Adapting the COMPASS prospective cohort in real time
to understand the impact of the COVID-19 pandemic
on youth health in the early and ongoing pandemic period

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Acknowledgements

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Leadership Team
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**Background**

*Figure 4.1* Proportion of deaths due to cancer and other causes, Canada, 2016

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Cancer</td>
<td>29.6%</td>
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<tr>
<td>Heart disease</td>
<td>19.2%</td>
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<tr>
<td>Other</td>
<td>26.7%</td>
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<tr>
<td>Liver disease</td>
<td>1.3%</td>
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<tr>
<td>Suicide</td>
<td>1.5%</td>
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<tr>
<td>Influenza and pneumonia</td>
<td>2.3%</td>
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<tr>
<td>Alzheimer’s disease</td>
<td>2.4%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.6%</td>
</tr>
<tr>
<td>Chronic lower respiratory diseases</td>
<td>4.6%</td>
</tr>
<tr>
<td>Accidents</td>
<td>4.7%</td>
</tr>
<tr>
<td>Cerebrovascular diseases</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

*Note:* The total of all deaths in 2016 in Canada was 267,213.

*Data source:* Canadian Vital Statistics Death Database at Statistics Canada; Deaths and age-specific mortality rates, by selected grouped causes, [Table 13-10-0392-01](#).
Over 60% of cancer deaths are potentially preventable (modifiable risk behaviours typically established during adolescence)

Figure 2: Causes of Cancer Deaths in Developed Countries
Source: Adapted from Adami et al., 2001 and Colditz et al., 1996
Within the Canadian context (and likely the same in the US), we know that variations in school and community characteristics surrounding youth are independently associated with their risk factor profile:

- **marijuana use** [Costello, Leatherdale, Ahmed et al., 2012],
- **smoking** [Leatherdale, McDonald, Cameron et al., 2005],
- **alcohol use** [Heircui, Laxer, Cole & Leatherdale, 2013],
- **vaping** [Cole, Aleyan & Leatherdale, 2019],
- **eating behaviour** [Leatherdale, Stefanczyk, Kirkpatrick, 2016],
- **obesity** [Leatherdale & Papadakis, 2011],
- **physical activity** [Hobin, Leatherdale, Manske et al., 2013],
- **sedentary behaviour** [Leatherdale, Faulkner & Arbour-Nicitopoulos, 2010],
Even PRIOR to COVID-19 within the Canadian context…..

• Timely and accessible longitudinal data on youth populations were not readily available.

• Comprehensive inventories of important school and community characteristics (programs, policies, built environment resources) impacting youth were not systematically collected and/or linked to student data.

• As a result, we know very little about how real-world changes to programs, policies or built environment resources actually impact youth over time. (natural experiments)
The Vision for COMPASS

• To create a **learning system** designed to:

1. Collect population-level longitudinal data from students as they progress through high school (grades 9 to 12)

2. Evaluate the impact of ongoing real-world **natural experiments** as **programs, policies, and/or built environment resources** in schools, communities or provinces change over time

3. Share the emerging practice-based evidence with relevant stakeholders in real-time, and

4. Share the available data with researchers outside of our research team.

Leatherdale, 2016
The COMPASS Study

• The COMPASS study (2012-2028) is a prospective cohort study designed to collect hierarchical longitudinal data from a sample of 160+ secondary schools and the 75,000+ grade 9 to 12 students attending those schools.

Leatherdale et al., 2014

• Active-information passive consent procedures
  – Active assent for students

• Convenience sample of schools
The COMPASS Study

- The COMPASS study (2012-2022) is a prospective cohort study designed to collect hierarchical longitudinal data from a sample of 160+ secondary schools and the 75,000+ grade 9 to 12 students attending those schools.

- Ontario
- Quebec
- Alberta
- British Columbia
- Nunavut
Measures / Data

• Longitudinal data are collected annually at both:

1. Student-level
   • COMPASS Student Questionnaire (Cq)

2. School-level
   • COMPASS School Programs and Policies Questionnaire (SPP),
   • COMPASS School Environment Application (Co-SEA),
   • COMPASS Built Environment Data (C-BED)
PRE-COVID Student Questionnaire (Cq)

• Scantron paper-based questionnaire designed to facilitate multiple large-scale in-person school-based data collections.

• The Cq collects individual student data pertaining to:
  – tobacco use, e-cigarettes (vaping), alcohol use, marijuana use, opioid use
  – obesity (height and weight to calculate body mass index [BMI]), weight perceptions
  – physical activity, correlates of physical activity, sedentary behaviours, sleep
  – healthy eating and diet
  – mental health and resilience

  – correlates (e.g., bullying, academic outcomes, school connectedness), and

  – demographic characteristics (e.g., age, gender, income, ethnicity).
Post-COVID Student Questionnaire (Cq)

- Qualtrics online questionnaire designed to facilitate multiple large-scale school-based data collections (in-person or online).

- The Cq also **NOW** collects individual student data pertaining to:
  - impact of COVID on sports/activity participation, sedentary behaviour, sleep
  - impact of COVID on substance use and mental health
  - COVID related attitudes and knowledge
  - Compliance with COVID regulations/restrictions/rules
  - New demographic characteristics (e.g., family affluence scale, experiences with discrimination, sex and gender, ).
  - Disordered eating, weight stigma, psilocybin use
COMPASS School Programs & Policies Questionnaire (SPP)

• Online survey completed by the administrator(s) most knowledgeable about the school program and policy environment.

• For each COMPASS domain, the SPP measures:
  – the presence or absence of relevant programs and/or policies, and
  – changes to school policies, practices, or within school resources.

• Annually provides administrator with what was in place previously to:
  – Assist with recall
  – Provide new administrators with background on the school context

• SPP now also measures COVID-related programs and policies
COMPASS School Environment Application (Co-SEA)

• An direct observation tool completed on a mobile device used to measure the built environment within a school.

Leatherdale, Bredin & Blashill, 2014

• Also has the functionality to take photos and archive photos of the different observations being measured in the audit.
COMPASS School Environment Application (Co-SEA)

- An direct observation tool completed on a mobile device used to measure the built environment within a school. (Leatherdale, Bredin & Blashill, 2014)

- Also has the functionality to take photos and archive photos of the different observations being made.

Co-SEA data no longer collected since in-person data collectors not currently allowed in schools due to COVID restrictions.
COMPASS Built Environment Data (C-BED)

• Data on the built environment surrounding each school
  – CanMap RouteLogistics (CMRL) spatial information database
    • data layers surrounding each school
      e.g. land use, boundary files, and street networks
  – Enhanced Points of Interest (EPOI) data resource
    • type and location of different opportunity structures surrounding each school
      e.g. tobacco retailers, beer stores and LCBO outlets, variety stores, etc.

• Arcview 3.3 software is used to geocode the school addresses and to create the desired buffer distance
  – typically 500m and 1km.
Knowledge Transfer and Exchange (KTE) activities

• Research has identified that providing schools with data on their student population and recommendations for action that are relevant to their school context can help schools advance their own prevention agenda
  
  Leatherdale et al. (2009); Cameron et al. (2007)

• In response we use 3 different KTE approaches in COMPASS
  1. COMPASS School Health Profile (SHP)
  2. COMPASS Knowledge Brokers
  3. COMPASS social media presence (website, YouTube, Twitter)
COMPASS School Health Profile

Physical Activity Outcomes at Anyplace School

Among Students at your school:

- 49% are meeting the National guidelines of 60 min/day of physical activity

RECOMMENDATION:
The Physical Activity and Nutrition Program is designed to improve physical activity levels and nutritional intake. 
http://www.compasshealth.org/

CURRICULUM SUPPLEMENT:
- Online Physical and Health Education program
- www.healtheducation.ca

PUBLIC HEALTH UNIT:
- Lora Donnell, Health Nurse
  - P: (519) 555-5555
  - E: ldonnell@health.ca

Healthy Eating Outcomes at Anyplace School

Among Students at your school:

- 60% eat the recommended 4 servings of vegetables per day
- 14% eat the recommended 2 servings of fruits per day
- 56% eat the recommended 2-3 servings of dairy products per day
- 18% eat the recommended 6 servings of grains per day
- 24% eat the recommended 6-7 servings of grains per day
- 71% eat the recommended 2 servings of lean meats per day
- 50% buy their lunch at school at least once per week
- 16% buy school lunch meals at least once per week

RECOMMENDATION:
- 2 nutrition camp sessions per year
- www.compasshealth.ca

CURRICULUM SUPPLEMENT:
- www.healtheducation.ca

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  - E: ldonnell@health.ca

Obesity Outcomes at Anyplace School

Among Students at your school:

- 68% are of healthy weight
- 54% don’t smoke

RECOMMENDATION:
- 8 nutrition camp sessions per year
- www.compasshealth.ca

CURRICULUM SUPPLEMENT:
- www.healtheducation.ca

PUBLIC HEALTH UNIT:
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  - P: (519) 555-5555
  - E: ldonnell@health.ca

Alcohol Use Outcomes at Anyplace School

Among Students at your school:

- 22% reported binge drinking in the last month
- 25% average

RECOMMENDATION:
- 3 nutrition camp sessions per year
- www.compasshealth.ca

CURRICULUM SUPPLEMENT:
- www.healtheducation.ca

PUBLIC HEALTH UNIT:
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COMPASS KT Videos

https://www.youtube.com/watch?v=3nmjWUiX5fY
WHAT IS COMPASS?

The COMPASS study connects researchers with schools and youth across Ontario to identify important youth health issues and understand how school programs, policies, or resources help and hinder health outcomes for Ontario youth.

COMPASS offers multi-level, multi-year, comprehensive research, paired with knowledge exchange and strategic health partnerships to help turn knowledge into action and action into positive results for youth, like no study has done before. COMPASS is dedicated to working with participating schools for four years to find the best ways of improving youth health behaviours and student academic outcomes.

DID YOU KNOW?

IN CANADA, 31% OF BOYS AND 25% OF GIRLS AGED 15-19 WERE CLASSIFIED AS OVERWEIGHT/ OBSESE.

(2007-2009 CFNS)

For the first time, children are poised to have shorter lifespans than their parents.

(2005-2009 NHIS)
Evaluating the impact of COVID-19 on youth substance use and mental health as a natural experiment
What is a natural experiment?

- A natural experiment is when a particular intervention has been implemented but the circumstances surrounding the implementation are not under the control of researchers.

- Two additional features often associated with natural experiments are:
  1. the implementation of the intervention is not dependent on whether or not there is a plan to evaluate the intervention, and
  2. random allocation of the intervention is not feasible for ethical, political or other reasons.

COVID-19 related restrictions and regulations!!!
Pre-post COVID study design

- Natural experimental studies can be either:
  - an experimental design (intervention and control groups), or
  - a non-experimental design (no control group).
    - COVID-19 does not allow for unexposed control groups.

- However, we can still use an interrupted time series non-experimental design

  ![Diagram of study design]

- Our repeat cross-sectional data can examine overall trends in outcomes, and our sequential cohort longitudinal data can examine the differential changes in outcomes among students across the onset and progression of the COVID-19 pandemic.
## Pre-post COVID study sample in 2020

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2020</th>
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<tbody>
<tr>
<td>Sept</td>
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<td>Dec</td>
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<td>Jan</td>
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<td>Scantron In-person DC (n=\sim35,000 students)</td>
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<td>Feb</td>
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<td>Mar</td>
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<td>Qualtrics Online DC (n=\sim9,000)</td>
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<td>Apr</td>
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<td>May</td>
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- While the immediate COVID-19 pandemic response period sample in 2020 may seem small….
  - Still have data from \sim9,000 respondents
  - 1st wave collected immediately after shut down
  - Shows buy-in we had from COMPASS schools
Trends in Cannabis Use

Cannabis use frequency among students participating in the COMPASS Study (2015-16 to 2019-20)

Over time:
- 19.4% increase in never users
- 38.0% decrease in occasional users
- 51.8% decrease in current users

Leatherdale, 2021
<table>
<thead>
<tr>
<th>Wave</th>
<th>N</th>
<th>Observed Mean (SD)</th>
<th>Adjusted Estimate&lt;sup&gt;a&lt;/sup&gt; Mean (95% CI)</th>
<th>Weekly Use</th>
<th>Adjusted Estimate&lt;sup&gt;a&lt;/sup&gt; Mean (95% CI)</th>
<th>Daily Use</th>
<th>Adjusted Estimate&lt;sup&gt;a&lt;/sup&gt; Mean (95% CI)</th>
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<tr>
<td></td>
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<td>Observed</td>
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<td>Mean (SD)</td>
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<td>Adjusted</td>
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<td></td>
<td>Estimate&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>Mean (95% CI)</td>
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<tr>
<td>Observed and Adjusted Outcome Mean</td>
<td>2018</td>
<td>7567</td>
<td>5.7 (0.2)</td>
<td>5.7 (4.9, 6.5)</td>
<td>2.4 (0.2)</td>
<td>0.6 (0.1)</td>
<td>0.6 (0.3, 0.9)</td>
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<tr>
<td></td>
<td>2019</td>
<td>7548</td>
<td>12.1 (0.3)</td>
<td>12.0 (11.0, 12.9)</td>
<td>6.1 (0.2)</td>
<td>1.5 (0.1)</td>
<td>1.4 (1.1, 1.7)</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>1937</td>
<td>7.5 (0.3)</td>
<td>12.6 (10.7, 14.4)</td>
<td>3.9 (0.2)</td>
<td>0.8 (0.1)</td>
<td>1.9 (1.4, 2.5)</td>
</tr>
<tr>
<td>Average Discrete Change&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2019–2018 (pre-COVID-19 period)</td>
<td>6.3 (5.2, 7.4)</td>
<td>4.0 (2.5, 5.4)</td>
<td>0.8 (0.4, 1.2)</td>
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<td></td>
<td>2020–2019 (early COVID-19 period)</td>
<td>0.6 (–1.2, 2.3)</td>
<td>1.0 (–1.5, 3.5)</td>
<td>0.5 (–0.1, 1.0)</td>
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<tr>
<td>Estimated Causal Effect&lt;sup&gt;b&lt;/sup&gt;</td>
<td>(2020-2019 - 2019-2018)</td>
<td>– 5.7 (–8.0, –3.4)</td>
<td>–3.0 (–6.7, 0.8)</td>
<td>–0.3 (–1.1, 0.4)</td>
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Notes: 95% CI (confidence interval)
<sup>a</sup> Fixed effect model with a lagged variable as the outcome, controlling for time-invariant confounders but constraining sex and age effects on the outcome to be fixed across time, and sample selection correction with the predictors of age, sex, weekly spending money, school connectedness, and province.
<sup>b</sup> based on adjusted estimates.
Trends in Vaping

Figure 1a. Vaping frequency among students participating in the COMPASS Study (2015-16 to 2019-20)

Table 2

Adjusted proportions of vaping behaviour over survey waves, discrete change of vaping behaviour over time, and estimated causal effect of the early COVID-19 period on vaping by difference-in-difference among eligible students attending the 43 linked-longitudinal COMPASS schools across three study waves (2018, 2019, 2020).

<table>
<thead>
<tr>
<th>Wave</th>
<th>Vaping Behaviour</th>
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<tbody>
<tr>
<td></td>
<td>Monthly Use</td>
<td>Weekly Use</td>
<td>Daily Use</td>
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<tr>
<td></td>
<td>Mean(^b) (95% CI)</td>
<td>Mean(^b) (95% CI)</td>
<td>Mean(^b) (95% CI)</td>
<td></td>
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<tr>
<td>Adjusted Estimates(^a)</td>
<td>2018</td>
<td>16.3 (13.4, 19.2)</td>
<td>7.0 (5.6, 8.5)</td>
<td>1.3 (0.9, 1.8)</td>
</tr>
<tr>
<td></td>
<td>2019</td>
<td>31.7 (30.0, 33.9)</td>
<td>18.8 (16.5, 21.1)</td>
<td>6.8 (5.4, 8.1)</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>22.5 (12.2, 32.9)</td>
<td>14.3 (11.8, 16.9)</td>
<td>7.1 (4.3, 9.7)</td>
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<table>
<thead>
<tr>
<th>Average Discrete Change</th>
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<td></td>
<td>Mean(^b) (95% CI)</td>
<td>Mean(^b) (95% CI)</td>
<td>Mean(^b) (95% CI)</td>
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<tr>
<td>2019-2018 (pre-COVID-19 period)</td>
<td>15.4 (13.1, 17.7)</td>
<td>11.8 (9.8, 13.6)</td>
<td>5.5 (0.4, 6.6)</td>
</tr>
<tr>
<td>2020-2019 (early COVID-19 period)</td>
<td>-9.2 (-19.3, 0.9)</td>
<td>-4.5 (-7.1, -1.8)</td>
<td>0.3 (-2.7, 3.2)</td>
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<td>Difference-in-Difference (95% CI)</td>
<td>Difference-in-Difference (95% CI)</td>
<td>Difference-in-Difference (95% CI)</td>
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<tr>
<td></td>
<td>-24.6 (-35.4, -13.8)</td>
<td>-16.3 (-20.1, -12.2)</td>
<td>-5.2 (-8.8, -1.6)</td>
</tr>
</tbody>
</table>

Notes:
95% CI (confidence interval)
\(^a\) Fixed effect model with a lagged variable as the outcome, controlling for time-invariant confounders but constraining sex and age effects on the outcome to be fixed across time, and sample selection correction with the predictors of age, sex, weekly spending money, and province.
\(^b\) Refers to the proportion of users for the corresponding vaping outcome based on the adjusted models.
Pre-post COVID study design in 2021

Sample if you only include the 79 schools that participated in all of the last 3 data collection waves (minimize sample bias).
Figure 3b  Generalized estimating equation parameter estimates for the interaction of Time and student Cohort when examining the likelihood of current vaping using the longitudinal sample from the COMPASS study (2018/19, 2019/20, 2020/21)
Fig. 1. Prevalence of substance-related coping with COVID-19 among current substance users in COMPASS Y₈ (May–July 2020), N = 7150. Note. Fig. 1 shows the prevalence of substance-related coping with COVID-19 among female and male students who reported current use of cannabis, binge drinking, cigarettes, and vaping. For example, among students who reported current cannabis use, 51.9% of females and 48.3% of males engaged in cannabis use to help cope with COVID-19-related changes.
Opportunities to Collaborate

• We make all of our data available to other researchers and/or stakeholders willing to collaborate:
  • secure file transfer available at UW
  • de-identified data

• We are willing to share tools and resources when possible
  • e.g., statistical modelling can be provided

• Student projects and trainees are prioritized

• Future funding proposals
Recent publications (2020 to present)


Motivation: my boys
Thank you

sleather@uwaterloo.ca

COMPASS Website:  https://uwaterloo.ca/compass-system/