

## EVIDENCE BRIEF

# Impact of COVID-19 Pandemic on Youth Tobacco Smoking and Vaping

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## Key Messages

- Vaping continues to be the most common tobacco/nicotine product used by youth (under legal age of purchase) during the COVID-19 pandemic.
- The largest decrease in vaping occurred among those reporting past 30 day use, while those reporting daily use either did not change their use or reported an increase.
- There were larger observed decreases in vaping among males than females; however, the overall amount of vaping reported was lower for females than males.
- The most commonly-reported reasons for vaping during the pandemic were for youth who reported feeling anxious, sadness, stress, or who wanted a means to cope with the pandemic or to combat boredom.
- While some youth reported difficulty accessing tobacco and vaping products during the pandemic, the majority of youth were still able to access these products during the pandemic, via the same channels as prior to the pandemic (e.g., social source, retail location, borrowing device).
- Youth continued to vape with their peers, even throughout the early stages of the pandemic, including face-to-face encounters.
- Some youth attempted to quit or reduce their vaping during the pandemic. Reasons included: concern for their health, difficulty accessing vaping products, being home with parents, resulting in fewer opportunities or inability to vape.
- Youth who reported adhering to the public health measures were more likely to quit or reduce their vaping. Additionally, an association between learning environment and current nicotine product use was observed, as youth who attended in-person classes were more likely to report current use compared to those who were learning online.

## Issue and Research Question

Young people's use of nicotine, regardless of delivery system, is harmful.<sup>1</sup> Nicotine is addictive, and children and adolescents are especially susceptible to the harmful effects of nicotine as the brain continues to develop into a person's mid-20s.<sup>1</sup> Nicotine use during this life stage has been known to alter brain development and may affect one's attention, learning and memory.<sup>2</sup> With the development and evolution of vaping devices, combustible cigarettes have been replaced as the most commonly used nicotine product among youth.<sup>3</sup> Given there is no universally agreed upon definition of 'youth,' this population often has various age groups used as definitions. The definition of youth for the purposes of this evidence brief will be discussed in more detail in the Methods section.

Social groups and social context affect both the initiation and use of tobacco and nicotine products among youth (those under the legal age of purchase). Youth tobacco use and vaping is highly dependent on availability and access to these products. Most Canadian youth are accessing their tobacco and vaping products from social sources (e.g., friends).<sup>4</sup> Frequently reported reasons for vaping/smoking tobacco among youth are experimentation, social reasons, and fun.<sup>5</sup>

In response to the COVID-19 pandemic, jurisdictions around the world enacted various laws, policies and guidelines to reduce the spread and subsequent impacts on the health of their populations. The level of mitigation varied across jurisdictions and time period within the pandemic, however, many responded by halting in-person attendance for schools, services and extra-curricular activities for children and youth, prohibition of social gatherings, and social distancing requirements.<sup>6</sup> Social distancing measures restricted youth's ability to be in their usual education, social and leisure environments, increasing their time at home, and time with family members.

Adolescence is a time of increased exploration and development of social, emotional and cognitive skills to prepare for the independence of adulthood. However, this period is also associated with increased vulnerability to stress and risk-taking behaviours, such as sensation seeking and experimentation with substances.<sup>7</sup> It is therefore essential to examine how the COVID-19 pandemic and the public health response impacted the youth population and their access to and use of nicotine products.

This evidence brief aims to contribute to the limited review-level evidence on the impact of the COVID-19 pandemic on commercial tobacco and nicotine product use among youth. The primary purpose of this evidence brief is to help fill the gap in review-level evidence by answering the question: "How has the COVID-19 pandemic impacted youth behaviour and consumption of commercial tobacco and nicotine products?"

## Methods

A literature search was conducted in July and August 2022 by Public Health Ontario's (PHO) Library Services for articles published from 2020 at the start of the COVID-19 pandemic to August 2022. The search involved three databases: Ovid MEDLINE, Ovid Embase and EBSCOhost CINAHL Complete. Search terms included but were not limited to: vaping, smoking, tobacco use, adolescent, COVID-19, physical distancing, and quarantine. To identify relevant grey literature, we searched Google using similar terms and reviewed the first 100 search results of each search string. The grey literature search was completed in October 2022. The full search strategy is available upon request.

Articles were eligible for inclusion if they: examined tobacco use and/or vaping among youth during the COVID-19 pandemic; were highest-level evidence available; included study participants 18 years old or younger (under legal age of purchase in Ontario); and were published in English.

We made an exception to the 18 years and younger inclusion criterion for two articles.<sup>8,9</sup> Gaiha et al. (2020) defined youth as those under the age of 21 and therefore not of legal purchase age of tobacco/nicotine products in the United States.<sup>8</sup> Kreslake et al. (2021) broke down results based on age categories of interest and included the relevant age range to 18 years; however, some results were reported according to a total population aged 15-24 years.<sup>9</sup>

One reviewer screened titles and abstracts of all library search results, and a second reviewer independently screened a randomly selected 20% of results. Any discrepancies were resolved through discussion. There was strong agreement (>90%) among the titles and abstracts screened by both reviewers. Full text of eligible titles and abstracts were retrieved and screened for eligibility by one of the two reviewers and 20% of full texts were randomly selected to be screened independently by both reviewers. Strong agreement was established between the reviewers during the full text review. Consensus on inclusion for the relevant studies was achieved through discussion. Relevant findings were extracted from each article independently by both reviewers, including details of how the COVID-19 pandemic impacted youth behaviour and consumption of commercial tobacco and nicotine products.

Quality appraisal was conducted for each included article using quality appraisal tools that aligned with the research design of each paper. The National Institute for Health and Care Excellence (NICE) 1.7 Checklist for cross-sectional studies,<sup>10</sup> the NICE 1.6 Checklist for longitudinal studies,<sup>11</sup> and the Newcastle Ottawa Scale<sup>12</sup> for the retrospective cohort studies were used. For each included article, quality appraisal was completed independently by both reviewers, with discrepancies resolved through discussion.

Given the dynamic nature of the pandemic and the subsequent public health measures which evolved throughout the pandemic, and their potential impact on data collection and responses, we reviewed and reported findings based on the year of data collection.

## Main Findings

A total of 681 records were retrieved from the library searches, from which 64 articles were included after title and abstract screening. Seventeen articles met the inclusion criteria and were included in this evidence brief after full text screening. An additional two records were identified through grey literature searches, for a total of 19 included papers. Of these 19, 16 were retained after quality appraisal: 11 cross-sectional studies and five longitudinal studies.

Only one systematic review was identified in the literature search.<sup>13</sup> Although there was some overlap between Layman et al.'s (2022) systematic review and this synthesis, that review included studies with a wider age range (up to adults age 24), and included other non-nicotine substances, such as alcohol.<sup>13</sup> This review focuses on the impact of the COVID-19 pandemic on tobacco and nicotine product use, with a detailed breakdown of the reported consumption and behaviour before and during the pandemic. As the review aims to identify opportunities for intervention, and inform future planning for potential societal impacts, such as social distancing, the Layman et al. (2022) article was excluded from this synthesis.<sup>13</sup>

Since there was only one review level article<sup>13</sup> in the library search results, remaining articles included only individual studies. For the cross-sectional studies:<sup>8,9,14-23</sup> four were rated strong,<sup>8,9,18,23</sup> six rated moderate<sup>14-17,19,20</sup> and two rated weak.<sup>10,21,22</sup> Van Deelen et al. (2022) was excluded due to the low quality appraisal rating and the extremely low sample size of participants that reported outcome of interest (tobacco and/or nicotine product use),<sup>22</sup> leaving 11 included cross-sectional studies.

Of the five longitudinal studies,<sup>24-28</sup> strength of evidence for two studies<sup>25,26</sup> were rated moderate and three were rated weak.<sup>11,24,27,28</sup> Two of the longitudinal studies also included cross-sectional data collected during the pandemic and included new indicators not previously collected with these cohorts.<sup>26,28</sup>

## Changes in Nicotine Product Use

### TOBACCO CIGARETTES

The prevalence of cigarette use among youth remained consistently low both before and during the pandemic.<sup>18,19</sup>

Overall, there was a reduction in youth current cigarette smoking early in the pandemic compared to pre-pandemic.<sup>9,15,23,24</sup> Cigarette smoking decreased at similar rates among youth males and females, with greater decreases observed in older age groups.<sup>23</sup>

However, Roges et al. (2021) reported an increase in prevalence of daily smoking among specific subgroups, such as students (16-17 years old) attending vocational and educational training, those with parents with lower levels of education and those in regions that implemented earlier and stricter lockdown measures to control the spread of COVID-19.<sup>24</sup> This group also had a significantly higher risk of daily smoking during the pandemic compared to those aged 15-18 who were attending secondary and or college preparation education.<sup>24</sup>

None of the included articles addressed whether youth reported switching from smoking cigarettes to other forms of nicotine products during the pandemic. However, one article reported that some youth that used cannabis/THC in vaping devices switched to combustible cigarettes early on in the pandemic.<sup>8</sup>

### VAPING

Vaping devices remained the most common tobacco/nicotine product used by youth throughout the pandemic.<sup>18-20</sup>

Most youth reported a change in their vaping during the beginning of the COVID-19 pandemic,<sup>8,14,21,26</sup> with the majority of youth reporting a significant reduction in their vaping early in the pandemic compared to pre-pandemic.<sup>9,14,21,23,26,28</sup> The reduction observed was predominantly among the older youth age group (15-18 years of age) compared to younger youth (13-14 years of age).<sup>9,23</sup> The largest reduction in vaping was among those who reported past 30 day use early in the pandemic compared to pre-pandemic.<sup>9,23,25,26,28</sup> Though two longitudinal cohort studies reported significant decrease in past 30 day vaping prevalence,<sup>25,26</sup> Chaffee et al. (2021) found no association with the onset of the pandemic social distancing policies and the reported reduction in use.<sup>28</sup> In addition, a reduction in the average number of days vaping was reported among youth.<sup>9,29</sup> Youth were also less likely to report current vaping compared to young adults during the same time period.<sup>9,29</sup>

There was a percentage of youth that reported no change in their vaping frequency from pre-pandemic to early pandemic.<sup>14,21,23</sup> Thorisdottir et al. (2021) found that reported vaping was unchanged among younger youth (13-15 year olds).<sup>23</sup>

A smaller percentage of youth that reported an increase in vaping during the early stages of the pandemic.<sup>9,21</sup> Those who reported an increase in vaping were youth who also reported established vaping (frequent use) and/or self-reported feeling sad, stressed or bored at the time of the survey.<sup>21</sup> In comparison to youth who reported past month or weekly use, the number of youth who were vaping daily increased over this same period of time. However, the magnitude of the increase appears smaller than expected during the early stages of the pandemic.<sup>26</sup>

While there was an observed initial decrease in reported vaping in the early stages of the pandemic, by the end of the first year (December 2020) and into the second (2021) year of the pandemic, there was a reported increase in the percentage of youth who started vaping and/or reported vaping across the duration of the pandemic.<sup>21,27</sup> These results on reported increase in frequency were supported in cross-sectional studies that collected data in the second (2021) and third (2022) year of the pandemic in which youth commonly reported use on multiple days each month.<sup>18-20</sup> Available results suggest youth vaping rates did not seem as affected by subsequent stay-at-home orders as compared to the initial stay-at-home orders.<sup>27</sup>

One of the longitudinal studies<sup>27</sup> explored the differences between high school students and those who transitioned out of secondary school during the pandemic. They found that students who were transitioning out of high school during the study period appeared to be at particularly high risk for substance use (alcohol, binge drinking, cannabis, vaping) compared to those who remained in high school. These authors also reported that students who transitioned out of high school also reported significantly higher frequency of vaping compared to those in high school.<sup>27</sup> These findings are consistent with increases in vaping and other substance use during this life transition as well as substance use increase among youth as they age, therefore, the aging of youth during the pandemic might account for the reported increase in use of substances.<sup>19</sup>

While there was an observed decrease in vaping among both genders early in the pandemic, of those that explored differences between males and females, greater decreases were found in vaping among males over time.<sup>23,26</sup> Frequency of vaping was lower for females compared to males, however in the early stages of the pandemic one study found that females appeared more likely to maintain use or even escalate daily vaping compared to males.<sup>26</sup>

Gaiha et al. (2020) reported the majority of the youth who vaped during the early stages of the pandemic reported no change in nicotine strength.<sup>8</sup> Compared with young adults, underage youth were more likely to indicate that they did not know the nicotine strength of their vaping device before or since the start of the pandemic. More youth reported no change or less time to finish a pod or vaping device since the start of the pandemic.<sup>8</sup>

A small portion of youth who currently vaped switched to other forms of nicotine since the pandemic.<sup>8</sup> Youth who switched their source of nicotine reported switching to combustible cigarettes, nicotine gum and patches.<sup>8</sup>

## Reasons for Vaping during the Pandemic

Most youth reported vaping as a means to cope with the ongoing changes throughout the pandemic.<sup>8,21,26</sup>

Youth who vaped or increased their vaping during the pandemic were more likely to report reasons such as boredom/had nothing else to do, stress, anxiety, feeling sad and needing a distraction. They also mentioned vaping as an alternative to smoking cigarettes because they felt addicted, friends were vaping, and because they wanted to have fun.<sup>8,21</sup>

## Quitting or Reducing Nicotine Product Use

None of the included studies reported specifically on youth tobacco smoking cessation or reduction during the first two years of the pandemic.

In the early stages of the pandemic, youth were more likely to self-report quitting vaping compared to young adults.<sup>8</sup> However, the reported reduction in use (ranging from slight reduction to use reduced by half) was lower among youth compared to young adults during this same time period.<sup>8</sup>

By the end of the first year (2020) of the pandemic, the majority of youth who participated in the McCreary Centre Society (2021) survey reported that they wanted to stop or reduce their vaping.<sup>21</sup> The largest percentage of this group wanted to quit in the next three months, followed by quitting within the next year, and the remainder intended to quit in more than a year. The reported intention to stop or reduce their vaping did not differ by gender, age or frequency of vaping in the past month.<sup>21</sup>

Youth provided a number of reasons as to why they stopped or reduced their vaping during the pandemic, some which include: vaping might weaken their lungs/worried about their health, their parents would find out that they were vaping, they could not access vaping products, loss of interest, not being allowed to vape in their home, and fewer opportunities to vape.<sup>8,21</sup>

Two of the reviewed articles explored factors associated with reducing or quitting vaping.<sup>8,21</sup> Age, pandemic phase, and frequency of vaping influenced the reason for reducing or quitting vaping. Loss of interest in vaping was reported among youth aged 14 or older, those who vaped five or fewer days in the past month, and in the early phase of the pandemic (spring 2020) compared to end of the first year (fall of 2020).<sup>21</sup>

Youth's perception of vaping harm impacted the likelihood of whether they intended to reduce or quit their use during the first year of the pandemic. Youth who perceived vaping as less harmful than smoking tobacco cigarettes were less likely to report wanting to stop or reduce their vaping (e.g., 28% vs. 46% who saw vaping as equally harmful as smoking cigarettes).<sup>21</sup> It was also reported that youth with nicotine dependence (as measured by the Hooked on Nicotine Checklist<sup>30</sup>), youth who used a pod-based vaping device (e.g., JUUL) in the past 30 days, or youth who reported having vaped 10 times or more were all associated with lower likelihood of quitting or reducing vaping.<sup>8</sup>

In the second year (2021) of the pandemic, based on the 2021 National Youth Tobacco Survey in the United States, the majority of youth in high school and middle school who reported tobacco/nicotine product use expressed interested in wanting to quit. Of those that reported tobacco/nicotine product use at the time of the survey, most reported stopping use for more than one day during the past year in an attempt to quit.<sup>18</sup>

## Access and Availability of Nicotine Products

Numerous studies examined where and how youth obtained tobacco and nicotine products during the pandemic.<sup>8,9,18,19,21,25,28</sup>

### TOBACCO CIGARETTES

Only one article reported on youth access to tobacco and nicotine products (all products, not just cigarettes).<sup>28</sup> The majority of respondents, which included tobacco users and nonusers, reported that they did not know if any of the public health measures (social distancing rules, school closures and other developments related to COVID-19) impacted their access to tobacco and nicotine products. The remainder of the respondents reported it being much more or somewhat more difficult to access tobacco and nicotine products, which was reported slightly more than no difference at all.<sup>28</sup>

In the second year of the pandemic (2021), youth (middle and high school students) commonly reported obtaining their tobacco cigarettes by buying the products themselves, asking someone to give them products, asking a family member to get them products, receiving products from a friend, or through some other way that was not further disclosed.<sup>18</sup> Purchase locations include gas stations or convenience stores, from another person (friend, family member, or someone else), tobacco shops, grocery stores, or some other place that was not further disclosed.<sup>18</sup> Nearly half of youth (middle and high school students) reported not purchasing the tobacco cigarettes they used in the past 30 days.<sup>18</sup>

### VAPING PRODUCTS

Only Miech et al. (2021) explored access and availability of vaping products in a longitudinal study before and during the pandemic among a national sample of grade 12 students.<sup>25</sup> This study found that the perceived availability of vaping devices among youth declined during the pandemic. US grade 12 students who reported that they could “fairly easily” or “very easily” obtain a vaping device declined from 73% to 63% before and after the declaration of COVID-19 as a global pandemic and the implementation of related public health measures.<sup>25</sup>

Common sources of obtaining vaping products throughout the pandemic among youth included from friends, family members, or someone else.<sup>18,19,21</sup> Youth also reported buying the products themselves, however, most youth reported that they did not purchase vaping products the last time they used.<sup>18,21</sup> In one study, half of the youth who vaped reported acquiring their vape juice from another youth early on during the pandemic and this was more likely to be reported at the end of the first year of the pandemic (September and December 2020).<sup>21</sup>

Youth reported encountering barriers in accessing vaping devices early in the pandemic due to the inability to get to a retail location,<sup>8</sup> changes to store hours,<sup>9</sup> and challenges finding products in-store.<sup>9</sup> Underage youth were more likely to be impacted by restrictions on the number of products they could buy and the inability to get to a vape shop.<sup>8</sup> Kreslake et al. (2021) found that those who experienced limited access to retail environments were significantly more likely to report vaping less during the pandemic compared with those who did not report limited access.<sup>9</sup>

Conversely, some youth found it easy to access vaping devices early on during the pandemic and the most commonly reported reason was direct vape shop/dealer delivery.<sup>8</sup> Early on in the pandemic, the predominant source of vaping products shifted from retail environments to purchasing online.<sup>8</sup> However, Gaiha et al. (2020) reported that underage youth (13-21 years) were more likely to have no change in retail location compared to young adults (21-24 years).<sup>8</sup> Despite the challenges posed by public health restrictions, such as limited access to vaping products, longer shipping time, inability to go

to the vape shop, online product unavailability, higher prices, and restrictions on number of products, youth showed no significant difference in quitting or reducing their vaping compared with young adults.<sup>8</sup>

Age verification during vaping product purchases was not a consistent practice. According to Gaiha et al. (2020), nearly a third of underage youth reported buying vapes without any age verification or not knowing if their age was verified.<sup>8</sup>

In the second year of the pandemic (2021), youth commonly reported purchasing directly from another person (friend, family member, or someone else), directly from vape shops or tobacco shops and gas stations or convenience stores.<sup>18</sup> Other places in which vaping devices were purchased included drugstore or grocery store, through the mail, online, from a mall or shopping center kiosk or stand, through a vending machine, or from some other place not further disclosed.<sup>18</sup>

The majority of youth who vape reported sharing their devices during the pandemic.<sup>9,21</sup> In one study, most youth reported sharing less or about the same amount as before the pandemic.<sup>9</sup> Kreslake et al. (2021) found that those who reported sharing less during the pandemic had nearly twice the odds of reporting a reduction in frequency of vaping, and those who had shared more during the pandemic had lower odds of reducing their use.<sup>9</sup> The McCreary Centre Society (2021) found that the more frequently youth vaped (i.e., greater than six days in the past month), the more likely they were to share a device.<sup>21</sup> Further, youth aged 14 or older and those who last vaped in person with friends were more likely to have shared a vaping device during the pandemic.<sup>21</sup> On the other hand, there were youth who reported not owning a vaping device and had shared with friends prior to the pandemic but did not want to continue sharing due to the risk of contracting COVID-19.<sup>21</sup>

A few of the articles highlighted that there were other factors other than the pandemic that may have influenced the changes reported by youth on vaping product availability and access.<sup>8,9,25</sup> For example, in the US some significant policy changes occurred at the federal level just prior to the start of the pandemic, “*Tobacco to 21 Act*” took effect the first day of 2020 and limited purchase age of tobacco and nicotine products across all US states to those 21 years of age and older.<sup>8,25,31</sup> There were also federal restrictions implemented on the sale of pre-filled cartridge based vaping devices (e.g., JUUL), limiting sales to tobacco or menthol flavours.<sup>9,32</sup> These along with other policy changes at the federal, regional and local levels across all jurisdictions may have impacted access of tobacco and nicotine products among youth during the pandemic.

## Impact of Perceived Risk of COVID-19

Two articles examined the perceived risk of COVID-19 related to substance use (a variety of substances, including tobacco and nicotine products) behaviours among youth during the pandemic.<sup>14,29</sup> Dumas et al. (2020) found that youth who reported greater fears of contracting COVID-19 were significantly more likely to use substances alone.<sup>14</sup> A study conducted by Gaiha et al. (2022) found that those that reported vaping in their lifetime perceived lower risk of COVID-19 and respiratory complications compared to those that have never used.<sup>29</sup>

## Impact of Public Health COVID-19 Response

In the early stages of the pandemic, the majority of youth reported adhering to stay-at-home directives, but fewer reported perceiving their friends as adhering to the same measures.<sup>8</sup>

Responses from the early phase of the pandemic showed that youth who reported low levels of substance use (alcohol, cannabis, vaping) pre-pandemic were more likely to adhere to social distancing measures.<sup>25</sup> Further, lower adherence to social distancing measures was correlated with substantially higher levels of both pre-pandemic substance use and perceived availability among youth. Overall, there was an observed decrease in both past 30 day prevalence of vaping and reported availability of vaping devices among youth, regardless of their level of social distancing adherence.<sup>25</sup> Furthermore, youth who were adhering to stay-at-home mandates were 1.5 times more likely to make a quit attempt or reduce vaping since the start of the pandemic.<sup>25</sup>

Conversely, there was an association found between youth smoking and the extent to which their community was impacted by COVID. Youth who smoked tobacco cigarettes and reported living in communities that were most impacted by COVID-19 and therefore had strict COVID-19 mandates, were more likely to report increase in daily smoking.<sup>24</sup> Kreslake et al. (2021) observed that a weak COVID-19 response at the state level predicted high smoking rates; however the strength of COVID-19 response did not predict other outcomes beyond cigarette smoking.<sup>9</sup>

The instructional mode of learning in which youth engaged in throughout the pandemic was found to be associated with tobacco use and vaping.<sup>16,19,21</sup> Youth who attended class remotely were found to have lower rates of current tobacco use compared to those who attended class in-person.<sup>19</sup> Current vaping and ever use was found to be greater among youth who attended class in-person.<sup>16,19,21</sup> In one study, youth who returned to school in September 2020 were more likely to have vaped with friends in-person.<sup>21</sup>

## Changes in Social Context Impacting Tobacco Use and Vaping

Even in the early stages of the pandemic, youth continued to vape with their peers. The most commonly reported social use contexts were vaping with friends through technology, vaping alone, vaping with friends face-to-face, sending posts to friends of their vaping directly (privately) or via social media and vaping with parents.<sup>14,21</sup> Youth who reported using substances in multiple social contexts compared to those who used in a single context engaged in more vaping since the start of the pandemic.<sup>14</sup> The McCreary Centre Society (2021) study found that youth who reported they had vaped only in social situations before the pandemic (e.g., at school, or parties), had fewer opportunities and less of a desire to vape during the first three months of the pandemic.<sup>21</sup> In addition, youth who reported having friends who vaped or lived with someone who vaped were more likely to report current vaping and past vaping compared to those who did not have friends or live with someone who vaped.<sup>21</sup>

Kapetanovic et al. (2022) explored the context in which youth substance use (smoking, alcohol use and other drugs) increased during the pandemic.<sup>15</sup> They found that higher general family conflict and decreases in quality time with family predicted an increase in smoking and other substances. In addition to family circumstances, they also found that increased involvement with peers and hanging out without parents' knowledge also increased substance use.<sup>15</sup>

Dumas et al. (2020) also explored youth self-reported popularity and the association with substance use (alcohol, cannabis and vaping) within social contexts.<sup>14</sup> Youth who indicated higher self-reported popularity were more likely to use substances with friends through technology and send posts of their use to friends. Also, self-reported popularity and reputation concerns were found to predict the likelihood of using substances alone and face-to-face with friends. Solitary substance use was predicted to be more likely among those with reputation concerns and average to high self-reported popularity, and face-to-face substance use with friends was predicted to be more likely among those with reputation concerns and low self-reported popularity. It is also important to note that solitary substance use was related to both increased COVID-19 fears, reported depression and anxiety symptoms.<sup>14</sup>

## Limitations

There are several limitations to consider when interpreting the results of this evidence brief. First, the articles included relied on survey data, some longitudinal studies (existing and new)<sup>24-28</sup> and ongoing population-level surveys,<sup>18,20,23</sup> while others were cross sectional.<sup>8,9,14-17,19,21</sup> Implementation of COVID-19 protocols varied across jurisdictions and the scope of implementation impacted survey methodology and collection during the pandemic. Also, pandemic-related social restrictions were not the same across all jurisdictions and evolved throughout the pandemic so the location and time of data collection could impact the results.

The majority of the studies that were included were cross-sectional, which does not allow us to analyze behaviour over time.<sup>8,9,14-21,23</sup> Therefore, most articles used self-reported assessments of COVID-related impacts (i.e., pre- vs during-COVID-19 pandemic) which are subject to recall and social desirability bias. Despite this limitation, the data available provides insight into the possible mechanisms by which COVID-19 pandemic and the responding public health measures might have influenced tobacco use and vaping among youth.

Most study samples were not representative of the youth population and were unable to apply to other jurisdictions.<sup>8,9,14-17,19,21,23,24,26-28</sup> For example, for many of the studies there was an over representation of females and those who identified as white/Caucasian.

Lastly, a few authors acknowledged that their studies were unable to account for federal, regional or local level policy changes implemented just prior to or during the pandemic.<sup>8,9,25</sup> For example, on the first day of 2020 in the United States implementation of a federal bill limited purchase age of tobacco and nicotine products across all US states to those 21 years of age and older.<sup>8,25</sup> These type of policy changes implemented just prior to or during the pandemic could have impacted access to or products available to youth that may have impacted the results reported.<sup>8,9,25</sup>

## Discussion and Conclusions

Overall, the available evidence suggests the largest reduction was in youth reporting past 30 day vaping early in the pandemic.<sup>9,23,25,26,28</sup> There was less of a reduction in the frequency of vaping (daily/weekly), suggesting less of an impact on youth with more established vaping behaviours.<sup>9,21</sup> This indicates that the COVID-19 pandemic and public health response may have initially had an impact on experimentation, social use, and escalation of use.

Despite reductions in past 30 day vaping and weekly vaping during the early stages of the pandemic, these decreases did not persist as the pandemic continued.<sup>18-21,27</sup> This suggests that vaping was disrupted mostly during the initial stay-at-home orders, while subsequent stay-at-home order and social distancing measures, as well as willingness to adhere to them, were not found to have the same impacts on use.<sup>14,25</sup>

Youth rely on social supply and use substances predominately in social contexts, therefore it was anticipated that with physical distancing regulations and disruption to both in-person education and social settings there would be an impact to access of tobacco and vaping products. However, access and availability of vaping and tobacco products early on in the pandemic was not reported to be impacted as much as would have been expected.<sup>8,9,25</sup>

There is a need to explore and gain a better understanding of the role of key covariates in youth vaping and smoking behaviour. For example, covariates such as socioeconomic status and mental health should be further explored to understand the relationship of vaping and smoking to youth mental health and social well-being throughout the different stages of the pandemic. In addition, gaining a better understanding of those transitioning from high school (already a sensitive period of stress and increase in substance use) and how that period was impacted during the pandemic.

It will be important to continue to review the evidence as it becomes available to get a better understanding as to how and to what extent the pandemic influenced substance use and any underlying causal mechanisms. As we shift to the recovery phase of the COVID-19 pandemic, it will also be important to continue to monitor youth tobacco cigarette smoking/vaping trajectories to determine long-term impacts.

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