Journal Pre-proof

A scoping review of school-level risk and protective factors of youth cannabis use: An application of the socio-ecological model

Alexandra Butler, Isabella Romano, Scott T. Leatherdale

A scoping review of school-level risk and protective factors of youth cannabis use: An application of the socio-ecological model

Alexandra Butler, PhDc , Isabella Romano, PhDc, Scott T. Leatherdale, PhD

School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, Canada

Corresponding author:

Alexandra Butler

School of Public Health and Health Systems, University of Waterloo, 200 University Avenue, Waterloo, Ontario, N2L 3G1, Canada

Alle.butler@uwaterloo.ca

Abstract:

Risk and protective factors for cannabis use exist at various levels of influence, and the school environment can play a key role in preventing cannabis use and initiation as most youth. By using the socio-ecological model to hierarchically characterize school-specific risk and protective factors, a wholistic approach to school-based cannabis use prevention can be demonstrated. This study uses scoping review methodology to describe current research on school-level risk and protective factors of youth cannabis use. The socio-ecological model was used as a guiding framework to characterize the literature. PubMed, Embase, and Scopus were used to retrieve original research articles published between 2010-2020 that examined cannabis use as a main outcome of interest. Articles that examined school-related risk and protective factors within participants who were 18 years old or younger were included. Articles that met the pre-established criteria were extracted and categorised by theme based on levels of the socio-ecological framework. Four levels of risk and protective factors related to the school environment were identified (individual, interpersonal, community, and societal). A majority of school-based research examined individual and societal factors that influenced youth cannabis use. Our findings suggest most available research has focused on individual and societal school-level factors of cannabis use. A number of consistent themes were identified, however, findings were mixed and demonstrate the need for a more critical examination of research in order to understand which risk and protective factors are most influential among youth.

Key words: Review, Cannabis, Schools, Youth, Policy, Community, Socio-ecological model

Introduction

Within the past decade, cannabis use has become highly prevalent among youth with the most rapid increase in cannabis use being observed in developed nations across North America, Western Europe, and Australia (World Health Organization, 2021). Onset of cannabis use, or initiation of use, typically occurs during adolescence as it is often a time for experimentation (Zuckermann et al., 2021). While repercussions associated with risky cannabis use can occur at any age, adolescents are particularly susceptible to adverse effects during this stage of development (Hasin et al., 2017). Short- and long-term cannabis use has been associated with a number of negative health outcomes including acute, chronic, and psychosocial adversities (Fergusson & Boden, 2008; Hengartner et al., 2020; Organisation, 2016; Romano et al., 2019; Volkow et al., 2014). Research suggests that individuals who begin using cannabis at a young age (e.g., adolescence) are up to seven times more likely to develop cannabis use disorder as an adult (Mechoulam & Parker, 2013; Winters & Lee, 2008).

Risk and protective factors for cannabis use exist at various levels of influence. The socio-ecological model is a framework for prevention and considers the complex interrelationships between individual, interpersonal, community, and societal factors (Green et al., 1996). This framework illustrates the broad range of factors that can influence health behaviours in a hierarchical manner whereby distal or upstream factors (such as culture and policies) have a trickle-down effect on more proximal factors at the individual (e.g., one's health beliefs, behaviours) or interpersonal-level (e.g., peers, family). Fundamentally, the socio-ecological model recognizes the importance of a multi-layered environment impacting health and wellbeing. Previous reviews have described and summarized youth

substance use within the context of social ecology (Corbett, 2001; Nargiso et al., 2015). While these reviews examine various substances, both note the importance of multifaceted approaches (e.g., school-based programs, restrictive policies, media campaigns), across multiple levels of the social ecology in order to prevent or reduce youth substance use.

Within the context of cannabis use, the socio-ecological model can provide a helpful framework for understanding the multi-level factors that influence youths' susceptibility to cannabis. For example, factors at the individual-level might include sociodemographic characteristics such as age, gender, or sex (shown to be associated with increased likelihood of cannabis use (Leos-toro et al., 2019)), as well as individuals' own cannabis risk perceptions (Kilmer et al., 2007) and use of other substances such as alcohol or tobacco (Romano et al., 2019). At an interpersonal-level, the socio-ecological model dictates that youth may be more likely to engage in cannabis use via influence of their social networks (Caouette & Feldstein Ewing, 2017). More distally, community-level factors may include geographic variations in accessibility (Paschall & Grube, 2020) as well as the influence of institutional environments such as the schools youth attend (Costello et al., 2012). At the broadest societal-level, factors influencing cannabis use may include policy and legislation (e.g., increasing cannabis liberalization (Zuckermann et al., 2019)) in addition to the overall cultural and social norms of cannabis use (Roditis et al., 2016).

The school environment can play a key role in preventing cannabis use and initiation as most youth, regardless of socio-economic status, spend many of their waking hours interacting with their school environment. For the purpose of this study, we propose the school environment as a microcosm of the social ecology influencing youth cannabis use. Although schools exist within the broader socio-ecological framework (i.e., at the community-/institutional-level), youth are exposed to various factors of influence at school that exist at the individual, interpersonal, community, and societal levels. The World Health Organization initiated the concept of "Health Promoting School" which incorporates socio-ecological principles. Rather than focusing on individual behavioural change (A. Lee, 2009), Health Promoting Schools aim to improve the school's physical and social environments, teaching and learning methods (Parsons et al., 1996), and available resources and school policies (A. Lee, 2002) to foster the health and wellbeing of students. However, while ample research conducted among youth is school-based, school-level factors that influence behaviour are often not considered. A better understanding of youth cannabis use within the school context is required to create healthier school environments and support health promotion strategies targeting school aged youth.

Despite limitations in the focus of available evidence, examining the existing school-based literature on the risk and protective school factors of youth cannabis can improve our understanding. In this scoping review, we explore and synthesize existing literature examining the risk and protective elements of youth cannabis use within the context of a school setting. By examining this literature through a socio-ecological lens, the school-specific risk and protective factors identified can be hierarchically characterized, and a wholistic approach to school-based cannabis use prevention can be demonstrated. Using findings from this scoping review, our aim was to summarize the current literature and identify any existing knowledge gaps and implications for school health. In turn, these results can be used to inform future systematic reviews and prevention efforts within school settings.

Methods

This scoping review was drafted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) Extension for Scoping Reviews (Tricco et al., 2018) and follows the reporting guidelines recommended by Arksey and O'Malley (Arksey & O'Malley, 2005). This study was based on data that have been previously published and are available publicly, as such this study did not require ethical approval.

Eligibility Criteria: Peer-reviewed, primary research articles available in English were included if they were published between 2010 to September 2020 and study participants were 18 years old or younger. In order for an article to be eligible for inclusion, main outcomes and predictors needed to meet the predetermined criteria; papers specifically examining cannabis use (e.g., lifetime/ever use, past-year use, past-30 day use) as a main outcome of interest. Papers that examined multiple types of substance use behaviours were considered if cannabis-related results were presented as a main outcome of interest and not collapsed within a broader or poly-substance use outcome variable. Moreover, articles were included if risk/protective factors of cannabis use factors were presented as main predictors or mediators/moderators of interest and were specifically related to the school environment. Studies assessing the impact of school environmental factors (e.g., student-teacher relationships, school policies) in relation to cannabis use were included. Grey literature documents (Paez, 2017), including curriculum/policy documents and dissertations, were excluded. Papers were excluded if they were in the form of a review or conference/poster abstract. Papers were also excluded if they assessed attitudes towards cannabis, perceived risk of cannabis, or if cannabis use was examined as a predictor. Papers using school-based data (e.g., data that was collected during class time, or recruited student participants through schools, were considered for inclusion only if school factors were examined as a study objective or a main covariate.

Information Sources: Based on these research objectives and guidance from a subject-specialty liaison librarian at our institution, three databases were systematically searched for this scoping review: PubMed, Embase, and Scopus. The search strategy (Appendix) was drafted by two reviewers and appraised by a trained University librarian and a senior reviewer within the Faculty of Applied Health Science. The final search results from all three databases were exported in Mendeley and duplicates were automatically removed by the software.

Search and Search Terms: The search terms included are as follows: "cannabis", "marijuana", "marihuana", "weed", "marijuana use", "marijuana smoking", "marijuana abuse" in combination with "youth*", "child*", "teen*", or "adolescen*", and "predict*", "protect*", "buffer*, "vulnerab*", "risk*", "risk factors", or "protective factors", and "policy", "policies", "community", "family", "peer*", "parental", "parenting", "parents", "teachers", or "socioeco*", and "school*". The final search strategies for all three databases can be found in Appendix.

Selection of Sources of Evidence: After deduplication, the final search strategy yielded 2,829 articles. Articles were divided equally among two reviewers (AB and IR) and were screened independently at title and abstract. The first 50 articles were screened (at title and abstract) together by both researchers to ensure consistency of article inclusion/exclusion. Of those papers that were identified as possibly meeting the inclusion criteria at title and abstract screening, full text review was conducted and included articles were compared between both reviewers. Articles that were unclear on meeting the eligibility criteria were discussed iteratively and appraised jointly at each stage of the screening process. If reviewers were unable to reach an agreement on inclusion/exclusion of a paper, a senior reviewer was consulted. Three other papers meeting the inclusion criteria that were identified independent from the final search strategy were screened at full text and extracted.

Data Charting Process: A data charting template was developed by two reviewers and was used to, 1) organize data that was being extracted from papers meeting the inclusion criteria, 2) summarize overall conclusions, 3) identify the socio-ecological levels each factor fell under, and 4) highlight which risk and protective factors were significantly associated with cannabis use. As there were fewer articles after screening for inclusion, the reviewers extracted the first 30 articles together to ensure consistency of the variables being extracted. The two reviewers continued data extraction independently. Articles were collated and reviewed by both researchers once all eligible articles were extracted.

Data Synthesis and Abstraction: Data were extracted from each study sample and type (participants, sample size, cross-sectional vs. longitudinal vs. intervention); main predictors and outcomes; study objectives, findings, overall conclusions, limitations, and recommendations, the socio-ecological level and sub-levels each risk/protective factors falls under, and whether the risk/protective factors were predictive of with cannabis use. The socio-ecological model was used as a guiding framework to characterize the literature and to classify types of predictors within the school setting that influence cannabis use; this decision was made a priori.

3. Results
3.1 Article screening and study selection

A systematic literature search retrieved 4,186 articles from PubMed (n=1,541), Embase (n=944), and Scopus (n=1701). After deduplication within Mendeley, 2,829 articles were derived. Article title and abstracts were assessed in the first screening stage, and 2,657 failed to meet the inclusion criteria. After removing excluded articles from the first screening stage, 173 were retrieved for full-text screening. From the full-text screening, 81 met the inclusion criteria and were selected for data extraction and charting. The most common reasons for exclusion included: not examining school-specific risk and/or protective factors (n=40); outcome variable(s) of interest was not specific cannabis use (n=18); articles were not primary research (n=14); and research sample included participants who were >18 years of age (n=13). The screening and review process is illustrated using a CONSORT flow diagram.

3.2 Description of the charted literature

As per the inclusion criteria, publication year ranged from 2010 to 2020. A majority of the literature that met the inclusion criteria was cross-sectional (73% [n=61]), and the remaining 23 studies were longitudinal in design; 4 of which were longitudinal intervention studies. More than half of the included articles (64%) were from North America. Average student sample size was 10,191 (baseline sample sizes used for longitudinal or repeat cross-sectional studies) and the median student sample was 2,513; the smallest sample included was 121 students, and the largest was 114,364 students. More than half of the included studies were conducted within a high school sample (51% [n=42]), while 10 studies were conducted within a middle school sample, and 29 studies were conducted among both middle and high school students. Twenty-seven studies were conducted within a specific population of interest (e.g., among LGBTQ+ students, racialized students, students of a particular gender).

3.3 Characterizing the literature under the socio-ecological framework

Using the socio-ecological model (Bronfenbrenner, 1977) as a guiding framework for this scoping review, four levels of risk and protective factors of cannabis use were identified and used to characterize the retrieved literature. Overall findings from the extracted articles have been described under each domain as follows and summarized in Table A in the Appendix.

Individual-level:

Research examining associations between student cannabis use and truancy, bullying experience, school sports participation, attitudes, and commitment towards school and/or academic performance were considered under the individual-level of the socio-ecological model. Of the articles meeting the inclusion criteria, 41 examined individual-level school influences of cannabis use. There were 13 articles that examined truancy as a risk factor. In general, truancy was identified as a strong risk factor for cannabis use, however, Maynard and colleagues provide evidence that distinct profiles of truancy exist among youth and not all truant youth demonstrate the same propensity for risky behaviours (Maynard et al., 2012). Among the 9 articles examining in-school bullying as a risk factor for cannabis, results were mixed. While cannabis use was more common among students experiencing victimization (Fallin-Bennett & Goodin, 2019; Gaete et al., 2017; Lee, Hong, Resko, & Tripodi, 2018), results often varied by gender

(J. Lee et al., 2020; Wormington et al., 2013) and bullying type (e.g., physical bullying, cyberbullying, face-to-face bullying)(J. Lee et al., 2018; Vaughan et al., 2011); victimized boys (Lee, Choi, Thornberg, & Hong, 2020; Wormington, Anderson, Tomlinson, & Brown, 2013) and boys who reported participating in cyberbullying were more likely to report cannabis use (Lee et al., 2020). Perpetration was also consistently a significant risk factor for cannabis use (Farhat & Simons-Morton, 2011; Gaete, Tornero, et al., 2017). Five articles examined school sports participation and its association with cannabis use; similar to in-school bullying, results were mixed and showed differentiated associations across gender. Three articles examining the influence of social status at school and student cannabis use all demonstrated mixed results. Eleven articles examined whether attitude towards school was related to student cannabis use; results were mixed, and significant associations were observed in about half of the articles included (n=6). Among the significant findings observed, poor school satisfaction (Hoff, Andersen, & Holstein, 2010) and negative attitudes towards school (Jovic et al., 2014; King, Vidourek, & Yockey, 2019; Zaharakis et al., 2018) were associated with higher cannabis use among students. Lastly, 16 articles identified student academic performance and attainment as key factors related to cannabis use. In general, high academic achievement was identified as a significant protective factor against cannabis use and was observed in 13 articles. Gender stratified results from Farhat and colleagues (2011) suggest that this protective effect was more pronounced among male students.

Interpersonal-level:

Associations between at-school relationships (i.e., peers, teachers and other school administration), students' perceived connection to their school, and student cannabis use were examined and characterized under the interpersonal-level of the socio-ecological model. There were 55 articles that examined interpersonal-level school factors of cannabis use. Of these included articles, 22 examined the impact of school connectedness on student cannabis use. Overall, school connectedness was reported as an important indicator of cannabis use by a majority of the articles (n=13). Poor school connectedness and belongingness was often linked to an increased risk of cannabis use (Jovic et al., 2014) and frequency (Fallu, J.-S., et al., 2014), whereas strong school connectedness demonstrated protective effects against cannabis use (Arsenault et al., 2018; Devet et al., 2012; Gaete, Tornero, et al., 2017; Gaete & Araya, 2017; Vaughan et al., 2011; Weatherson et al., 2018; Wormington et al., 2013). Twenty-eight articles examined the influence of school peers. A majority found peers to be a significant predictive factor of cannabis use whereby negative peer influence, such as peer deviance and delinquency (Lee et al., 2020, 2018), and having friends that use substances (Rudolph et al., 2018) were found to be risk factors for cannabis use. While some research identified positive peer influences such as peer support as protective against cannabis use (Peltzer & Pengpid, 2019), other research found support from friends was associated with higher use of cannabis (Moore et al., 2018). Similarly, teacher influence on cannabis use can serve as both a risk or protective factor; while having positive and supportive relationships with teachers demonstrated protective effects against cannabis in 7 articles, teacher discrimination was identified as a risk factor for cannabis use in 2 articles. Student cannabis use and other school relationships were examined in 2 articles, however, associations were not found to be significant.

Community-level:

Research examining the location of schools, surrounding built environments, and school SES and student cannabis use were considered under the community level of the socio-ecological model. Eight articles examined community-level school factors of cannabis use whereby 5 of the included articles reported significant associations. Environmental access and availability of cannabis (i.e., proximity and number of cannabis retail stores) were examined in 3 articles, and no significant relationships were observed between cannabis use and access (Brooks-Russell et al., 2018; Zuckermann et al., 2020). School socio-economic status (SES) was examined in 5 included articles. While significant relationships between SES and cannabis use were observed, results varied; while one study found youth attending

schools belonging to areas with greater social disadvantages had a lesser risk for cannabis experimentation (Jovic et al., 2014), another study suggested attendance in lower-SES schools corresponded to greater risk of cannabis use (Buttazzoni et al., 2020; Hill & Mrug, 2015). On the other hand, medium school-level SES was associated with higher probability for cannabis use when compared to low school-level SES (Gaete, Tornero, et al., 2017; Pavic Simetin et al., 2013) and high school-level SES (Gaete, Tornero, et al., 2017). Six articles examined the association between school urbanicity and student cannabis use. Similar to school-level SES, both significant and insignificant relationships with urbanicity were observed. Among the significant associations, results were mixed and both urban schools (Zhen-Duan et al., 2014; Zuckermann et al., 2020) and rural schools (Buttazzoni et al., 2020) were identified as risk factors for cannabis use.

Societal-level:

Twenty-four articles examined societal-level school factors of cannabis use, which considered the distal elements of influence including school climate and policy. Eight articles examined the impact of school policy and discipline on cannabis use. Cannabis use was higher in schools using out-of-school suspension and low policy enforcement (Evans-Whipp et al., 2015). In support of this, fair but authoritative (Cornell & Huang, 2016; Magier et al., 2020) and progressive (Magier et al., 2020) school disciplinary types were associated with lower levels of cannabis use. School drug programs were examined by two articles, however, no significant effects on cannabis use were observed (Eitle et al., 2017; Zuckermann et al., 2020).

School type and school performance were examined by 4 articles; findings that general schools (i.e., compared to vocational or professional schools) and lower school-level academic performance (i.e., compared to high preforming schools) were consistent risk factors for cannabis use (Dudovitz et al., 2018; Gaete & Araya, 2017; Hill & Mrug, 2015; Pavic Simetin et al., 2013; Terzic Supic et al., 2013). Five articles examined school composition as a risk factor for cannabis use; in general, higher cannabis use rates were observed among schools with greater ethno-racial diversity (Fisher et al., 2019; Hill & Mrug, 2015; Eitle, Thorsen, & Eitle, 2017) and heterogenous SES among students (Pavic Simetin et al., 2013). Nineteen articles examined school culture and climate as a predictor of cannabis use; however, both significant [n=12] and insignificant [n=7] associations were identified. Some research found that cannabis use was inversely associated with supportive school environments(Hodder et al., 2016), particularly among LGBTQ youth (Heck et al., 2014; Zhang et al., 2020). Positive school climate demonstrated protective effects against cannabis use(Sznitman & Romer, 2014) whereas negative school climate was a risk factor (Cambron et al., 2020). Conversely, Farhat and colleagues (2011) found that negative school climate was protective against cannabis use only among female students. Visibility of cannabis use in school was related to an increase in student cannabis use (Hamilton et al., 2012; Kuntsche, 2010). School drug climate and perceived peer cannabis use were found to be consistently linked to individual cannabis use (Gaete & Araya, 2017; Hoff et al., 2010; Zuckermann et al., 2020).

Multi-level:

Of the 81 articles that met the search criteria, 39 examined more than one level of influence on cannabis use. Only 2 articles (Gaete & Araya, 2017; Rudolph et al., 2018) examined factors across all 4 levels of the socio-ecological framework. Current research that provides a comprehensive examination of all potential levels of influence is minimal and demonstrates the limitations of existing evidence.

Discussion

In order to provide a more complete picture of the various factors of youth cannabis use, this scoping review aimed to identify existing literature that examined the risk and protective elements of

cannabis use within the context of a school setting. Using the socio-ecological framework to classify the common themes of school-level influences within youth cannabis use research, this scoping review method was effective at identifying important school parameters of youth cannabis use. Moreover, this scoping review lent insight on potentially overlooked factors and levels of influence, important evidence gaps and inconsistencies within the literature, and direction for future research in this field. A majority of school-based research that was available examined individual- and societal-level school parameters of youth cannabis use. While some research indicates that individual-level factors are more commonly linked to cannabis use compared to environmental factors (Jovic et al., 2014), Dudovitz and colleagues provide compelling evidence that school climate and community is critical in shaping student health and wellbeing, and that changes can have immediate results (Dudovitz et al., 2018).

Many of the risk and protective factors identified in this scoping review demonstrated mixed findings both in terms of significance and directionality of association. Mixed findings may be a result of varying youth profiles, whereby risk or protective effects that are strongly present in subpopulations (e.g., geographical, demographic, or cultural factors) may become null when examined across a large sample of schools or among general populations. For example, school climate and student connectedness were often found to be important protective factors in vulnerable populations of youth, including lower-SES racialized youth (Dudovitz et al., 2018) and LGBTQ+ youth (Arsenault et al., 2018; Heck et al., 2014; King et al., 2015; Vaughan et al., 2011). Similarly, Maynard and colleagues (2012), provide evidence of distinct profiles of truancy existing among youth whereby only some truant youth are at a greater risk for cannabis use. Mixed findings may also be a result of school specific parameters being densely interconnected; school connectedness may impact cannabis use due to its dependence on other school factors such as peer victimization and bullying culture (J. Lee et al., 2020; Wormington et al., 2013). Additionally, academic culture of the school or school-level performance may also influence an individual's academic aspirations and attitudes towards school, and in turn, act as a protective factor against cannabis use. These results suggest a complex and bidirectional interplay between school-level influences and moderating variables when predicting cannabis use; additional research and critical appraisal is needed to understand the interrelationships that exist across different school domains and the true influential factors of cannabis use.

Evidently, schools predispose youth to both risk and protective environments. By using the socio-ecological model as a guiding framework, this scoping review provides a universal examination of the risk and protective factors of cannabis use across all levels of influence that students are exposed to within the school context. This scoping review summarizes school-level risk and protective factors of youth cannabis use, which suggest that individual- and societal-level factors may have the strongest influence. While mixed findings were observed within our scoping review, there were several factors that demonstrated consistent risk/protective effects. Truancy, bullying perpetration, and school drug climate were all found to be consistent risk factors for cannabis use. Moreover, authoritative and progressive school discipline approaches were consistently protective against student cannabis use, though literature was limited. On the other hand, higher academic achievement and performance were found to be protective at both the individual and school levels.

Given that findings for school risk and protective factors were mixed, our results suggest that factors may be unique to each student population and school environment. As such, schools are encouraged to learn more about their student population and the risk and protective factors that are present within their school specifically. These findings may also be supplemented by further systematic and meta-analytic review. Our synthesis revealed mixed findings and as such, critical appraisal of the evidence would provide additional insight into the robustness of significant and insignificant findings summarized in this scoping review. Moreover, many articles evaluating school-based cannabis intervention programming were retrieved by our search strategy and an assessment of the impact and

efficacy of ongoing prevention efforts would be of benefit to school decision makers. From a knowledge mobilization perspective, findings from a systematic review or meta-analysis may deliver more accessible and actionable evidence within this domain to school stakeholders specifically. However, it remains a necessary first step to map the current literature within the field, as we have in this scoping review.

Research gaps:

Our results identified a number of evidence-gaps within the existing literature. As previously noted in a report by the World Health Organization (World Health Organisation, 2016), most of the studies retrieved in our search were conducted in higher-income countries such as Australia, Canada, the United States, and several countries in Europe. Research retrieved within lower-income countries was modest, suggesting that while some of the same risk and protective factors may also apply within these populations (Hall & Degenhardt, 2007), additional research is needed to understand whether influential factors of youth cannabis use behaviours vary in developing countries.

Longitudinal literature was limited and most of the articles that met our criteria were cross-sectional by design. As such, available research and these findings are limited in determining the directionality of association and predictive value for many of the factors examined. Longitudinal research throughout elementary-middle-high school years is needed in order to understand upstream factors of cannabis use and how these complex behaviours interact and change in youth over time. More specifically, this literature scan suggests that the available longitudinal data tends to focus on more proximal levels of influence such as individual and interpersonal factors compared to distal factors at the community and societal level. Leveraging studies that collect hierarchical data over time, such as the COMPASS system (Leatherdale et al., 2014) in Canada, Add Health (Harris et al., 2019) in the United States, or the Millennium Cohort Study (Centre for Longitudinal Studies, n.d.) in the UK, may help to wholesomely address early indicators of risk and protective factors of cannabis use among school aged, and prevent/delay initiation or reduce cannabis use over time.

A majority of the articles that were originally retrieved by our systematic search was school-based research, however, only a limited number of studies examined school-specific influences of cannabis use. This suggests that while schools have been targeted as an accessible platform to reach many youth, the modifiable factors within the school environment are often overlooked. Our results suggest there is a paucity of research examining risk and protective factors at the community level (i.e., school-built environments) that were related to the school context. As cannabis legalization, decriminalization, and liberalization is becoming more common worldwide, cannabis retailer shops may become more globally prevalent. Given that existing behavioural evidence suggests that substance retail density and proximity to schools have been an important factor predicting youth tobacco (Chan & Leatherdale, 2011; Leatherdale & Strath, 2007) and alcohol (Gohari et al., 2021) use, research examining the association between the school-built environment and geographical accessibility to cannabis retailer shops is required to evaluate its potential impact.

Future research:

Identifying knowledge gaps and multi-level factors that may be associated with student cannabis use is an important first step to advancing school-based research and directing future studies. In turn, future research that aims to address the gaps identified in this literature scan (i.e., clarifying directionality of associations and the observed mixed findings), may assist school health decision makers in improving student cannabis use outcomes and promoting healthier school environments overall.

Consistent with the SEM, our findings suggest that influences of cannabis use exist at multiple levels (i.e., both proximal and distal). Additional research, with a particular focus on hierarchical and longitudinal evidence, is needed to understand youth cannabis use within a wholistic context and to

delineate directionality and complex interactions between the various levels of influence. Additional research on community level factors of interest is needed to better understand how the school-built environment influences student cannabis use behaviours.

The literature retrieved and extracted in this scoping review is sufficient to provide scientific consensus on key school correlates, however, deeper critical appraisal and evaluative reviews on the available evidence for risk and protective factors at the individual, interpersonal, societal levels is needed. Findings from this scoping review demonstrate the necessity to disentangle bullying experiences, it's interaction with other school factors such as school connectedness (J. Lee et al., 2020; Wormington et al., 2013), and the differential impacts on youth cannabis use (e.g., boys vs girls). Though data were limited, progressive and authoritative discipline was protective against student cannabis use; these findings may be in accord with a restorative justice approach more broadly, and additional research to understand this mechanism that may be guiding behaviour and decisions could have a more universal application to substance use policy and programs. Researchers should also consider studies to characterize sex and gender differences of cannabis use across the four levels of influence examined here.

Strengths and Limitations:

This scoping review was limited by the search strategy approach and inclusion criteria in that relevant information may have been missed. First, our search strategy was limited to articles published after 2010. While some relevant information may have been lost, we chose to focus on the most recent research given drug policy reform and changing attitudes within the last decade and our search strategy reflects the most current risk and protective factors of youth cannabis use. Moreover, studies conducting research within a group of high school students that were slightly older than our specified criteria were not extracted. Given the age restrictions of our criteria, any research examining cannabis use trajectories from adolescence into adulthood would be excluded and thus it is possible that our search was limiting in the number of longitudinal articles that were included in our analysis. Moreover, the criteria for age may have been particularly limiting for other cultural contexts, where middle school is not necessarily structured the same as high school, at least in North America. Although some research specified that the sample was indeed a high school sample, articles that included youth older than 18 years of age did not meet the bounds of the inclusion criteria. As such, relevant studies that are culturally unique may not be captured within this scoping review. Another limiting factor of our inclusion criteria was the requirement of peer-reviewed, primary research articles. Given that this scoping review did not include elements of critical appraisal, inclusion of peer-reviewed articles only may help to ensure a quality standard of the research that has been summarized. Moreover, our search was limited to 3 databases that were selected based on the topic of interest. Overall, these confines may limit our retrieval of all important information related to school-level influential factors of youth cannabis use.

Due to the nature and the broader focus of this type of review, our scoping review is limited in that it does not formally evaluate the quality of evidence nor does it provide insight to which risk or protective factors are most influential. The lack of critical appraisal further limits our ability to understand the gaps in the literature regarding the quality of research that is available within this domain (Pham et al., 2014). However, we provide comprehensive overview and synthesis of existing literature, which is the emphasis of a scoping study, and highlight the need for future systematic reviews within this domain to appraise the standard and quality of evidence available.

Conclusion

These findings suggest the importance of understanding cannabis use within wholistic contexts and that the school environment plays a key role in preventing and facilitating cannabis use. This scoping review summarizes recent literature examining the risk and protective school factors of youth cannabis use, using social ecology as a guiding framework. After a comprehensive review of the literature, our findings suggest a majority of available research has focused on individual and societal school-level

factors of cannabis use. While a number of consistent themes were identified, findings were mixed, illustrating the need for a more critical examination of available research in order to understand which risk and protective factors are most influential among youth. These findings have implications for future research within the school-health domain and cannabis prevention efforts within school settings.

References
Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology: Theory and Practice*. https://doi.org/10.1080/1364557032000119616
Arsenault, C. E., Fisher, S., Stevens-Watkins, D., & Barnes-Najor, J. (2018). The Indirect Effect of Ethnic Identity on Marijuana Use Through School Engagement: An African American High School Sample. *Substance Use & Misuse*, *53*(9), 1444–1453. https://doi.org/10.1080/10826084.2017.1412464
Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, *32*(7), 513–531.
Brooks-Russell, A., Ma, M., Levinson, A. H., Kattari, L., Kirchner, T., Anderson Goodell, E. M., & Johnson, R. M. (2018). Adolescent Marijuana Use, Marijuana-Related Perceptions, and

Use of Other Substances Before and After Initiation of Retail Marijuana Sales in Colorado (2013–2015). *Prevention Science*. https://doi.org/10.1007/s11121-018-0933-2

Buttazzoni, A., Tariq, U., Thompson-Haile, A., Burkhalter, R., Cooke, M., & Minaker, L. (2020). Cannabis use and stigma among Canadian high school students: Results from the 2015 and 2017 Cancer Risk Assessment in Youth Survey. In *Addictive Behaviors* (Vol. 111). https://doi.org/10.1016/j.addbeh.2020.106547

Cambron, C., Kosterman, R., Rhew, I. C., Catalano, R. F., Guttmannova, K., Hawkins, J. D. (2020). Neighborhood Structural Factors and Proximal Risk for Youth Substance Use. *Prevention Science : The Official Journal of the Society for Prevention Research*, *21*(4), 508–518. https://doi.org/http://dx.doi.org/10.1007/s11121-019-01072-8

Caouette, J. D., & Feldstein Ewing, S. W. (2017). Four Mechanistic Models of Peer Influence on Adolescent Cannabis Use. In *Current Addiction Reports* (Vol. 4, Issue 2, pp. 90–99). Springer. https://doi.org/10.1007/s40429-017-0144-0

Chan, W. C., & Leatherdale, S. T. (2011). Tobacco retailer density surrounding schools and youth smoking behaviour: A multi-level analysis. *Tobacco Induced Diseases*, *9*(1), 1–7. https://doi.org/10.1186/1617-9625-9-9

Corbett, K. K. (2001). Susceptibility of youth to tobacco: a social ecological framework for prevention. *Respiration Physiology*. https://doi.org/10.1016/S0034-5687(01)00269-9

Cornell, D., & Huang, F. (2016). Authoritative School Climate and High School Student Risk Behavior: A Cross-sectional Multi-level Analysis of Student Self-Reports. *Journal of Youth and Adolescence*, *45*(11), 2246–2259. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed17&NEWS=N&AN=620870492

Costello, M. J. E., Leatherdale, S. T., Ahmed, R., Church, D. L., & Cunningham, J. A. (2012). Co-morbid substance use behaviors among youth: any impact of school environment? *Global Health Promotion*, *19*(1) 50–59. https://doi.org/http://dx.doi.org/10.1177/1757975911429873

Dever, B. v, Schulenberg, J. E., Dworkin, J. B., O'Malley, P. M., Kloska, D. D., & Bachman, J. G. (2012). Predicting Risk-Taking With and Without Substance Use: The Effects of Parental Monitoring, School Bonding, and Sports Participation. *Prevention Science*, *13*(6), 605–615. https://doi.org/http://dx.doi.org/10.1007/s11121-012-0288-z

Dudovitz, R. N., Chung, P. J., Reber, S., Kennedy, D., Tucker, J. S., Shoptaw, S., Dosanjh, K. K., & Wong, M. D. (2018). Assessment of Exposure to High-Performing Schools and Risk of Adolescent Substance Use: A Natural Experiment. *JAMA Pediatrics*, *172*(12), 1135–1144. https://doi.org/10.1001/jamapediatrics.2018.3074

Eitle, D., Thorsen, M., & Eitle, T. M. (2017). School context and American Indian substance use. In *Social Science Journal* (Vol. 54, Issue 4, pp. 420–429). https://doi.org/10.1016/j.soscij.2017.07.001

Evans-Whipp, T. J., Plenty, S. M., Catalano, R. F., Herrenkohl, T. I., & Toumbourou, J. W. (2015). Longitudinal effects of school drug policies on student marijuana use in Washington state and Victoria, Australia. *American Journal of Public Health*. https://doi.org/10.2105/AJPH.2014.302421

Fallu, J.-S., Brière, F. N., & Janosz, M. (2014). Latent classes of substance use in adolescent cannabis users: Predictors and subsequent substance-related harm. *Frontiers in Psychiatry*, *5*(FEB), Article 9. https://doi.org/http://dx.doi.org/10.3389/fpsyt.2014.00009

Farhat, T., & Simons-Morton, B. (2011). Psychosocial correlates of adolescent marijuana use: Variations by status of marijuana use. *Addictive Behaviors*, *36*(4), 404–407. https://doi.org/http://dx.doi.org/10.1016/j.addbeh.2010.11.017

Fergusson, D. M., & Boden, J. M. (2008). Cannabis use and later life outcomes. *Addiction*, *103*(6), 969–976. https://doi.org/10.1111/j.1360-0443.2008.02221.x

Fisher, S., Zapolski, T., Al-Uqdah, S., Stevens-Watkins, D., Arsenault, C., & Barnes-Najor, J. (2019). Person–Environment Fit, Substance Use Attitudes, and Early Adolescent Substance Use. In *Substance Use and Misuse* (Vol. 54, Issue 4, pp. 628–638). https://doi.org/10.1080/10826084.2018.1531426

Gaete, J., & Araya, R. (2017). Individual and contextual factors associated with tobacco, alcohol, and cannabis use among Chilean adolescents: A multilevel study. *Journal of Adolescence*, *56*, 166–178. https://doi.org/10.1016/j.adolescence.2017.02.011

Gaete, J., Tornero, B., Valenzuela, D., Rojas-Barahona, C. A., Salmivalli, C., Valenzuela, E., & Araya, R. (2017). Substance Use among Adolescents Involved in Bullying: A Cross-Sectional Multilevel Study. *Frontiers in Psychology*, *8*, 1056. https://doi.org/10.3389/fpsyg.2017.01056

Gohari, M. R., Cook, R. J., Dubin, J. A., & Leatherdale, S. T. (2021). The impact of an alcohol policy change on developmental trajectories of youth alcohol use: examination of a natural experiment in Canada. *Canadian Journal of Public Health*, *112*(2), 210–218. https://doi.org/10.17269/s41997-020-00366-7

Goings, T. C., Salas-Wright, C. P., Howard, M. O., & Vaughn, M. G. (2018). Substance use among bi/multiracial youth in the United States: Profiles of psychosocial risk and protection. *American Journal of Drug and Alcohol Abuse*, *44*(2), 206–214. https://doi.org/http://dx.doi.org/10.1080/00952990.2017.1359617

Green, L. W., Richard, L., & Potvin, L. (1996). Ecological foundations of health promotion. In *American Journal of Health Promotion*. https://doi.org/10.4278/0890-1171-10.4.270

Hall, W., & Degenhardt, L. (2007). Prevalence and correlates of cannabis use in developed and developing countries. In *Current Opinion in Psychiatry*. https://doi.org/10.1097/YCO.0b013e32812144cc

Hamilton, H. A., Danielson, A. M., Mann, R. E., & Paglia-Boak, A. (2012). The roles of family, peer, school, and attitudinal factors in cannabis use across immigrant generations of youth. In *Journal of Drug Issues* (Vol. 42, Issue 1, pp. 46–58). https://doi.org/10.1177/0022042612436652

Hasin, D. S., Sarvet, A. L., Cerdá, M., Keyes, K. M., Stohl, M., Galea, S., & Wall, M. M. (2017). US Adult Illicit Cannabis Use, Cannabis Use Disorder, and Medical Marijuana Laws: 1991-1992 to 2012-2013. *JAMA Psychiatry*, *74*(6), 579–588. https://doi.org/10.1001/jamapsychiatry.2017.0724

Heck, N. C., Livingston, N. A., Flentje, A., Oost, K., Stewart, B. T., & Cochran, B. N. (2014). Reducing risk for illicit drug use and prescription drug misuse: High school gay-straight alliances and lesbian, gay, bisexual, and transgender youth. *Addictive Behaviors*, *39*(4), 824–828. https://doi.org/10.1016/j.addbeh.2014.01.007

Hengartner, M. P., Angst, J., Ajdacic-Gross, V., & Rössler, W. (2020). Cannabis use during adolescence and the occurrence of depression, suicidality and anxiety disorder across adulthood: Findings from a longitudinal cohort study over 30 years. *Journal of Affective Disorders*. https://doi.org/10.1016/j.jad.2020.03.126

Hill, D., & Mrug, S. (2015). School-Level Correlates of Adolescent Tobacco, Alcohol, and Marijuana Use. *Substance Use & Misuse*, *50*(12), 1518–1528. https://doi.org/10.3109/10826084.2015.1023449

Hodder, R., Freund, M., Bowman, J., Wolfenden, L., Gillham, K., & Dray, J. (2016). Association between adolescent tobacco, alcohol and illicit drug use and individual and environmental resilience protective factors. *BMJ Open*, *6*(11), e012688. https://doi.org/http://dx.doi.org/10.1136/bmjopen-2016-012688

Hoff, D. A., Andersen, A., & Holstein, B. E. (2010). Poor school satisfaction and number of cannabis using peers within school classes as individual risk factors for cannabis use among adolescents. *School Psychology International* (Vol. 31, Issue 5, pp. 547–556). https://doi.org/10.1177/0143034310382870

Jovic, S., Genolini, C., Delpierre, C., Spilka, S., Ehlinger, V., Rose, J., Arnaud, C., & Godeau, E. (2014). Socialization instances linked to cannabis experimentation among French teenagers. *Substance Use & Misuse*, *49*(13), 1808–1819. https://doi.org/http://dx.doi.org/10.3109/10826084.2014.925583

Kilmer, J. R., Hunt, S. B., Lee, C. M., & Neighbors, C. (2007). Marijuana use, risk perception, and consequences: Is perceived risk congruent with reality? *Addictive Behaviors*, *32*(12), 3026–3033. https://doi.org/10.1016/j.addbeh.2007.07.009

King, K. A., Vidourek, R. A., Merianos, A. L., & Bartsch, L. A. (2015). Predictors of Recent Marijuana Use and Past Year Marijuana Use Among a National Sample of Hispanic Youth. *Substance Use & Misuse*, *50*(11), 1395–1405. https://doi.org/http://dx.doi.org/10.3109/10826084.2015.1013136

Kuntsche, E. (2010). When cannabis is available and visible at school A multilevel analysis of students' cannabis use. In *Drugs: Education, Prevention and Policy* (Vol. 17, Issue 6, pp. 681–688). https://doi.org/10.3109/09687630902785356

Leatherdale, S. T., Brown, K. S., Carson, V., Childs, R. A., Dubin, J. A., Elliott, S. J., Faulkner, G., Hammond, D., Manske, S., Sabiston, C. M., Laxer, R. E., Bredin, C., & Thompson-Haile, A. (2014). The COMPASS study: A longitudinal hierarchical research platform for evaluating natural experiments related to changes in school-level programs, policies and built environment resources. *BMC Public Health*, *14*(1), 331. https://doi.org/10.1186/1471-2458-14-331

Leatherdale, S. T., & Strath, J. M. (2007). Tobacco retailer density surrounding schools and cigarette access behaviors among underage smoking students. *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, *33*(1), 105–111. https://doi.org/10.1207/s15324796abm3301_12

Lee, A. (2002). Helping schools to promote healthy educational environments as new initiatives for school based management: the Hong Kong Healthy Schools Award Scheme. In *Promotion & education*. https://doi.org/10.1177/10253823020090010114

Lee, A. (2009). Health-promoting schools: Evidence for a holistic approach to promoting health and improving health literacy. In *Applied Health Economics and Health Policy*. https://doi.org/10.2165/00148365-200907010-00002

Lee, J., Choi, M. J., Thornberg, R., & Hong, J. S. (2020). Exploring Sex Differences in the Association between Bullying Involvement and Alcohol and Marijuana Use among U.S. Adolescents in 6th to 10th Grade. *Substance Use and Misuse*, *55*(8), 1203–1213. https://doi.org/10.1080/10826084.2020.1725054

Lee, J., Hong, J. S., Resko, S. M., & Tripodi, S. J. (2018). Face-to-Face Bullying, Cyberbullying, and Multiple Forms of Substance Use Among School-Age Adolescents in the USA. In *School Mental Health* (Vol. 10, Issue 1, pp. 12–25). https://doi.org/10.1007/s12310-017-9231-6

Leos-toro, C., Rynard, V., Murnaghan, D., Macdonald, J., & Hammond, D. (2019). Trends in cannabis use over time among Canadian youth : 2004 – 2014. *Preventive Medicine*, *118*(April 2018), 30–37. https://doi.org/10.1016/j.ypmed.2018.10.002

Magier, M., Patte, K. A., Battista, K., Cole, A. G., & Leatherdale, S. T. (2020). Are school substance use policy violation disciplinary consequences associated with student engagement in cannabis? *International Journal of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph17155549

Maynard, B. R., Salas-Wright, C. P., Vaughn, M. G., & Peters, K. E. (2012). Who are truant youth? Examining distinctive profiles of truant youth using latent profile analysis. *Journal of Youth and Adolescence*, *41*(12), 1671–1684. https://doi.org/10.1007/s10964-012-9788-1

Mechoulam, R., & Parker, L. A. (2013). The Endocannabinoid System and the Brain. *Annual Review of Psychology*, *64*(1), 21–47. https://doi.org/10.1146/annurev-psych-113011-143739

Moore, G. F., Cox, R., Evans, R. E., Hallingberg, B., Hawkins, J., Littlecott, H. J., … Murphy, S. (2018). School, Peer and Family Relationships and Adolescent Substance Use, Subjective Wellbeing and Mental Health Symptoms in Wales: a Cross Sectional Study. Child Indicators Research, 11(6), 1951–1965. https://doi.org/10.1007/s12187-017-9524-1

Mrug, S., Gaines, J., Su, W., & Windle, M. (2010). School-level substance use: Effects on early adolescents' alcohol, tobacco, and marijuana use. *Journal of Studies on Alcohol and Drugs*, *71*(4), 488–495. https://doi.org/10.15288/jsad.2010.71.488

Nargiso, J. E., Ballard, E. L., & Skeer, M. R. (2015). A systematic review of risk and protective factors associated with nonmedical use of prescription drugs among youth in the united states: A social ecological perspective. *Journal of Studies on Alcohol and Drugs*. https://doi.org/10.15288/jsad.2015.76.5

Paez, A. (2017). Grey literature: An important resource in systematic reviews. *Journal of Evidence-Based Medicine*. https://doi.org/10.1111/jebm.12265

Parsons, C., Stears, D., & Thomas, C. (1996). The health promoting school in europe: Conceptualising and evaluating the change. *Health Education Journal*. https://doi.org/10.1177/001789699605500306

Paschall, M. J., & Grube, J. W. (2020). Recreational Marijuana Availability in Oregon and Use Among Adolescents. *American Journal of Preventive Medicine*, *58*(2), e63–e69. https://doi.org/10.1016/j.amepre.2019.09.020

Pavic Simetin, I., Kern, J., Kuzman, M., & Pförtner, T.-K. (2013). Inequalities in Croatian pupils' risk behaviors associated to socioeconomic environment at school and area level: a multilevel approach. *Social Science & Medicine (1982)*, *98*, 154–161. https://doi.org/10.1016/j.socscimed.2013.09.021

Peltzer, K., & Pengpid, S. (2019). Cannabis and amphetamine use and socio-ecological (proximal and distal) factors among school-going adolescents in four countries in the Caribbean and four countries in South America. *International Journal of Adolescent Medicine and Health*. https://doi.org/http://dx.doi.org/10.1515/ijamh-2018-0030

Pham, M. T., Rajić, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A., & Mcewen, S. A. (2014). A scoping review of scoping reviews: Advancing the approach and enhancing the consistency. *Research Synthesis Methods*. https://doi.org/10.1002/jrsm.1123

Roditis, M. L., Delucchi, K., Chang, A., & Halpern-Felsher, B. (2016). Perceptions of social norms and exposure to pro-marijuana messages are associated with adolescent marijuana use. *Preventive Medicine*, *93*, 171–176. https://doi.org/10.1016/j.ypmed.2016.10.013

Romano, I., Williams, G., Butler, A., Aleyan, S., Patte, K. A., & Leatherdale, S. T. (2019). Psychological and Behavioural Correlates of Cannabis use among Canadian Secondary School Students: Findings from the COMPASS Study. *Canadian Journal of Addiction*. https://doi.org/10.1097/CXA.0000000000000058

Rudolph, K. E., Sofrygin, O., Schmidt, N. M., Crowder, R., Glymour, M. M., Ahern, J., & Osypuk, T. L. (2018). Mediation of neighborhood effects on adolescent substance use by the school and peer environments. *Epidemiology*, *29*(4), 590–598. https://doi.org/http://dx.doi.org/10.1097/EDE.0000000000000832

Sznitman, S. R., & Romer, D. (2014). Student drug testing and positive school climates: testing the relation between two school characteristics and drug use behavior in a longitudinal study. *Journal of Studies on Alcohol and Drugs*, *75*(1), 65–73. https://doi.org/10.15288/jsad.2014.75.65

Terzic Supic, Z., Santric Milicevic, M., Sbutega, I., & Vasic, V. (2013). The importance of family relations for cannabis users: the case of serbian adolescents. *Iranian Journal of Public Health*, *42*(3), 249–260.

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. In *Annals of Internal Medicine*. https://doi.org/10.7326/M18-0850

Vaughan, E. L., Kratz, L., & d'Argent, J. (2011). Academics and substance use among Latino adolescents: Results from a national study. *Journal of Ethnicity in Substance Abuse*, *10*(2), 147–161. https://doi.org/http://dx.doi.org/10.1080/15332640.2011.573315

Volkow, N. D., Baler, R. D., Compton, W. M., & Weiss, S. R. B. (2014). Adverse Health Effects of Marijuana Use. *New England Journal of Medicine*, *370*(23), 2219–2227. https://doi.org/10.1056/NEJMra1402309

Weatherson, K. A., O'Neill, M., Lau, E. Y., Qian, W., Leatherdale, S. T., & Faulkner, G. E. J. (2018). The Protective Effects of School Connectedness on Substance Use and Physical Activity. In *Journal of Adolescent Health* (Vol. 63, Issue 6, pp. 724–731). https://doi.org/10.1016/j.jadohealth.2018.07.002

Winters, K. C., & Lee, C. Y. S. (2008). Likelihood of developing an alcohol and cannabis use disorder during youth: Association with recent use and age. *Drug and Alcohol Dependence*, *92*(1–3), 239–247. https://doi.org/10.1016/j.drugalcdep.2007.08.005

World Health Organization. (2021). *Cannabis*. https://www.who.int/teams/mental-health-and-substance-use/alcohol-drugs-and-addictive-behaviours/drugs-psychoactive/cannabis

World Health Organisation. (2016). The health and social effects of nonmedical cannabis use. *Who*.

Wormington, S. V, Anderson, K. G., Tomlinson, K. L., & Brown, S. A. (2013). Alcohol and Other Drug Use in Middle School: The Interplay of Gender, Peer Victimization, and Supportive Social Relationships. *The Journal of Early Adolescence*, *33*(5), 610–634. https://doi.org/10.1177/0272431612453650

Zhang, L., Finan, L. J., Bersamin, M., Fisher, D. A., & Paschall, M. J. (2020). Sexual Orientation–Based Alcohol, Tobacco, and Other Drug Use Disparities: The Protective Role

of School-Based Health Centers. In *Youth and Society* (Vol. 52, Issue 7, pp. 1153–1173). https://doi.org/10.1177/0044118X19851892

Zhen-Duan, J., Taylor, M. J., & J., Z.-D. (2014). The use of an ecodevelopmental approach to examining substance use among rural and urban latino/a youth: Peer, parental, and school influences. *Journal of Ethnicity in Substance Abuse*, *13*(2), 104–125. https://doi.org/http://dx.doi.org/10.1080/15332640.2013.873006

Zuckermann, A. M. E., Battista, K., Belanger, R. E., Haddad, S., Butler, A., Costello, M. J. E., & ST., L. (2021). Trends in youth cannabis use across cannabis legalization: Data from the COMPASS prospective cohort study. *Preventive Medicine Reports*, *22*.

Zuckermann, A. M. E., Battista, K., de Groh, M., Jiang, Y., & Leatherdale, S. T. (2019). Prelegalisation patterns and trends of cannabis use among Canadian youth: Results from the COMPASS prospective cohort study. *BMJ Open*. https://doi.org/10.1136/bmjopen-2018-026515

Zuckermann, A. M. E., Gohari, M. R., de Groh, M., Jiang, Y., & Leatherdale, S. T. (2020). The role of school characteristics in pre-legalization cannabis use change among Canadian youth: implications for policy and harm reduction. *Health Education Research*. https://doi.org/10.1093/her/cyaa018

Declaration of interests

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

Highlights

- 4 levels of influence of cannabis use at school were identified in the literature
- Schools predispose youth to both risk and protective environments
- Few studies examined school-specific factors of student cannabis use
- Influences of cannabis use may be unique to student populations/school environments