Severe vaping-related illness and injury

CPSP
CANADIAN PAEDIATRIC SURVEILLANCE PROGRAM

PROTOCOL

Principal investigator

Nicholas Chadi, MD, MPH, Assistant Professor of Paediatrics, Division of Adolescent Medicine, Department of Paediatrics, CHU Sainte-Justine, 3175 chemin de la Côte-Sainte-Catherine, Montreal QC H3T 1C5; nicholas.chadi@umontreal.ca

Co-investigators

Melissa Baker, PhD, Vaping Surveillance, Public Health Agency of Canada

Richard Bélanger, MD, Adolescent Medicine, CHU de Québec

Suzanne Beno, MD, Paediatric Emergency Medicine, The Hospital for Sick Children

Daniel Brody, MD, Paediatric Emergency Medicine, McGill University

Minh Do, PhD, Carleton University and University of Toronto

Camille Fournier, MD, Adolescent Medicine, Université de Sherbrooke

Christina Grant, MD, Adolescent Medicine, McMaster University

Karen Leslie, MD, Adolescent Medicine, The Hospital for Sick Children

Charlotte Moore Hepburn, MD, MP, Paediatric Medicine, The Hospital for Sick Children

Ian Pike, PhD, BC Injury Research and Prevention Unit

Sarah Richmond, PhD, MSc, Dalla Lana School of Public Health, University of Toronto

Sze Man Tse, MD, MPH, Paediatric Respirologist, Clinician-scientist, CHU Sainte-Justine and Université de Montréal

Trisha Tulloch, MD, Adolescent Medicine, The Centre for Addiction and Mental Health

Ellie Vyver, MD, Adolescent Medicine, Alberta Children's Hospital

Zofia Zysman-Colman, MD, Respiratory Medicine, CHU Sainte-Justine

Collaborators

Gordon Barrett, Consumer and Hazardous Products Safety, Health Canada

Lisa Belzak, Vaping Surveillance, Public Health Agency of Canada

James Hardy, Triage and Surveillance, Health Canada

Steven McFaull, Behaviours, Environments and Lifespan, Public Health Agency of Canada

Trevor Mischki, Tobacco Control, Health Canada

Wendy Thompson, Behaviours, Environments and Lifespan, Public Health Agency of Canada

CPSP
CANADIAN PAEDIATRIC SURVEILLANCE PROGRAM

PROTOCOL

Background

In less than a decade, the use of electronic cigarettes and similar devices (hereafter referred to as vaping devices) has increased dramatically among Canadian youth. According to the latest available data from the 2019 Ontario Student Health and Drug Use Survey, 23% of students in grades 7 to 12 used a vaping device in the past year (up from 11% in 2017) and 8% are daily users.[3] This survey also reveals that vaping is much more common than cigarette smoking among high school students, with 33% of grade 12 students vaping versus 10% who are smoking cigarettes.[3] In addition, the 2019 Canadian Tobacco and Nicotine Survey suggested that 15% of 15 to 19 year old youth used a vaping device in the past 30 days. These results are similar to rates seen in youth 20 to 24 years of age, but five times higher than what is seen among adults aged 25 years and above.[2]

While vaping devices were initially proposed as a smoking cessation and harm reduction strategy for cigarette smokers, they are now more popular among youth (most of whom are non-smokers or have never smoked) than among older adults.[4] Although the long-term impact of vaping is an area of active investigation, emerging literature suggests that first- and second-hand vaping aerosolization is associated with several short- and medium-term health risks,[5,6] including the following: nicotine and cannabis dependence;[7] increased risk of tobacco,[8] marijuana,[9] and other substances use;[10] impacts on brain development;[11] and exposure to a high number of toxic and potentially toxic substances.[12] Vaping is increasingly recognized as an important threat to child and adolescent health.[13] Since the effects of these products are not subject to rigorous study before widespread sale, and the labelling of the contents of vaping products are not strictly regulated, these products have the potential to harm youth in significant and unpredictable ways. Nowhere has this been more evident than during the recent outbreak of vaping product use-associated lung injuries (VALI).[14]

In 2015, a Canadian Paediatric Surveillance Program (CPSP) survey revealed 30 cases of vaping-related inhalation injuries and five cases of vaping product ingestions requiring medical attention.[15] In a second CPSP survey conducted in 2019, 88 cases of medically treated vaping-related injuries were reported resulting from inhalation, product ingestion, or from malfunction of the device. Among the 88 cases, there were 45 respiratory and/or head and neck injuries, nine cases of acute gastrointestinal symptoms, 15 cases of nicotine toxicity (with symptoms other than nausea and vomiting), and nine cases of altered mental status or central nervous system depression. There were 22 cases that required hospitalization and 13 that required observation or treatment in an intensive care unit.

While these two surveys provided important preliminary insights on the demographic and clinical characteristics of vaping-related illness and injury in Canadian children and youth, the nature of the one-time surveys left questions unanswered. A longitudinal CPSP surveillance study will provide more detailed case-level information on things such as: risk factors; patterns and trends related to cause, burden, and outcome of vaping-related illness and injury; the products themselves; and associated comorbidities.

CPSP
CANADIAN PAEDIATRIC SURVEILLANCE PROGRAM

Data from this study will be used to help inform strategies designed to protect children and adolescents from the negative health impacts of vaping products. Study results can further educate paediatricians and other health care providers who can then use the information with their patients. In addition, this study will provide timely information that has the potential to influence policy and regulations specific to vaping products as well as public health messaging around vaping.

Methods

Through the established methodology of the CPSP, nearly 2,800 paediatricians and paediatric subspecialists will be surveyed on a monthly basis for all new cases of vaping-related illness and injury requiring medical attention associated with the routine use or malfunction of a vaping device as well ingestion of vaping substances. Physicians who report a case will be asked to complete a detailed clinical questionnaire seeking non-nominal, case-level data.

PROTOCOL

Case definition

Report any patient less than 18 years of age (up to 18th birthday) requiring emergency department care, hospitalization, or admission to an intensive care unit (ICU) due to an illness or injury associated with any of the following:

1. Inhalation of aerosol from a vaping device (e.g., acute pulmonary injury, serious gastrointestinal symptoms, central nervous system activation/depression, acute nicotine toxicity or withdrawal)
2. Malfunction of a vaping device (e.g., burn, trauma to the eye, hand, and/or face)
3. Ingestion of a vaping substance (e.g., e-liquid with or without nicotine and/or flavours, tetrahydrocannabinol [THC] oil, hash oil)

Exposure to vaping devices/products/substances may be either **intentional** or **unintentional** and includes both primary (i.e., direct use/inhalation) and/or secondary exposures (i.e., exposure to another person's vaping aerosol or injury caused by another person using a vaping device).

Vaping devices include any type of electronic cigarette or similar device that aerosolizes a solid or liquid substance (vaping substance) which may contain some or all of the following: nicotine, cannabis, flavouring agents, and other chemicals.

Objectives

1) Capture the minimum incidence of children and youth with vaping-related injury and illness requiring emergency department care, hospitalization, or admission to an ICU in Canada

2) Describe the demographic characteristics, clinical presentations (i.e., types of injuries or illnesses), treatment courses, and clinical outcomes of children and youth with severe vaping-related illness or injury

3) Identify common risk factors, patterns of illness/injury, and vaping product characteristics that could inform future research and policy/legislation aiming

to improve the prevention and treatment of severe-vaping related illness and injury among Canadian children and youth

CPSP
CANADIAN PAEDIATRIC SURVEILLANCE PROGRAM

Duration

February 2021 to January 2022

Expected number of cases

While there is currently no data available to support the estimation of the national incidence of vaping-related illness and injury among Canadian youth, based on the results of the two previous CPSP surveys on vaping-related illness and injury and given the steadily increasing rates of electronic cigarette use among youth in the past five years,[2,16] it is anticipated that approximately 100 to 150 cases will meet the case definition during the two-year study period.

PROTOCOL

Study limitations

As with any voluntary reporting surveillance system, it is likely that minimum incidence rates will under-represent the true population incidence. It is also possible that subgroups of children/youth will be missed or under-represented (e.g., youth living in remote areas, homeless youth). Some patients who would meet the case definition may be treated by non-paediatricians, and thus will not be reported and included in the study sample.

In addition, case-level surveillance data will be extracted retrospectively from patient charts following a clinical encounter. Data elements not collected as part of routine care may be absent from the surveillance totals. To help reduce the amount of missing data, survey respondents will be asked for their permission to be contacted to provide clarification on survey responses that were left unanswered.

Nonetheless, surveillance serves an important purpose by providing rich clinical data to support a better understanding of circumstances and patterns associated with vaping-related illness and injury.

Ethical approval

- Health Canada and the Public Health Agency of Canada Research Ethics Board
- CHU Sainte-Justine's Research Ethics Board

Analysis and publication

Data will be analyzed quantitatively using statistical software (SPSS or Stata) under the guidance of a biostatistician. Analyses will include descriptive statistics, regression analyses, as well as t-test, ANOVA, or equivalent non-parametric analyses (e.g., Mann-Whitney).

Study results will inform paediatricians, researchers, health care providers, decision makers, youth, and families about risk factors and characteristics of vaping-related illness/injury and harms. Results will be submitted for publication in high-impact, peer-reviewed paediatric and/or public health journals. Data will also be integrated into educational material for health care providers, public

health practitioners, and families. In addition, the data may help inform the upcoming Canadian Paediatric Society policy statement on youth vaping. Study results will be communicated to paediatricians in Canada through the Canadian Paediatric Society. Key results will inform preventive messaging for paediatricians and other health care professionals to use with youth and families. The study team will also work with the Canadian Paediatric Society's media and communications team to share key results through French and English media outlets.

With the support of the Canadian Paediatric Society, the study team will work with local/provincial public health agencies (e.g., *Institut national de santé publique du Québec*, Public Health Ontario) to create tailored knowledge products that will be shared directly with public health practitioners working in injury prevention and tobacco control. Furthermore, the study team has established partnerships with the Canadian Cancer Society and the *Conseil québécois sur le tabac et la santé* to take part in the dissemination of study findings.

Study results will also be shared with the vaping collaborative group from The Hospital for Sick Children and the Centre for Addiction and Mental Health. This dynamic group will assist in the dissemination of key study results to health care providers and the public across the country as well as with the integration of key findings in screening and clinical assessment tools.

Key results will also be shared with decision makers at the provincial and federal levels to help improve vaping-related policies and regulations.

References

1. Propel Centre for Population Health Impact. *Detailed Tables for the Canadian Student Tobacco, Alcohol and Drugs Survey 2016-17*. Waterloo, ON. 2018.
2. The Daily — Canadian Tobacco and Nicotine Survey, 2019. https://www150.statcan.gc.ca/n1/daily-quotidien/200305/dq200305a-eng.htm. Accessed March 5, 2020.
3. Tara AB, Robert E-M, Mann E, Osduhs HAH. *Detailed Findings from the Ontario Student Drug Use and Health Survey Among Ontario Students*. 2020. www.camh.ca. Accessed March 14, 2020.
4. Canadian Tobacco, Alcohol and Drugs (CTADS) Survey: 2017 detailed tables - Canada.ca. https://www.canada.ca/en/health-canada/services/canadian-tobacco-alcohol-drugs-survey/2017-summary/2017-detailed-tables.html#t9. Accessed March 3, 2020.
5. U.S. Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults: A Report of the Surgeon General*. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2016:298. https://e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Full_Report_non-508.pdf. Accessed June 3, 2018.

6. Chadi N, Belanger RE. Teen vaping: There is no vapour without fire. *Paediatr Child Health*. doi:10.1093/PCH/PXZ137.

7. Breitbarth AK, Morgan J, Jones AL. E-cigarettes—An unintended illicit drug delivery system. *Drug Alcohol Depend*. 2018;192:98-111. doi:10.1016/j.drugalcdep.2018.07.031.

8. Soneji S, Barrington-Trimis JL, Wills TA, et al. Association Between Initial Use of e-Cigarettes and Subsequent Cigarette Smoking Among Adolescents and Young Adults: A Systematic Review and Meta-analysis. *JAMA Pediatr*. 2017;171(8):788-797. doi:10.1001/jamapediatrics.2017.1488.

9. Chadi N, Schroeder R, Jensen JW, Levy S. Association Between Electronic Cigarette Use and Marijuana Use Among Adolescents and Young Adults. *JAMA Pediatr*. August 2019:e192574. doi:10.1001/jamapediatrics.2019.2574.

10. Curran KA, Burk T, Pitt PD, Middleman AB. Trends and Substance Use Associations With E-Cigarette Use in US Adolescents. *Clin Pediatr (Phila)*. April 2018:000992281876940. doi:10.1177/0009922818769405.

11. The Society for Adolescent Health and Medicine. Protecting Youth From the Risks of Electronic Cigarettes. *J Adolesc Heal*. 2020;66(1):127-131. doi:10.1016/j.jadohealth.2019.10.007.

12. National Academies of Sciences Engineering and Medicine. *Public Health Consequences of E-Cigarettes*. Washington D.C. 2018. http://nationalacademies.org/hmd/Reports/2018/public-health-consequences-of-e-cigarettes.aspx. Accessed June 2, 2018.

13. Adams J. *Surgeon General's Advisory on E-Cigarette Use Among Youth The E-Cigarette Epidemic Among Youth*. 2018. doi:10.17226/24952.

14. Perrine CG, Pickens CM, Boehmer TK, et al. Characteristics of a Multistate Outbreak of Lung Injury Associated with E-cigarette Use, or Vaping - United States, 2019. *MMWR Morb Mortal Wkly Rep*. 2019;68(39):860-864. doi:10.15585/mmwr.mm6839e1.

15. Richmond SA, Pike I, Maguire JL, Macpherson A. E-cigarettes: A new hazard for children and adolescents. *Paediatr Child Health*. 2018;23(4):255-259. doi:10.1093/pch/pxx204.

16. Hammond D, Reid JL, Rynard VL, et al. Prevalence of vaping and smoking among adolescents in Canada, England, and the United States: repeat national cross sectional surveys. *BMJ*. 2019;365:l2219. doi:10.1136/bmj.l2219.