs currently in cessation programs is insufficient to understand whether their input informs successful vaping cessation strategies because it is unclear how long their cessation will last. In this study, we overcome past research shortcomings by recruiting ex-vapers with substantial past vaping histories and maintenance periods to identify cessation strategies used and recommended by this demographic.

YYA e-cigarette users with intentions to quit vaping identify barriers for tobacco cessation and vaping cessation that have some similarities, but important differences do exist—for example, flavor enjoyment is unique to vaping cessation (Sanchez et al., 2021). In addition, no studies to date have examined relapse triggers among ex-vapers; a group who would provide information on key triggers that are important to be aware of for preventing relapse. Raising awareness of which triggers are associated with vaping relapse increases the prospects of developing appropriate cessation aids that can be made available to those who are struggling to control their urges (Patwardhan, 2020). The current study explores factors that impact the likelihood of vaping relapse among ex-vapers by asking them about triggers that tempt them to vape again after maintaining abstinence.

The vaping literature has demonstrated that motives for vaping differ across age and gender groups (Amato et al., 2020; Sanchez et al., 2021). Therefore, cessation strategies, recommended strategies for quitting, and relapse factors will likely vary among age and gender groups, yet this proposition has not been tested in the literature. This study seeks to rectify this gap by examining these differences.

In summary, the aim of the current study is to discover cessation strategies associated with successful vaping abstinence, factors linked to relapse, and strategies recommended by ex-vapers for others to quit in a sample of regular YYA ex-vapers in maintenance.

2. Material and methods

2.1. Data collection

Recruitment for this study took place through paid Facebook and Instagram ads that included a few sentences on eligibility and a link for more information. Respondents that clicked on the ads were redirected to an online survey on the platform Qualtrics. Their anonymous responses were collected between September and November 2020. The authors obtained ethics approval from the ethics review board at Saint Mary’s University (REB#20-110).

2.2. Sample

Eligible participants for the survey were youth and young adult (aged 16–24) ex-vapers living in Nova Scotia with a minimum maintenance period of 30 days, and minimum past use of nicotine-based e-cigarettes of three consecutive months, during which they vaped at least once a week. We assessed eligibility through screening questions for age, country of residence, maintenance period, and e-cigarette use history. All respondents had the option to be included in a draw for one of three \$100 CAD gift cards. Respondents with complete surveys received an additional incentive of a guaranteed \$10 CAD gift card by email. Using G*power (Faul et al., 2009), we calculated the minimum sample needed to conduct the analysis. We identified a minimum sample of 238 to detect a medium effect size [$w = 0.30$, power = 0.80, and $df = 21$ (groups $4 - 1 \times$ categories $8 - 1$)] at an alpha level of 0.05.

2.3. Survey

The survey contained two sections. The first was a closed-ended section with questions about vaping history (e.g., vaping frequency prior to cessation) and demographics, such as age, gender, and residence. This section of the survey confirmed the eligibility of participants and defined their characteristics. The second section included a list of open-ended questions concerning YYA vaping cessation experiences—vaping cessation strategies, factors that influenced their likelihood for relapse, and any recommendations they had for helping others to quit vaping. To learn about successful vaping cessation strategies, we asked the following questions: “How did you finally quit vaping? What strategies did you use?” To gather information on factors that influence relapse likelihood, we asked the following questions: “What are some things that make you want to vape again? What are your triggers? Is there a place, thing, or person that makes you want to vape again?” Last, to explore which vaping cessation strategies are recommended as effective for other vapers, we asked: “What strategies do you think could help youth and young adults quit vaping? Do you think there should be an app, a counsellor at school, a doctor or therapist? Do you think this would be best done in person, online, or via phone?”

The initial draft of the survey went through two pilot rounds for feedback on structure, length, and content. The first was from YYAs with first-hand vaping experience and the second was from health professionals who work in vaping cessation or policy. We incorporated input from both groups to create the final version.

2.4. Data analysis

For the purpose of analysis, we designated youth as aged 16–18 years and young adults as aged 19–24 years. We chose to examine older youth (16–18 years) rather than younger youth because of the high prevalence of vaping among this demographic (Government of Canada, 2019). Similarly, we specifically selected young adults (19–24 years) due to the higher prevalence of vaping in this age group compared to older adults (Health Canada, 2020). We chose the age outpoint of 19 years old because the minimum legal age for purchasing tobacco and vaping products in Nova Scotia, Canada, the jurisdiction this study was conducted in, is 19 years old. Given the overwhelming majority of participants who identified as male and female, analyses did not include those identifying as other gender types (1.5 %) because of an inability to generate meaningful group differences with such a small subsample.

Before conducting the analyses, code development took place based on the limited literature on vaping cessation and relapse (see Table 2). These codes acted as a guide for sorting the responses to the open-ended questions into categories (within each topic). Prior to using the codebook, we modified its contents based on the open-ended responses collected in this study. Two researchers coded the responses and used Cohen’s kappa coefficient scores to assess agreement (vaping cessation strategy, $\kappa = 0.82$; relapse triggers, $\kappa = 0.81$; ex-vaper recommendations, $\kappa = 0.99$).

The quantitative analyses compared age and gender groups in terms of their vaping cessation strategies, factors that influence their likelihood for relapse, and recommendations for others. Chi-square tests assessed differences in topic responses (vaping cessation strategies, relapse triggers, and ex-vaper recommendations) by age and gender. To minimize type-I error rate inflation, we used Bonferroni correction tests to identify which groups (e.g., male youth vs. female youth) differed by categories within each topic (e.g., pharmacotherapy as a category within the cessation strategy topic).

3. Results

3.1. Demographic characteristics

Six hundred and sixty-six participants clicked on the survey. Of these,

83 did not answer any questions and the survey screened out 181 people due to ineligibility, with 169 being abstinent for fewer than 30 days, six residing outside of Nova Scotia, four having never vaped, and two being under the age of 16. Of the 402 remaining participants, 290 completed the survey. From these respondents, six individuals identified their gender as “other”, and we did not include them in the analyses due to an inability to generate meaningful group differences. The sample demographic characteristics of the participants who completed the survey fully ($N = 284$) can be found in Table 1. Out of 284 people, all (100 %) responded to the question about successful quitting strategies, 262 (92.2 %) responded to the question about relapse triggers, and 254 (89.4 %) responded to the question about ex-vaper strategy recommendations. Of the 74 % ($N = 215$) of participants who reported trying to quit vaping more than once, the mean number of quit attempts was 3.2 ($SD = 2.2$) before they were successful.

3.2. Topics and categories

The topic questions and categories, as well as an example for each category and response, are displayed in Table 2. The frequencies of responses by ex-vapers to categories within the three topics and their percentages within each age and gender group are identified in Table 3. The results of the chi-square and Bonferroni correction tests are also depicted in Table 3.

Table 1
Sample demographic characteristics.

Variable	Male youth ($N = 36$), M (SD)	Male young adults ($N = 54$), M (SD)	Female youth ($N = 87$), M (SD)	Female young adults ($N = 107$), M (SD)	Overall ($N = 284$), M (SD)
Days vaped per week prior to cessation	6.6 (1.0)	6.9 (0.5)	6.3 (1.4)	6.6 (1.2)	6.55 (1.1)
Episodes per day prior to cessation	29.9 (33.5)	28.1 (26.7)	27.9 (29.0)	31.3 (32.8)	29.5 (30.5)
Puffs per episode prior to cessation	8.7 (7.3)	6.3 (4.0)	8.3 (6.7)	6.6 (4.9)	7.3 (5.8)
	Male youth, N (%)	Male young adults, N (%)	Female youth, N (%)	Female young adults, N (%)	Overall, N (%)
Cultural/racial background					
White	30 (83.3)	46 (85.2)	78 (89.7)	91 (85.0)	245 (86.3)
Black	1 (2.8)	1 (1.8)	4 (4.6)	3 (2.8)	9 (3.2)
Aboriginal	1 (2.8)	0 (0.0)	4 (4.6)	8 (7.6)	13 (4.6)
South Asian	1 (2.8)	3 (5.6)	0 (0.0)	1 (0.9)	5 (1.7)
Latin	2 (5.5)	1 (1.8)	0 (0.0)	1 (0.9)	4 (1.4)
American					
West Asian	0 (0.0)	3 (5.6)	1 (1.1)	0 (0.0)	4 (1.4)
Southeast Asian	1 (2.8)	0 (0.0)	0 (0.0)	3 (2.8)	4 (1.4)
Housing					
Urban	30 (83.3)	43 (79.6)	68 (78.2)	85 (79.4)	226 (79.6)
Rural	6 (16.7)	11 (20.4)	19 (21.8)	22 (20.6)	58 (20.4)
Employed					
Yes	24 (66.7)	34 (63.0)	53 (60.9)	67 (62.6)	178 (62.7)
No	12 (33.3)	20 (37.0)	34 (39.1)	40 (37.4)	106 (37.3)

Note. M = mean, SD = standard deviation.

3.3. Successful strategies

As Table 2 indicates, six distinctive categories of quit strategies emerged. Quitting cold turkey included any mention of quitting vaping abruptly or without a specific strategy and/or using willpower and determination to stay vape-free (28.9 %). Self-restriction constituted an effort to try to delay or limit one’s access to the product (e.g., not charging the device; 27.5 %). Alternative coping mechanisms encompassed any mention of replacing vaping behavior with a healthier behavior or a distraction (e.g., exercise; 19.0 %). The use of support systems included relying on a friend or professional supports (5.3 %). The desire to improve health was evidenced by any mention of quitting for health reasons, being worried about side-effects, or reflecting on past negative experiences (4.9 %). Last, the necessity to eliminate social influences included distancing oneself from those who vape (3.2 %). The remaining responses were either meaningless (1.7 %) or did not belong to a distinct category (“other”; 9.5 %).

3.4. Relapse triggers

As Table 2 shows, five distinct categories for relapse triggers emerged. Social influences included being around others who vape or

being at social gatherings where vaping occurs (35.5 %). Mental state encapsulated any mention of stress, anxiety, or related feelings (18.3 %). Substance use included any mention of drinking, smoking, or using any other substance (15.7 %). A fourth category constituted any mention of not having any identifiable triggers (14.1 %). Last, sensory vaping cues consisted of any mention of flavors, taste, smell, head rush, or other vaping sensations (11.1 %). The remaining responses were either meaningless (0.7 %) or did not belong to a distinct category (“other”; 4.6 %).

3.5. Recommendations of strategies for vaping cessation

As Table 2 shows, eight distinct categories for recommended strategies emerged. Support systems included friend groups or professional counselling services (29.5 %). A second category consisted of recommending that apps be created to assist with vaping cessation (17.3 %). A third recommendation was education for those who vape on the dangers of vaping (11.8 %). Ex-vapers also recommended willpower and staying committed to the goal of quitting (10.6 %), replacing the behavior of vaping with an alternative behavior (7.5 %), the need for more policies that target aspects of vaping such as flavor bans and nicotine caps (2.8 %), and self-restriction or engaging in behaviors to limit one’s access to

Table 2
Topics with category codes and explanations with examples for responses.

Topic	Code	Code category	Explanation	Example response
Success strategy	1	Quitting cold turkey	Any mention of quitting vaping cold turkey or not using specific strategy, willpower to stay quit, determination, self-control, being committed to staying quit	<i>“I cold turkey quit and threw it away.”</i>
	2	Self-restriction	Any mention of intentionally restricting one’s access to vaping products including selling it, throwing it away, hiding or misplacing the product, giving it to someone, destroying the product or delaying access.	<i>“Just decided not to buy more pods after I ran out.”</i>
	3	Alternative coping mechanism	Any mention of replacing vaping behavior with a healthier behavior (e.g., exercise, drinking water, nicotine replacement therapy, etc.) or distracting oneself to eliminate thoughts of vaping	<i>“I just never bought pods and chewed gum.”</i>
	4	Used support systems	Any mention of developing a support system/relying on others for support, including counselling and other professional supports	<i>“I talked to a counsellor and a doctor.”</i>
	5	Desired health improvements	Any mention of quitting because of education, wanting better health, being worried about side-effects, reflecting on past negative experiences, etc.	<i>“Educating myself on the harm it causes.”</i>
	6	Eliminated social influences	Any mention of distancing oneself from others who vape, saying no to vaping, telling others not to offer their vape/vaping products, etc.	<i>“I just stayed away from people and never asked to hit it.”</i>
	7	Other	Anything not captured in the other categories	<i>“Quarantine”</i>
	8	Meaningless		<i>“idk”</i>
Relapse trigger	1	Social influences	Any mention of being around others who vape, being pressured or influenced by others to vape, or being at social gatherings where vaping is happening	<i>“Being around other people doing it.”</i>
	2	Mental state	Any mention of stress, anxiety, or any related feelings	<i>“Stress with school or work.”</i>
	3	Substance use	Any mention of drinking, smoking, or using any other substances	<i>“Drinking is mostly it.”</i>
	4	Nothing	Any mention of not having any triggers	<i>“Nothing makes me want to vape again.”</i>
	5	Sensory vaping cues	Any mention of flavors, taste, smell, head rush, or other vaping sensations	<i>“Flavours and not worrying about making a place smell like cigarettes.”</i>
	6	Other	Anything not captured in the other categories	<i>“When studying.”</i>
	7	Meaningless		<i>“Nope”</i>
Ex-vaper recommendations	1	Quitting cold turkey/ willpower	Any mention of quitting vaping cold turkey or not using specific strategy, willpower to stay quit, determination, self-control, being committed to staying quit.	<i>“You just need to be in the right mindset.”</i>
	2	Apps	Any mention of apps that help track use, that are a way to support others while remaining anonymous, that provide users with resources, etc.	<i>“I think an app would be perfect.”</i>
	3	Support systems	Any mention of talking to others about trying to quit vaping, talking to counsellors or therapists, social circles, etc.	<i>“School counselling and doctors in person.”</i>
	4	Alternative coping mechanism	Any mention of finding another coping mechanism besides vaping, including replacing the behavior with something else, keeping oneself busy/distracted, etc.	<i>“Chewing gum and going to the gym.”</i>
	5	Education	Any mention of educating oneself or others on the harms of vaping, on addiction, on targeting the social acceptability of vaping, fear-based messaging, or anything related to improving health through education.	<i>“More information on long-term effects.”</i>
	6	Policies	Any reference to laws that restrict vaping including flavor bans, nicotine caps, prices/taxation, age restrictions, advertisement/social media ad bans, school-based policies, etc.	<i>“No flavours or high nicotine content...”</i>
	7	Self-restriction	Any mention of distancing oneself from others who vape, getting rid of one’s vaping device, intentionally eliminating access to vaping products, etc.	<i>“Just not have it so easily accessible.”</i>
	8	Recognize triggers/ motivations	Any mention of needing to recognize one’s triggers or why someone vapes	<i>“They need to recognize the stimulus that triggers urges...”</i>
	9	Other	Anything not captured in the other categories.	<i>“Show how much it costs.”</i>
	10	Meaningless		<i>“Yea”</i>

Table 3
E-cigarette user differences in topics and categories by age and gender groups.

Topic	df	Chi-square (χ^2)	p	Category	Age and gender groups								
					Male youth, N (%), adjusted residual)	Male young adults, N (%), adjusted residual)	Female youth, N (%), adjusted residual)	Female young adults, N (%), adjusted residual)	Overall, N (%)				
Success strategy N = 284 ⁱ	21	20.2	.506	Quit cold turkey	12 _a (33.3)	17 _a (31.5)	21 _a (24.1)	32 _a (29.9)	82 (28.9)				
				Self-restriction	12 _a (33.3)	8 _a (14.8)	30 _a (34.5)	28 _a (26.2)	78 (27.5)				
				Alternative coping mechanism	6 _a (16.7)	15 _a (27.8)	16 _a (18.4)	17 _a (15.9)	54 (19.0)				
				Used support systems	0 _a (0.0)	2 _a (3.7)	7 _a (8.0)	6 _a (5.6)	15 (5.3)				
				Desired health improvements	1 _a (2.8)	2 _a (3.7)	6 _a (6.9)	5 _a (4.7)	14 (4.9)				
				Eliminated social influences	2 _a (5.6)	2 _a (3.7)	1 _a (1.1)	4 _a (3.7)	9 (3.2)				
				Other	3 _a (8.3)	7 _a (13.0)	4 _a (4.6)	13 _a (12.1)	27 (9.5)				
				Relapse trigger	18	52.6	.000	Social influences	12 _{a,b,c} (36.4, 0.11)	11 _c (21.2, -2.41)	40 _b (51.3, 3.48)	30 _{a,c} (30.3, -1.37)	93 (35.5)
				N = 262 ⁱⁱ				Mental state	7 _a (21.2)	6 _a (11.5)	17 _a (21.8)	18 _a (18.2)	48 (18.3)
Substance use	1 _{a,b} (3.0, -2.13)	19 _c (36.5, 4.63)	2 _b (2.6, -3.80)					19 _{a,c} (19.2, 1.23)	41 (15.6)				
Nothing	8 _a (24.2)	8 _a (15.4)	10 _a (12.8)					11 _a (11.1)	37 (14.1)				
Sensory vaping cues	3 _a (9.1)	7 _a (13.5)	8 _a (10.3)					11 _a (11.1)	29 (11.1)				
Other	2 _a (6.1)	0 _a (0.0)	1 _a (1.3)					9 _a (9.1)	12 (4.6)				
Ex-vaper recommendations	27	44.6	.018					Support systems	8 _a (24.2)	13 _a (25.0)	27 _a (35.5)	27 _a (29.0)	75 (29.5)
N = 254 ⁱⁱⁱ				Apps	3 _{a,b} (9.1, -1.3)	2 _b (3.8, -2.9)	18 _a (23.7, 1.8)	21 _a (22.6, 1.7)	44 (17.3)				
				Education	2 _a (6.1)	6 _a (11.5)	12 _a (15.8)	10 _a (10.8)	30 (11.8)				
				Cold turkey/willpower	7 _a (21.2)	9 _a (17.3)	4 _a (5.3)	7 _a (7.5)	27 (10.6)				
				Replace the behavior	3 _a (9.1)	4 _a (7.7)	4 _a (5.3)	8 _a (8.6)	19 (7.5)				
				Policies	4 _a (12.1)	5 _a (9.6)	1 _a (1.3)	3 _a (3.2)	7 (2.8)				
				Self-restriction	2 _a (6.1)	1 _a (1.9)	1 _a (1.3)	3 _a (3.2)	7 (2.8)				
				Recognize triggers	0 _a (0.0)	2 _a (3.8)	2 _a (2.6)	0 _a (0.0)	4 (1.6)				
				Other	4 _a (12.1)	8 _a (15.4)	5 _a (6.6)	7 _a (7.5)	24 (9.4)				

Note. Number of responses determined meaningless by coders: ⁱ5 out of 284, ⁱⁱ2 out of 262, ⁱⁱⁱ24 out of 254. Each subscript (a,b,c) letter denotes a subset of the age/gender categories whose column proportions do not differ significantly from each other at the .05 level. Different subscript letter assignment between groups denotes a significantly different pair of values based on Bonferroni post hoc test corrections. For success strategies and relapse triggers, Pearson Chi-square test was used because less than 50 % of the cells had an n of less than 5. For Ex-vaper recommendations the Likelihood Ratio test was used because 50 % of the cells had an n of less than 5. Adjusted residuals are listed for significant results only.

vaping products (2.8 %). The least common recommendation was a need for vapors to recognize their own triggers (1.6 %). The remaining responses were either meaningless (9.4 %) or did not belong to a distinct category (“other”; 1.6 %).

3.6. Group differences

As Table 3 identifies, analyses of vaping cessation strategies revealed no age or gender differences. However, age and gender groups did differ on relapse triggers ($\chi^2 (18, N = 262) = 52.6, p < .001$). A higher percentage of female youth (51.3 %) indicated social influences as a relapse trigger compared to male (21.2 %) and female YAs (30.3 %). In addition, male YAs reported higher proportions of substance use as a relapse trigger (36.5 %) than both male (3.0 %) and female youth (2.6 %). Similarly, age and gender groups differed on their recommended strategies for others to quit vaping ($\chi^2 (27, N = 254) = 44.6, p = .018$). In particular, female youth (23.7 %) and YAs (22.6 %) recommended apps more than their male YA counterparts (3.8 %).

4. Discussion

The current study provides information on YYA vaping cessation strategies, and its findings highlight some commonalities and some differences from those reported in past tobacco cessation studies. For instance, self-restriction, including throwing products away, was frequently cited by ex-vapers in this study as a quitting aid—a finding

that has been identified in the tobacco cessation literature as an effective strategy (Muraven, 2011). This finding suggests that self-restriction should be explored as an option in practice, perhaps as a central behavioral domain of cognitive behavioral therapy for vaping cessation (Shams et al., 2021). Examples of incorporating self-restriction into practice include suggestions for hiding a vaping device or purposely failing to charge it to decrease or stop e-cigarette use. Similar to smokers’ desire for information on the harms of cigarettes (Cummings et al., 2004), ex-vapers in this study identified as being useful a desire to improve one’s health through seeking information on the harms of vaping. Considering this finding and drawing on results from other studies, education should be maintained in conjunction with other vaping cessation strategies (Bold et al., 2022; Kong et al., 2021).

The findings of this study suggest that some strategies used to quit vaping are similar to those cited in tobacco cessation, although their importance may be less evident for quitting vaping. For example, past literature suggests that most smokers attempt to quit smoking through unassisted methods, such as quitting cold turkey, though the efficacy of this method is debated (Chapman & MacKenzie, 2010). By comparison, less than one-third of ex-vapers in this study identified cold turkey as their success strategy. The current study also found that support systems and social influences, although deemed as important, were not reported as often as other strategies employed to quit vaping. In contrast, past studies found that tobacco smokers rely heavily on support systems for smoking cessation and cite social influences as a critical factor in their smoking decisions (Myers et al., 2007; Ontario Tobacco Research Unit,

2020; Putte et al., 2005; Tworek et al., 2014). One potential explanation for these deviating results may be due to the COVID-19 pandemic-mandated restrictions, which hindered the ability of ex-vapers to gather for support. Therefore, future studies should examine how successful quitting methods for vaping vary post-COVID-19 restrictions.

The most frequent relapse trigger indicated by ex-vapers in this study was social influences. This finding is congruent with tobacco and vaping cessation studies that found peer approval to be an important factor for use (East et al., 2019; Sanchez et al., 2021). The current study adds to the literature by revealing how social influences differ as a relapse trigger across different age and gender groups. Female youth were more impacted by social influences compared to both male and female YAs. This finding underscores the importance of intensifying the use of social-centric behavioral strategies to support relapse prevention in female youth, and how general refusal skills (e.g., interpersonal assertiveness) can be modified to accomplish this goal (Gambrill & Richey, 1975).

Similar to previous studies on tobacco and vaping cessation, this study found that mental state is an important relapse trigger to account for vaping cessation (Patrick et al., 2016; Sanchez et al., 2021). Future research looking at developing vaping cessation programs may need to expand its focus on mental health resources and practices that participants can implement to better aid in successful long-term vaping cessation. Also, in line with past studies on tobacco smoking cessation, the current study found that vaping relapse seems to be heavily influenced by other substances and alcohol (Patrick et al., 2016). This study extends the existing literature by demonstrating that substance use is specifically important for a subset of age and gender groups—female YAs and male YAs cited substance use as a relapse trigger more frequently relative to their youth counterparts. The fact that female and male YAs are of legal age (as the minimum age for tobacco and e-cigarette use in the jurisdiction of this study is 19 years) means they can access vaping products as well as other substances more readily in comparison to male and female youth (Gambrill & Richey, 1975), which may explain why substance use is an important trigger for YAs compared to youth. However, since polysubstance use is common among both youth (Zuckermann et al., 2019) and YAs (Young-Wolff et al., 2021), future studies should seek to explore the aforementioned finding further.

This study identified sensory cues as being a distinct relapse trigger; however, it was not among the most frequently reported factors for relapse. This finding is noteworthy given how the enticing nature of flavors and nicotine have been documented as being heavily influential on vaping behavior (Harrell et al., 2019; Pokhrel et al., 2015). Given that the current study was conducted in Nova Scotia where flavor bans and nicotine caps have been implemented prior to conducting this study (Nova Scotia Government, 2020), logically, sensory cues were not a frequently cited relapse trigger. Future studies should focus on incorporating other jurisdictions to confirm whether sensory cues are as important a relapse trigger as previous studies have found.

Despite not being the most employed cessation technique among participants in this study, participants identified support systems as being potentially useful in assisting others with vaping cessation, which is consistent with the literature (e.g., Bold et al., 2022; Kong et al., 2021). This finding is also consistent with the evidence on the importance of social support systems in preventing substance use (Havassy et al., 1991). Apps also emerged as a frequently recommended way to quit vaping. The fact that female youth and YAs recommended apps more than male YAs suggests that female e-cigarette users may be more receptive to apps relative to males. However, interventions utilizing quit vaping apps need to test for differences in uptake and outcomes between males and females before concluding that this differential response by gender holds.

4.1. Limitations

The current study has some limitations. First, our sample includes only YYAs living in Nova Scotia, Canada, who are predominantly White,

and may therefore not be generalizable to other jurisdictions and ethnicities. Future studies should incorporate multiple jurisdictions before generalizing the findings to other YYAs. Nevertheless, YYAs tend to be similar in terms of their perceptions in different countries (East et al., 2019). Second, this study employed a cross-sectional design and therefore may not accurately predict long-term successful vaping cessation probabilities. Longitudinal studies are needed to assess whether the strategies that YYAs use remain stable over time and whether relapse triggers also change over time with age. However, the current study provides preliminary evidence on the importance of learning about quit strategies and relapse triggers that are associated with success from ex-vapers. Third, because six participants who self-identified as neither male nor female were excluded from data analyses, a possibility exists that the results are not generalizable to the entire YYA population. Nonetheless, the findings are still valuable for creating vaping cessation programs. Fourth, because this study examined 16–24-year-olds, the findings may not be generalizable to other age groups. Previous studies have shown that motivations to use vaping products differ between age groups; therefore, various age groups may also present distinct success strategies for vaping cessation as well different relapse triggers than other age groups (Al-Hamdani et al., 2021). Fifth, because of the differences in group sizes, group comparisons should be interpreted with some caution and may not be generalizable to a larger sample. Sixth, only associations about success strategies can be drawn from this study. Future studies with control groups or control strategies should draw causal inferences about success strategies. Finally, this study used online surveys, which, unlike interviews, do not offer researchers the opportunity to prompt or elicit certain responses or provide clarity to questions. Nevertheless, most responses were easily understood, and the online survey enabled wider reach and a larger number for quantitative analysis and a greater degree of anonymity for participants to respond freely.

Funding source

Open access funding provided by the Qatar National Library. This research was supported by Health Promotion grant funding from the Health Promotion/Mental Health and Addictions Branch of the Nova Scotia Department of Health and Wellness.

Declaration of competing interest

Mohammed Al-Hamdani, Myles Davidson, and D. Brett Hopkins were affiliated with the Lung Association of Nova Scotia and Prince Edward Island when conducting the study. They are no longer affiliated with this organization. There may be a perceived conflict due to these past affiliations.

References

- Al-Hamdani, M., Hopkins, D. B., Hardardottir, A., & Davidson, M. (2021). Perceptions and experiences of vaping among youth and young adult e-cigarette users: Considering age, gender, and tobacco use. *Journal of Adolescent Health*. <https://doi.org/10.1016/j.jadohealth.2020.08.004>
- Amato, M. S., Botcher, M. M., Cha, S., Jacobs, M. A., Pearson, J. L., & Graham, A. L. (2020). "It's really addictive and I'm trapped:" A qualitative analysis of the reasons for quitting vaping among treatment-seeking young people. *Addictive Behaviors*, 112, Article 106599. <https://doi.org/10.1016/j.addbeh.2020.106599>
- Banks, E., Yazidjoglou, A., Brown, S., Ford, L., Zulfikar, T., Baenziger, O., & Joshy, G. (2020). Systematic review and meta-analysis of evidence on the efficacy of e-cigarette use for sustained smoking and nicotine cessation. *Health & Medicine Week*, 7435. <https://doi.org/10.1101/2020.11.02.20224212>
- Berg, C. J. (2016). Preferred flavors and reasons for e-cigarette use and discontinued use among never, current, and former smokers. *International Journal of Public Health*, 61(2), 225–236. <https://doi.org/10.1007/s00038-015-0764-x>
- Bold, K., Kong, G., Cavallo, D., Davis, D., Jackson, A., & Krishnan-Sarin, S. (2022). School-based E-cigarette cessation programs: What do youth want? *Addictive Behaviors*, 125, Article 107167. <https://doi.org/10.1016/j.addbeh.2021.107167>
- Camara-Medeiros, A., Diemert, L., O'Connor, S., Schwartz, R., Eissenberg, T., & Cohen, J. E. (2020). Perceived addiction to vaping among youth and young adult

- regular vapers. *Tobacco Control*, 30, 273–278. <https://doi.org/10.1136/tobaccocontrol-2019-055352>.
- Chadi, N., & Belanger, R. E. (2019). Teen vaping: There is no vapour without fire. *Paediatrics & Child Health*, 25(6), 337–339. <https://doi.org/10.1093/pch/pxz137>
- Chapman, S., & MacKenzie, R. (2010). The global research neglect of unassisted smoking cessation: Causes and consequences. *PLoS Medicine*, 7(2), Article e1000216. <https://doi.org/10.1371/journal.pmed.1000216>
- Cooper, M., Harrell, M. B., & Perry, C. L. (2016). Comparing young adults to older adults in e-cigarette perceptions and motivations for use: Implications for health communication. *Health Education Research*, 31(4), 429–438. <https://doi.org/10.1039/her/cyw030>
- Cummings, K. M., Hyland, A., Giovino, G. A., Hastrup, J. L., Bauer, J. E., & Bansal, M. A. (2004). Are smokers adequately informed about the health risks of smoking and medicinal nicotine? *Nicotine & Tobacco Research*, 6(Suppl. 3), S333–S340. <https://doi.org/10.1080/14622200412331320734>
- Dinardo, P., & Rome, S. E. (2019). Vaping: The new wave of nicotine addiction. *Cleveland Clinic Journal of Medicine*, 86(12), 789–798. <https://doi.org/10.3949/ccjm.86a.19118>
- East, K. A., Hitchman, C. S., McNeil, A., Thrasher, F. J., & Hammond, D. (2019). Social norms towards smoking and vaping and associations with product use among youth in England, Canada, and the US. *Drug and Alcohol Dependence*, 205(1), Article 107635. <https://doi.org/10.1016/j.drugalcdep.2019.107635>
- Evans-Polce, R. J., Patrick, M. E., Lanza, S. T., Miech, R. A., O'Malley, P. M., & Johnston, L. D. (2018). Reasons for vaping among U.S. 12th graders. *Journal of Adolescent Health*, 62(4), 457–462. <https://doi.org/10.1016/j.jadohealth.2017.10.009>
- Fataar, F., & Hammond, D. (2019). The prevalence of vaping and smoking as modes of delivery for nicotine and cannabis among youth in Canada, England and the United States. *International Journal of Environmental Research and Public Health*, 21(16), 4111. <https://doi.org/10.3390/ijerph16214111>
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149–1160. <https://doi.org/10.3758/BRM.41.4.1149>
- Gambrell, E. D., & Richey, C. A. (1975). An assertion inventory for use in assessment and research. *Behavior Therapy*, 6, 550–561. [https://doi.org/10.1016/S0005-7894\(75\)80013-X](https://doi.org/10.1016/S0005-7894(75)80013-X)
- Government of Canada. (2019). Summary of results for the Canadian Student Tobacco, Alcohol and Drugs Survey 2018–19. Retrieved from <https://www.canada.ca/en/health-canada/services/canadian-student-tobacco-alcohol-drugs-survey/2018-2019-summary.html>.
- Graham, A. L., Jacobs, M. A., Amato, M. S., Cha, S., Bottcher, M. M., & Papanonatos, G. D. (2020a). Effectiveness of a quit vaping text message program in promoting abstinence among young adult e-cigarette users: Protocol for a randomized controlled trial. *JMIR Research Protocol*, 9(5), Article e18327. <https://doi.org/10.2196/18327>
- Graham, L. A., Jacobs, A. M., & Amato, S. M. (2020b). Engagement and 3-month outcomes from a digital e-cigarette cessation program in a cohort of 27 000 teens and young adults. *Nicotine & Tobacco Research*, 22(5), 859–860. <https://doi.org/10.1093/ntr/ntz097>
- Hadland, S. E., & Chadi, N. (2020). Through the haze: What clinicians can do to address youth vaping. *Journal of Adolescent Health*, 66(1), 10–14. <https://doi.org/10.1016/j.jadohealth.2019.10.009>
- Harrell, P. T., Brandon, T. H., England, K. J., Barnett, T. E., Brockenberry, L. O., Simmons, V. N., & Quinn, G. P. (2019). Vaping expectancies: A qualitative study among young adult nonusers, smokers, vapers, and dual users. *Substance Abuse*, 13, 1–12. <https://doi.org/10.1177/1178221819866210>
- Havassy, B. E., Hall, S. M., & Wasserman, D. A. (1991). Social support and relapse: Commonalities among alcoholics, opiate users, and cigarette smokers. *Addictive Behaviors*, 16(5), 235–246. [https://doi.org/10.1016/0306-4603\(91\)90016-b](https://doi.org/10.1016/0306-4603(91)90016-b)
- Health Canada. (2020). Canadian Tobacco and Nicotine Survey (CTNS): Summary of results for 2019. Retrieved from <https://www.canada.ca/en/health-canada/service/canadian-tobacco-nicotine-survey/2019-summary.html>.
- Kalininskiy, A., Bach, T. C., Nacca, E. N., Ginsberg, G., Marragga, J., Navarette, A. K., McGraw, D. M., & Croft, P. D. (2019). E-cigarette, or vaping, product use associated lung injury (EVALI): Case series and diagnostic approach. *The Lancet Respiratory Medicine*, 7(12), 1017–1026. [https://doi.org/10.1016/S2213-2600\(19\)30415-1](https://doi.org/10.1016/S2213-2600(19)30415-1)
- Kinouani, S., Leflot, C., Vanderkam, P., Auriacombe, M., Langlois, E., & Tzourio, C. (2020). Motivations for using electronic cigarettes in young adults: A systematic review. *Substance Abuse*, 41(3), 315–322. <https://doi.org/10.1080/08897077.2019.1671937>
- Kong, G., Bold, K. W., Cavallo, D. A., Davis, D. R., Jackson, A., & Krishnan-Sarin, S. (2021). Informing the development of adolescent e-cigarette cessation interventions: A qualitative study. *Addictive Behaviors*, 114, Article 106720. <https://doi.org/10.1016/j.addbeh.2020.106720>
- Kong, G., Morean, M. E., Cavallo, D. A., Camenga, D. R., & Krishnan-Sarin, S. (2015). Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. *Nicotine & Tobacco Research*, 17(7), 847–854. <https://doi.org/10.1093/ntr/ntu257>
- Margolis, K. A., Donaldson, E. A., Portnoy, D. B., Robinson, J., Neff, L. J., & Jamal, A. (2018). e-Cigarette openness, curiosity, harm perceptions and advertising exposure among US middle and high school students. *Preventive Medicine*, 112, 119–125. <https://doi.org/10.1016/j.ypmed.2018.04.017>
- McDonald, E. A., & Ling, P. M. (2015). One of several 'toys' for smoking: Young adult experiences with electronic cigarettes in New York City. *Tobacco Control*, 24(6), 588–593. <https://doi.org/10.1136/tobaccocontrol-2014-051743>
- Muraven, M. (2011). Practicing self-control lowers the risk of smoking lapse. *Psychology of Addictive Behaviours*, 24(3), 446–452. <https://doi.org/10.1037/a0018545>
- Myers, M. G., MacPherson, L., Jones, L. R., & Arons, G. A. (2007). Measuring adolescent smoking cessation strategies: Instrument development and initial validation. *Nicotine & Tobacco Research*, 9(11), 1131–1138. <https://doi.org/10.1080/14622200701648466>
- Nova Scotia Government. (2020). Province bans sales of flavoured e-cigarettes, commits to legislation. Retrieved from <https://novascotia.ca/news/release/?id=20191205001>.
- Ontario Tobacco Research Unit. (2020). Build smoke-free: Year 1 evaluation highlights. Retrieved from <https://www.otru.org/documents/build-smoke-free-year-1-evaluation-highlights/>.
- Ontario Tobacco Research Unit. (2019). *Conversations about vaping: A focus group study*. Retrieved from Project News https://www.otru.org/wp-content/uploads/2019/03/otru-projectnews_mar2019.pdf.
- Osibogun, O., Bursac, Z., & Maziak, W. (2020). e-Cigarette use and regular cigarette smoking among youth: Population assessment of tobacco and health study (2013–2016). *American Journal of Preventive Medicine*, 58(5), 657–665. <https://doi.org/10.1016/j.amepre.2020.01.003>
- Owotomo, O., Stritzel, H., McCabe, S. E., Boyd, C. J., & Maslowsky, J. (2020). Smoking intention and progression from e-cigarette use to cigarette smoking. *Pediatrics*, 146(6), Article e2020002881. <https://doi.org/10.1542/peds.2020-002881>
- Park, H., O'Sullivan, M., Vallarino, J., Shumyatcher, M., Himes, B. E., Park, J., Christiani, D. C., Allen, J., & Lu, Q. (2019). Transcriptomic response of primary human airway epithelial cells to flavoring chemicals in electronic cigarettes. *Scientific Reports*, 9. <https://doi.org/10.1038/s41598-018-37913-9>
- Patrick, M. E., Miech, R. A., Carlier, C., O'Malley, P. M., Johnston, L. D., & Schulenberg, J. E. (2016). Self-reported reasons for vaping among 8th, 10th, and 12th graders in the US: Nationally-representative results. *Drug and Alcohol Dependence*, 165, 275–278. <https://doi.org/10.1016/j.drugalcdep.2016.05.017>
- Patwardhan, P. (2020). COVID-19: Risk of increase in smoking rates among England's 6 million smokers and relapse among England's 11 million ex-smokers. *BJGP Open*, 4(2), Article bjgpopen20X101067. <https://doi.org/10.3399/bjgpopen20X101067>
- Pepper, J. K., Ribisl, K. M., Emery, S. L., & Brewer, N. T. (2014). Reasons for starting and stopping electronic cigarette use. *International Journal of Environmental Research and Public Health*, 11(10), 10345–10361. <https://doi.org/10.3390/ijerph111010345>
- Pokhrel, P., Herzog, T., Muranaka, N., & Fagan, P. (2015). Young adult e-cigarette users' reasons for liking and not liking e-cigarettes: A qualitative study. *Psychology & Health*, 30(12), 1450–1469. <https://doi.org/10.1080/08870446.2015.1061129>
- Putte, B., Yzer, M., & Brunsting, S. (2005). Social influences on smoking cessation: A comparison of the effect of six social influence variables. *Preventive Medicine*, 41, 186–193. <https://doi.org/10.1016/j.ypmed.2004.09.040>
- Sanchez, S., Kaufman, P., Pelletier, H., Baskerville, B., Feng, P., O'Connor, S., Schwartz, R., & Chaiton, M. (2021). Is vaping cessation like smoking cessation? A qualitative study exploring the responses of youth and young adults who vape e-cigarettes. *Addictive Behaviors*, 113, Article 106687. <https://doi.org/10.1016/j.addbeh.2020.106687>
- Seiler-Ramadas, R., Sandner, I., Haider, S., Grabovac, I., & Dörner, T. E. (2020). Health effects of electronic cigarette (ecigarette) use on organ systems and its implications for public health. *Wiener Klinische Wochenschrift*. <https://doi.org/10.1007/s00508-020-01711-z>
- Shams, F., Wong, J., Nikoo, M., Outadi, A., Moazen-Zadeh, E., Kamel, M. M., Song, M. J., Jang, K. L., & Krausz, R. M. (2021). Understanding eHealth cognitive behavioral therapy targeting substance use: Realist review. *Journal of Medical Internet Research*, 23(1), Article e20557. <https://doi.org/10.2196/20557>
- Sidani, E. J., Colditz, B. J., Barrett, I. E., Shensa, A., Chu, K.-H., James, E. A., & Primack, B. B. (2019). I wake up and hit the JUUL: Analyzing Twitter for JUUL nicotine effects and dependence. *Drug and Alcohol Dependence*, 204, Article 107500. <https://doi.org/10.1016/j.drugalcdep.2019.06.005>
- Simonavicius, E., McNeill, A., Arnott, D., & Brose, L. S. (2017). What factors are associated with current smokers using or stopping e-cigarette use? *Drug and Alcohol Dependence*, 173, 139–143. <https://doi.org/10.1016/j.drugalcdep.2017.01.002>
- Struijk, L., & Yang, Y. (2021). e-Cigarette cessation: Content analysis of a quit vaping community on reddit. *Journal of Medical Internet Research*, 23(10), Article e28303. <https://doi.org/10.2196/28303>
- Sun, J., Xi, B., Ma, C., Zhao, M., & Bovet, P. (2022). Prevalence of e-cigarette use and its associated factors among youths aged 12 to 16 years in 68 countries and territories: Global youth tobacco survey, 2012–2019. *American Journal of Public Health*, 112(4), 650–661. <https://doi.org/10.2105/AJPH.2021.306686>
- Stratton, K., Kwan, L. Y., & Eaton, D. L. (2018). *Public health consequences of e-cigarettes: Consensus study report*. National Academies Press. <https://doi.org/10.17226/24952>
- Tworek, C., Schauer, G. L., Wu, C. C., Malarcher, A. M., Jackson, K. J., & Hoffman, A. C. (2014). Youth tobacco cessation: Quitting intentions and past-year quit attempts. *Tobacco Control*, 47(2, Supplement 1), S15–S27. <https://doi.org/10.1016/j.amepre.2014.05.009>
- Young-Wolff, K. C., Adams, S. R., Sterling, S. A., Tan, A. S., Salloum, R. G., Torre, K., Carter-Harris, L., & Prochaska, J. J. (2021). Nicotine and cannabis vaping among adolescents in treatment for substance use disorders. *Journal of Substance Abuse Treatment*, 125, Article 108304. <https://doi.org/10.1016/j.jsat.2021.108304>
- Zuckermann, A. M., Williams, G., Battista, K., de Groh, M., Jiang, Y., & Leatherdale, S. T. (2019). Trends of poly-substance use among Canadian youth. *Addictive Behaviors Reports*, 10, Article 100189. <https://doi.org/10.1016/j.abrep.2019.100189>