



Pandemic fatigue or enduring precautionary behaviours? Canadians' long-term response to COVID-19 public health measures

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ABSTRACT

The long-term dynamics of COVID-19 disease incidence and public health measures may impact individuals' precautionary behaviours as well as support for measures. The objectives of this study were to assess longitudinal changes in precautionary behaviours and support for public health measures. Survey data were collected online from 1030 Canadians in each of 5 cycles in 2020: June 15–July 13; July 22–Aug 8; Sept 7–15; Oct 14–21; and Nov 12–17. Precautionary behaviour increased over the study period in the context of increasing disease incidence. When controlling for the stringency of public health measures and disease incidence, mixed effects logistic regression models showed these behaviours did not significantly change over time. Odds ratios for avoiding contact with family and friends ranged from 0.84 (95% CI 0.59–1.20) in September to 1.25 (95% CI 0.66–2.37) in November compared with July 2020. Odds ratios for attending an indoor gathering ranged from 0.86 (95% CI 0.62–1.20) in August to 1.71 (95% CI 0.95–3.09) in October compared with July 2020. Support for non-essential business closures increased over time with 2.33 (95% CI 1.14–4.75) times higher odds of support in November compared to July 2020. Support for school closures declined over time with lower odds of support in September (OR 0.66 [95% CI 0.45–0.96]), October (OR 0.48 [95% CI 0.26–0.87]), and November (OR 0.39 [95% CI 0.19–0.81]) compared with July 2020. In summary, respondents' behaviour mirrored government guidance between July and November 2020 and supported individual precautionary behaviour and limitations on non-essential businesses over school closures.

1. Introduction

At the time of writing, the COVID-19 pandemic has continued for more than 2 years. Regardless of the availability of pharmaceutical interventions (e.g., vaccines or antivirals), non-pharmaceutical interventions (NPIs) remain essential for controlling transmission and mitigating the impact of COVID-19. The implementation of these measures in Canada has varied by region and over time and include provincially mandated school and non-essential business closures, as well as

recommendations to reduce contact with non-household members (Cameron-Blake et al., 2021; McCoy et al., 2020).

Interventions that are voluntary in nature (i.e., individual precautionary behaviours) require considerable and sustained behavioural change which comes with substantial economic costs (Angus Reid Institute, 2021; Centre for Addiction and Mental Health, 2020; Statistics Canada, 2020b, 2020a). Despite the variation in NPIs across time and region, the reduction of close proximity contacts, especially in indoor settings, has continued to be recommended across the country

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(Cameron-Blake et al., 2021; McCoy et al., 2020). While mandated business and school closures result in regulated behaviour change, reducing contacts more generally, requires the voluntary cooperation of individuals. Given the social and economic disruptions of NPIs, it is reasonable to expect participation in precautionary behaviours to wane over time. Several studies have demonstrated that self-reported adherence to physical distancing measures declined throughout the COVID-19 pandemic (Bearth et al., 2020; Enticott et al., 2021; Kim and Crimmins, 2020; Łaszewska et al., 2021; Yoshida-Montezuma et al., 2021). Such results may suggest ‘pandemic fatigue’ which has been defined as “demotivation to follow recommended protective behaviours, emerging gradually over time and affected by a number of emotions, experiences and perceptions” (page 4) (World Health Organization (WHO), 2020). However, most longitudinal studies reporting this type of observation were conducted over a relatively short period of time in the early stages of the pandemic and did not control for either: 1) the stringency of public health measures, or 2) measures of epidemic severity; both of which may influence behaviour. Thus, the observed decline in precautionary behaviours in these studies may be confounded by relaxing local public health restrictions or varying pandemic severity during the data collection period.

Public support for government mandated measures such as closures of certain sectors may also change over time. Public support for temporary closure of non-essential businesses in response to the COVID-19 pandemic has been reported in several countries (Bearth et al., 2020; Brankston et al., 2021b; Czeisler et al., 2020) and maintained over time (Łaszewska et al., 2021). In contrast, declining support for school closures has been documented (Bearth et al., 2020; Łaszewska et al., 2021) and may be due to a variety of factors including perceptions of negative impacts on learning (Engzell et al., 2021; Hammerstein et al., 2021), psychosocial impacts (Meherali et al., 2021; Pfefferbaum, 2021), and declines in physical well-being (Maximum City, 2020; Storz, 2020). Monitoring Canadians’ attitudes toward public health measures can guide evidence-based public health decision-making and messaging in terms of the types of measures to which individuals are willing to adhere (Czeisler et al., 2020).

Throughout the COVID-19 pandemic in Canada, disease incidence, knowledge, and public health measures have continually evolved and affected the behaviour of individuals, creating a dynamic risk scenario. Given the heterogeneous nature in severity of the virus and in government responses it is important to understand changes in Canadians’ pandemic-related attitudes and behaviour over time to allow policy-makers to focus on the most effective control measures and public health messaging. The objectives of this study were: 1) to quantify longitudinal changes in precautionary behaviours in Canada; and 2) to quantify longitudinal changes in public support for public health measures such as closures of schools and non-essential businesses in the context of varying disease incidence and stringency of public health measures. The current study included times of low incidence of COVID-19 and de-escalation of public health measures (July and August 2020) as well as the beginning of the second pandemic wave in Canada (September to November 2020).

2. Methods

2.1. Data collection

The study protocol was approved by the University of Guelph Research Ethics Board (protocol #20-04-011) and the University of Toronto Research Ethics Board (protocol #38251).

The survey research agency, Dynata, was contracted to invite Canadian adults 18 years of age and older to complete a longitudinal online survey between June 2020 and November 2020 with a proportion of respondents from each survey cycle being recontacted to complete the next cycle for a total of 5 cycles. Respondents provided informed consent after reading the study information by choosing to continue to the

survey questions and were paid a nominal fee to participate. Representativeness of the sample population for the first three cycles was ensured by setting quotas on age, gender, official language (English and French), and region of residence (i.e., Atlantic, Quebec, Ontario, and West) based on 2016 Canadian Census data (Statistics Canada, 2016). Responses were excluded for being non-citizens, being under the age of 18 years, completing the survey in under one-third of the estimated time, providing non-differentiated answers to three or more matrix questions, exceeding the age, gender, or region quotas, being duplicate responses, or for having an incomplete dataset (including respondent attrition). After exclusions, survey responses included a convenience sample of respondents in each cycle: cycle 1 (June 15–July 13, 2020); cycle 2 (July 22–Aug 8, 2020); cycle 3 (Sept 7–15, 2020); cycle 4 (Oct 14–21, 2020); and cycle 5 (Nov 12–17, 2020).

The survey instrument was designed by the research team and included questions about sociodemographic characteristics, precautionary behaviours, attitudes toward public health measures, as well as trust in provincial government and approval of the provincial government response to the COVID-19 pandemic (Appendix: Survey Instrument; Table A1). Participation in precautionary behaviours was assessed by asking respondents whether, in the 7 days prior to survey completion, they had avoided contact with friends and family due to COVID-19 and whether they had attended an indoor gathering with those outside their own household. Attitudes about public health measures were assessed by asking respondents whether they would support provincial government policies such as the closure of non-essential businesses and the closure of schools in the event of a second wave of COVID-19. All other variables are defined in the Appendix (Survey Instrument; Table A1).

To assess variation in public health measures across time and place, a subnational unitless indicator of stringency of public health measures was calculated using methods adapted from the Oxford COVID-19 Government Response Tracker (OxCGRT) team (Cameron-Blake et al., 2021). Briefly, data were collected from publicly available sources such as news articles and government press releases and coded by a team of epidemiologists at the Public Health Agency of Canada. A higher value for the stringency index indicates greater stringency of public health measures. The 7-day rolling average of incident cases of COVID-19 per 100,000 population by province was extracted from the Canada Open Data Working Group datasets (Berry et al., 2021).

2.2. Data analysis

Post-stratification weights were constructed using an iterative proportional fitting algorithm. Data were weighted within region by age and gender with a maximum weight of 3.00 ($n = 69$) and a minimum weight of 0.50 ($n = 236$). Descriptive statistics were computed for key sociodemographic variables and outcome variables. The proportion of respondents who avoided contact with family and friends, attended an indoor social gathering, and supported school and non-essential business closures was calculated overall and by region of Canada (i.e., West, Ontario, Québec, Atlantic). For the Western (British Columbia, Alberta, Saskatchewan and Manitoba) and the Atlantic (New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland/Labrador) regions, the provincial stringency index and the 7-day rolling average incidence of COVID-19 were combined at the respondent level to form a weighted average regional measure for each.

Mixed effects logistic regression models were developed with the respondent specified as the random effect to account for repeated measures. Models were developed to assess changes over time in: 1) the likelihood of having attended an indoor gathering in the week prior to survey completion; 2) the likelihood of having avoided in-person contact with friends and family in the week prior to survey completion; 3) support for non-essential business closures in the event of a second wave of COVID-19; and 4) support for school closures in the event of a second wave of COVID-19. Time was treated as a categorical variable as indicated by each of the five survey cycles.

The stringency index and provincial incidence of COVID-19 were included in all models to control for temporal and regional variability in public health measures and epidemic severity. Univariable models were first assessed using a liberal P-value (less than 0.20) to determine eligibility for inclusion in the multivariable models. A complete list of variables included in each of the initial full models is included in Table A1 (Appendix).

A manual backward elimination procedure was used to evaluate variables for inclusion in the final multivariable regression models. The stringency index for all regression models was categorized as this variable was not normally distributed. Confounding was assessed by examining the coefficients in the model for changes of more than 20% when the potentially confounding variable was excluded from the model. Once the final model was determined, based on the descriptive results from the current analysis, two-way multiplicative interactions were assessed for region by concern about the COVID-19 pandemic.

RStudio (RStudio Team, 2020) packages dplyr (Wickham et al., 2022) and ggplot2 (Wickham, 2016) were used to analyse the descriptive characteristics of respondents and create figures, respectively. Descriptive analyses of indicators and mixed effects logistic regression models were analysed using Stata 16.0 (StataCorp, 2019).

3. Results

A total of 19,751 unique responses were collected over the five survey cycles: 10,122 responses in cycle 1; 5068 responses in cycle 2; 2008 responses in cycle 3; 1523 responses in cycle 4; and 1030 responses in cycle 5. Respondent attrition due to exclusions and diminishing recontacts resulted in a final sample size of 1030 respondents with complete survey responses for each of the 5 survey cycles. Respondents included in the final sample differed in some sociodemographic variables from those who were not recontacted (Table A2 Appendix). However, outcome measures and risk perceptions were similar between the different periods of respondent attrition (Table A3 Appendix).

The mean number of days between survey cycles ranged from 28.7 ± 9.1 days to 44.5 ± 4.8 days (Table A4 Appendix). A small number of individuals ($n = 37$) responded to survey 2 fewer than 14 days after survey 1 which may result in minimal changes in reported behaviours due to little change in their environment in a short time period.

Sociodemographic characteristics of respondents are included in Table 1. Responses were weighted within region by age and gender to achieve representativeness of the Canadian population.

Descriptive proportions for each of the precautionary behaviours and support for closures across Canada by survey cycle are shown in Fig. 1. The proportion of respondents who reported avoiding contact with family and friends in the 7 days prior to survey completion showed a U-shaped trend and began with 50.9 % (95 % CI 47.5–54.4) in July, declined to 44.7 (95 % CI 41.3–48.1) in September, and increased to 60.5 % (95 % CI 57.1–63.9) in November. The proportion of respondents who reported attending an indoor gathering with people outside their household in the 7 days prior to survey completion was 27.6 % (95 % CI 24.5–30.7) in July, increased to 30.7 % (95 % CI 27.5–33.8) in September, and subsequently decreased to 21.4 % (95 % CI 18.5–24.2) in November.

The proportion of respondents reporting support for the closure of non-essential businesses in the event of a second wave of COVID-19 ranged from 47.3 % (95 % CI 43.8–50.7) in July to 53.5 % (95 % CI 50.1–56.9) in November. Support for school closures in the event of a second wave of COVID-19 declined from 52.8 % (95 % CI 49.4–56.2) in July to 40.4 % (95 % CI 37.0–43.8) in November.

The average stringency index varied by region and survey cycle ranging from a maximum of 52.6 (95 % CI 51.4–53.7) in July to a low of 42.3 (95 % CI 41.8–42.7) in November in Atlantic Canada. In Ontario, the stringency index was 62.3 (95 % CI 62.2–62.4) in July, decreased to 45.8 (95 % CI 45.5–46.1) in September, and increased again to 51.9 (95 % CI 51.9–51.9) by November. In Québec, the stringency index was 53.6

Table 1
Sociodemographic characteristics of survey respondents.

	Number of respondents per survey cycle (%)	Number of respondents per survey cycle, weighted (%)
	N = 1030	N = 1031.9
Gender		
Male	570 (55.3 %)	508.0 (49.3 %)
Female	458 (44.5 %)	521.0 (50.6 %)
Neither (e.g., trans, non-binary, two-spirit)	2 (0.194 %)	1.84 (0.179 %)
Age Category		
18–29 years	72 (6.99 %)	183.0 (17.7 %)
30–39 years	192 (18.6 %)	174.0 (16.8 %)
40–49 years	208 (20.2 %)	174.0 (16.9 %)
50–59 years	238 (23.1 %)	198.0 (19.2 %)
60–69 years	232 (22.5 %)	160.0 (15.5 %)
Over 70 years	88 (8.54 %)	143.0 (13.9 %)
Province of Residence		
Newfoundland	22 (2.14 %)	19.1 (1.85 %)
Prince Edward Island	3 (0.291 %)	4.50 (0.436 %)
New Brunswick	21 (2.04 %)	21.4 (2.07 %)
Nova Scotia	35 (3.40 %)	35.4 (3.44 %)
Quebec	244 (23.7 %)	250 (24.3 %)
Ontario	362 (35.1 %)	366.0 (35.5 %)
Manitoba	34 (3.30 %)	34.4 (3.34 %)
Saskatchewan	39 (3.79 %)	40.1 (3.89 %)
Alberta	128 (12.4 %)	130 (12.6 %)
British Columbia	142 (13.8 %)	131.0 (12.7 %)
Education Level		
Secondary or less	243 (23.6 %)	249.0 (24.2 %)
College/Trades/Other qualification	262 (25.4 %)	267.0 (25.9 %)
At least some university	524 (50.9 %)	514.0 (49.8 %)
Unsure	1 (0.0971 %)	0.652 (0.063 %)
Household income		
\$0–\$60,000	374 (36.3 %)	401.0 (38.9 %)
\$60,001–\$110,000	370 (35.9 %)	361.0 (35.0 %)
> \$110,000	232 (22.5 %)	213.0 (20.6 %)
Unsure/Prefer not to answer	54 (5.24 %)	56.5 (5.48 %)
Living with Children Under the Age of 15 years		
Yes	231 (22.4 %)	235.0 (22.8 %)
Risk Group and/or Pregnant		
Yes	343 (33.3 %)	335.0 (32.5 %)
Employment Status		
Full-time/Part-time/On paid leave	486 (47.2 %)	479.0 (46.5 %)
Self-employed	107 (10.4 %)	106.0 (10.2 %)
Unemployed	68 (6.60 %)	69.7 (6.76 %)
Working within the home	33 (3.20 %)	32.5 (3.15 %)
Retired	242 (23.5 %)	236.0 (22.9 %)
Student	18 (1.75 %)	32.0 (3.10 %)
Disabled	47 (4.56 %)	47.9 (4.64 %)
Student/Homemaker/Retired and working for pay	25 (2.43 %)	25.1 (2.43 %)
Other/Unsure	4 (0.388 %)	3.21 (0.31 %)
Size of Geographic Area of Residence		
Large city	457 (44.4 %)	459.0 (44.5 %)
Medium sized city	300 (29.1 %)	295.0 (28.6 %)
Large town	95 (9.22 %)	88.4 (8.57 %)
Small town	116 (11.3 %)	127.0 (12.3 %)
Rural place	62 (6.02 %)	61.8 (6.00 %)

Note: The unweighted number of respondents are reported as well as the number of respondents weighted within region by age and gender.

(95 % CI 52.9–54.4) in July, decreased to 38.0 (95 % CI 38.0–38.0) in September, and increased to 52.8 (95 % CI 52.8–52.8) in November. The stringency index for the Western provinces was 47.7 (95 % CI 47.1–48.2) in July, declined to 44.1 (95 % CI 43.7–44.6) in August 2020 and increased to 53.2 (95 % CI 52.5–54.0) by November.

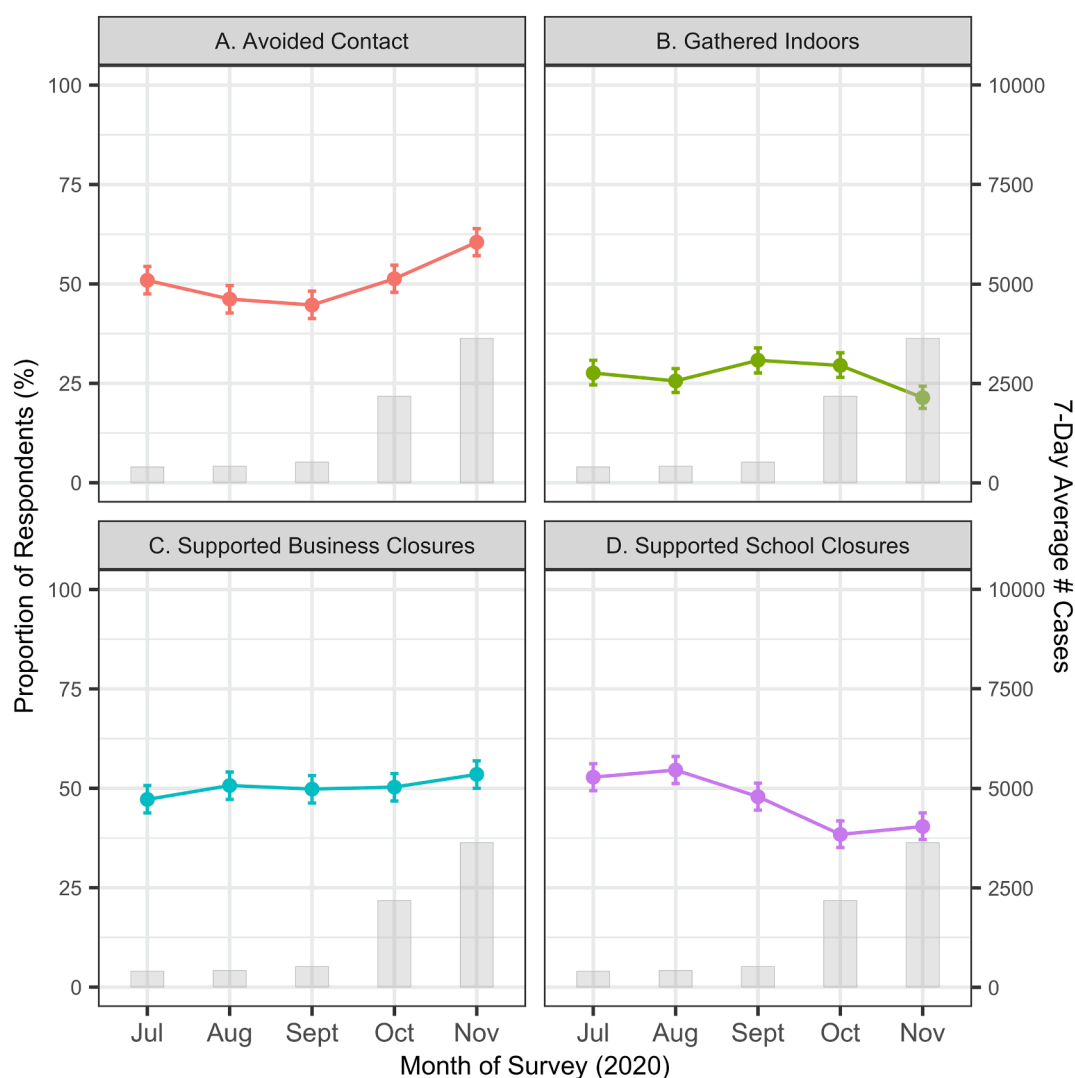


Fig. 1. Trends in behavioural and support indicators by survey cycle. Values are reported as proportions and 95 % confidence intervals. Data are weighted within region by age and gender. Indicators are as follows: A) the proportion of respondents that avoided contact with family and friends as a result of the COVID-19 pandemic in the 7 days prior to survey completion; B) the proportion of respondents reporting a household member having attended an indoor social gathering with at least one non-household contact in the 7 days prior to survey completion; C) the proportion of respondents indicating support for government mandated closure of non-essential businesses in the event of a second wave of COVID-19 cases; and D) the proportion of respondents indicating support for government mandated school closures in the event of a second wave of COVID-19 cases. The secondary y-axis shows the 7-day rolling average number of cases of COVID-19 in Canada for each survey time period (grey bars).

Fig. 2 represents participation in precautionary behaviours and support for closure of schools and non-essential businesses in the context of the stringency of public health measures and incidence of COVID-19 by survey cycle and region. In Ontario, Québec and the Western provinces, the trend in precautionary behaviours was consistent with that of the stringency index and COVID-19 incidence in each region. In the Atlantic provinces, the trend in precautionary behaviours deviated from that of the stringency index and COVID-19 incidence. As the stringency index declined and incidence remained consistent, a greater proportion of respondents in Atlantic Canada reported avoiding contact with family and friends and a lower proportion reported attending an indoor gathering. Support for closure of non-essential businesses showed an increasing trend over the 5-month study period in the Atlantic and Western provinces but little change was noted in Ontario and Québec. Support for school closures in the event of a second wave of COVID-19 declined over the 5-month duration of the study in all Canadian regions.

Fig. 3 represents the odds ratios for the mixed effects logistic regression models for each precautionary behaviour and support for school and non-essential business closures using July 2020 as the

baseline measure. After controlling for the stringency index and the provincial incidence of COVID-19 cases, the odds ratios for avoiding contact with family and friends in the week prior to survey completion ranged from 0.84 (95 % CI 0.59–1.20) in September 2020 to 1.25 (95 % CI 0.66–2.37) in November 2020 and were not significantly different in any of the time periods compared with that in July 2020 (Fig. 4; Table A5 Appendix). Similarly, the odds ratios for attending an indoor gathering in the 7 days prior to survey completion ranged from 0.86 (95 % CI 0.62–1.20) in August 2020 to 1.71 (95 % CI 0.95–3.09) in October 2020 and were not significantly different over the 5-month study period (Fig. 4; Table A6 Appendix). Support for non-essential business closures increased over time with the odds of supporting this measure estimated to be 2.33 (95 % CI 1.14–4.75) times higher in November compared with July (Fig. 4; Table A7 Appendix). Support for school closures declined over the 5-month period with lower odds of support in September (OR 0.66 [95 % CI 0.45–0.96]), October (OR 0.48 [95 % CI 0.26–0.87]), and November 2020 (OR 0.39 [95 % CI 0.19–0.81]) compared with July 2020 (Fig. 4; Table A8 Appendix).

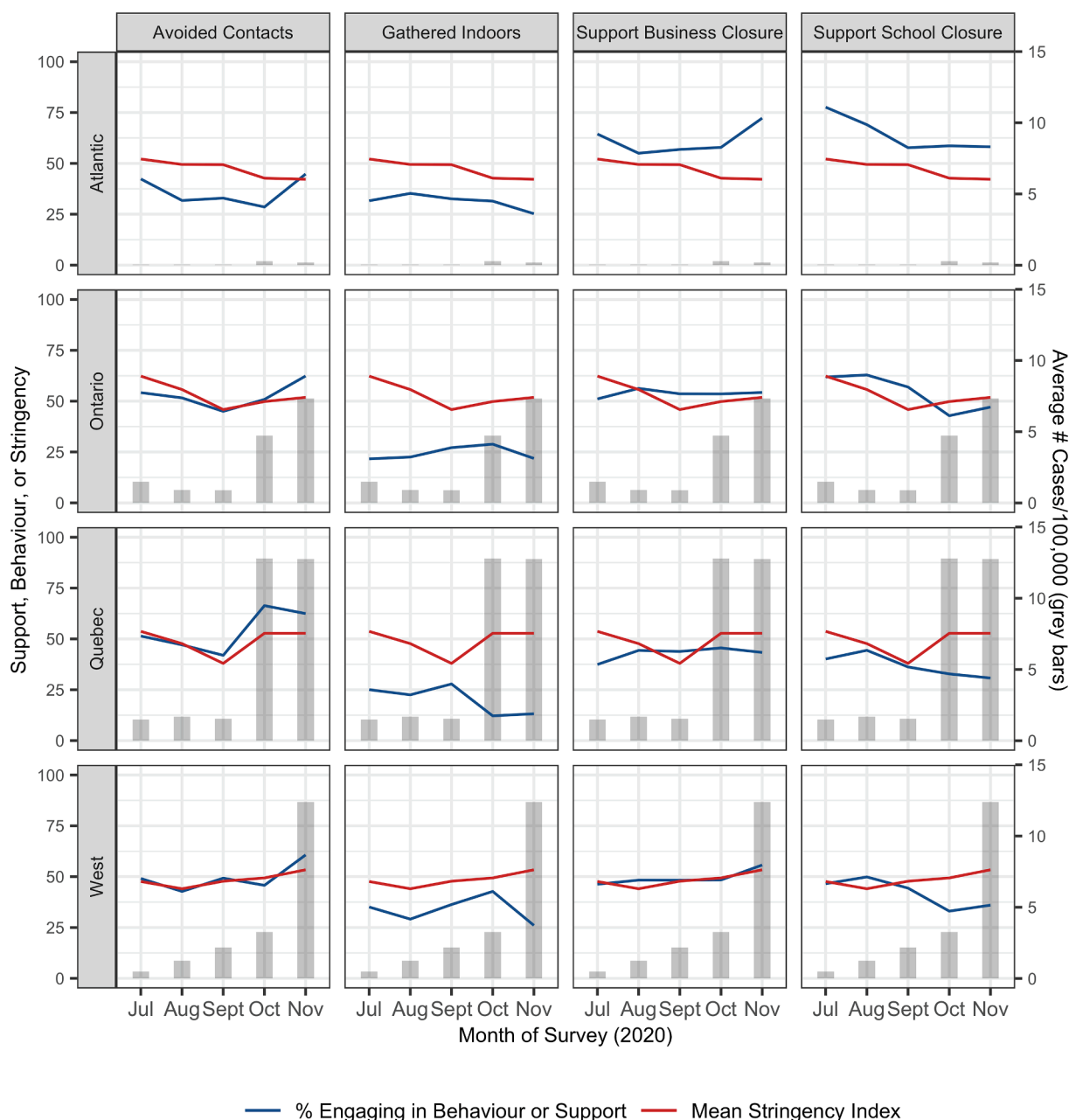


Fig. 2. Trends in behavioural and support indicators per survey cycle by region in the context of the average regional stringency index for the survey time period and the regional 7-day rolling average of incident cases per 100,000 population. Indicators are as follows: 1) the proportion of respondents that avoided contact with family and friends as a result of the COVID-19 pandemic in the 7 days prior to survey completion; 2) the proportion of respondents reporting a household member having attended an indoor social gathering with at least one non-household contact in the 7 days prior to survey completion; 3) the proportion of respondents indicating support for government mandated closure of non-essential businesses in the event of a second wave of COVID-19 cases; and 4) the proportion of respondents indicating support for government mandated school closures in the event of a second wave of COVID-19 cases. Data are weighted within region by age and gender. The secondary y-axis shows the 7-day rolling average number of cases of COVID-19 per 100,000 for each region and survey time period (grey bars).

4. Discussion

In March 2020, the rapid spread of COVID-19 in Canada led to the implementation of a variety of public health measures across the country designed to reduce transmission of the virus with subsequent de-escalation of measures as incidence declined. The five-month period encompassed in the current study included times of relatively low incidence (July and August 2020) as well as the beginning of the second pandemic wave in Canada (September to November 2020). The data presented in this analysis show that most respondents were engaging in voluntary precautionary behaviours to mitigate transmission. Fewer than 25% of respondents reported gathering indoors and more than half

of respondents reported avoiding contact with family and friends. There was no change in the likelihood of engaging in voluntary precautionary behaviours over the 5-month study period when stringency of public health measures and incidence of COVID-19 were considered. These results suggest that respondents modified their behaviour voluntarily in response to public health information and/or in response to changes in public health policy.

Previous research has demonstrated adherence to COVID-19 public health recommendations such as avoiding indoor social contact declined over time during the initial phase of the pandemic in several countries (Bearth et al., 2020; Enticott et al., 2021; Kim and Crimmins, 2020; MacIntyre et al., 2021; Yoshida-Montezuma et al., 2021). Only two of

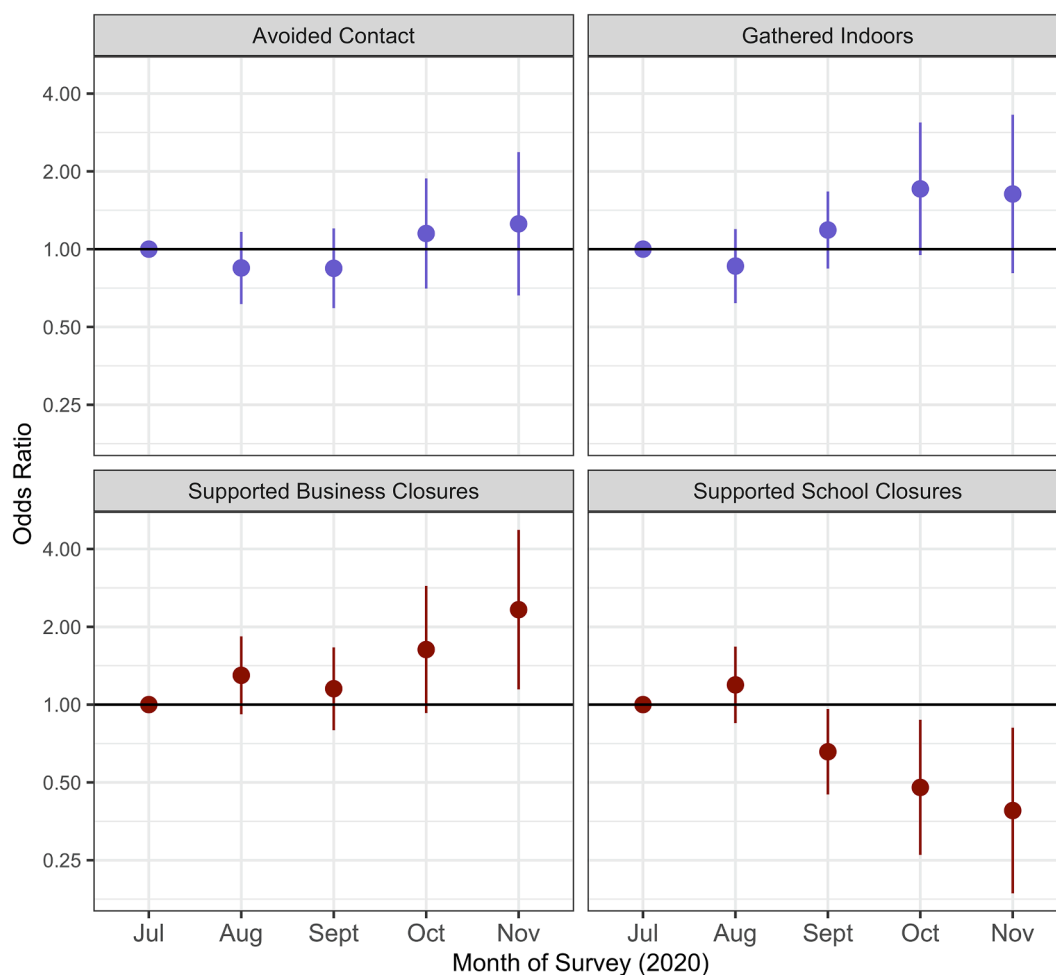


Fig. 3. Multivariable mixed effects analysis of behavioural and support indicators by survey cycle. Odds ratios and 95 % confidence intervals are reported for behavioural and support indicators by survey cycle controlling for the stringency of public health measures, incidence of COVID-19, and respondents' concern about the pandemic. Data are weighted within region by age and gender. Indicators are as follows: 1) avoided contact with family and friends as a result of the COVID-19 pandemic in the 7 days prior to survey completion; 2) attended an indoor social gathering with at least one non-household contact in the 7 days prior to survey completion; 3) respondent support for government mandated closure of non-essential businesses in the event of a second wave of COVID-19 cases; and 4) respondent support for government mandated school closures in the event of a second wave of COVID-19 cases. The y-axis is represented by the log₂ scale.

these analyses controlled for epidemic severity (MacIntyre et al., 2021; Petherick et al., 2021), one controlled for stringency of public health measures (Petherick et al., 2021), and most were conducted during a period of de-escalation of public health measures due to a declining epidemic. The current study time frame included a period of epidemic growth. Consistent with established models of health behaviour (Rogers, 1975; Rosenstock et al., 1988), patterns of voluntary quarantine-type measures are dynamic over time and associated with disease incidence (Ibuka et al., 2010). Therefore, regardless of government or public health policy, individuals may respond to increasing incidence of disease by voluntarily adjusting their precautionary behaviour. Distinguishing between the effects of disease incidence and public health policy was beyond the scope of the current analysis.

Our findings are consistent with Canadian studies that have measured mobility based on cell phone data and those that have quantified contact patterns (Brankston et al., 2021a; Cavalli, Lake et al., 2020). While pandemic-related reductions in mobility rebounded to pre-pandemic levels by July 2020, proximity data show that there was no concomitant return to pre-pandemic levels of proximity between individuals (Cavalli et al., 2020). Similarly, Canadians reported an increase in workplace and school-related contacts between summer and fall of 2020; however, there was no change in contacts related to social settings (Brankston et al., 2021a). These data reflect the return to in-

person employment and school, as well as the reopening of non-essential businesses that occurred during the summer and fall of 2020 suggesting individuals continued to limit contacts in social settings.

Support for school closures declined while support for non-essential business closures increased over time in the context of increasing incidence of COVID-19 during the second wave of the pandemic in Canada. These data are consistent with previous research conducted in the US (Czeisler et al., 2020) and Europe (Bearth et al., 2020) and suggest individuals were willing to continue voluntary precautionary behaviours for the study duration while at the same time reducing support for re-implementation of school closures and increasing support for non-essential business closures in the event of a second wave of infection. Having children within the household was not associated with support for school closures in this analysis implying that, overall, Canadians supported individual precautionary behaviours and closure of non-essential businesses over school closures (regardless of whether they themselves had children in their household) and were therefore supportive of keeping transmission low in the community to keep schools open to in-person learning.

Interestingly, while participation in precautionary behaviours was consistent with stringency of public health measures in most of Canada, such engagement across the Atlantic provinces became decoupled from public health policy by the fifth cycle of the survey. As stringency of

public health measures declined in this region, precautionary behaviours increased. While it is possible that respondents residing in Atlantic Canada modified their behaviour in response to media reports of the second wave of COVID-19 in other regions, an explanation for this finding remains unclear. Atlantic Canada is comprised of small urban regions and a high proportion of rural residents (National Resources Canada, 2008), attributes that have been associated with a strong sense of community (Kitchen et al., 2012), health (Kitchen et al., 2012), and adherence to physical distancing recommendations (Coroiu et al., 2020). The strictly enforced Atlantic bubble, which allowed residents of Atlantic provinces to travel freely within the bubble while restricting movements in and out of the bubble, as well as a 'COVID-zero' approach may have motivated individuals to engage in precautionary behaviours without the need for policy (Cameron-Blake et al., 2021; Wu and Mackenzie, 2021). Further work to understand the drivers of individual behaviour in Atlantic Canada would be invaluable to inform future public health response strategies.

5. Limitations

While this study is based on a large sample of Canadian adults, the online nature of the survey may have resulted in a disproportionate representation of individuals who regularly use the internet. Self-reporting introduced the potential for recall and response bias. Social desirability bias carries with it the risk of distorting the true effect of time on engagement in precautionary behaviours. The behavioural outcomes of interest represent only two behaviours and there was no information about whether respondents were wearing masks or using other personal protective measures when participating in indoor social activities. These findings reflect information collected less than one year into the pandemic at a time when vaccines were not yet available and therefore may not reflect more recent attitudes and behaviours. Finally, the nature of the data collected did not allow us to disentangle the individual effects of epidemic severity and public health policy on reported precautionary behaviour.

6. Conclusion

The results of this study provide evidence that, for the most part, Canadians adjusted their behaviour in a manner that was consistent with public health and provincial government guidance between July and November 2020. It is vital that government and public health leaders work to engage with the public and communicate effectively and clearly to enhance adherence to public health recommendations in times of crisis. Finally, Canadians supported individual measures and closure of non-essential businesses over school closures and were therefore supportive of keeping schools open to in-person learning. Future work should attempt to disentangle the effects of epidemic severity, public health measures, and pandemic response approaches on behaviour to better inform policy.

CRedit authorship contribution statement

Gabrielle Brankston: Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Eric Merkley:** Methodology, Investigation, Writing – review & editing. **Peter J. Loewen:** Methodology, Investigation, Writing – review & editing. **Brent P. Avery:** Data curation, Writing – review & editing. **Carolee A. Carson:** Data curation, Writing – review & editing. **Brendan P. Dougherty:** Data curation, Writing – review & editing. **David N. Fisman:** Writing – review & editing. **Ashleigh R. Tuite:** Writing – review & editing. **Zvonimir Poljak:** Methodology, Writing – review & editing. **Amy L. Greer:** Methodology, Investigation, Writing – review & editing, Supervision.

Declaration of Competing Interest

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.

Data availability

Data will be made available on request.

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AT was employed by the Public Health Agency of Canada when the research was conducted. The work does not represent the views of the Public Health Agency of Canada.

Ethics approval and consent to participate.

The study protocol was approved by the University of Guelph Research Ethics Board (protocol #20-04-011) and the University of Toronto Research Ethics Board (protocol #38251). All methods were performed in accordance with the relevant guidelines and regulations. Informed consent was obtained prior to survey completion by providing information about the study, ensuring anonymity and confidentiality, and providing the process to withdraw from the survey. Respondents provided informed consent after reading the study information by choosing to continue to the survey questions.

Availability of data and materials.

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2022.101993>.

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