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Canadian parents' perceptions of COVID-19 vaccination and intention to vaccinate their children: Results from a cross-sectional national survey



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ABSTRACT

Background: Vaccinating children (≤ 17 years old) is important for controlling the COVID-19 pandemic. As parents are primary decision makers for their children, we aimed to assess parents' perceptions and intentions regarding COVID-19 vaccination for their children, including for some underserved populations (e.g., newcomers, Indigenous peoples, and visible minority groups).

Methods: We conducted a cross-sectional national survey of Canadian parents in December 2020, just as COVID-19 vaccines were approved for adults, to assess intention to vaccinate their children (aged 0–17 years) against COVID-19, perceptions of COVID-19 disease and vaccines, previous uptake of influenza and routine vaccines, and sociodemographic characteristics. Binomial logistic regression was used to assess the association between parents' lack of COVID-19 vaccination intention for their children and various independent variables.

Results: Sixty-three percent of parents (1074/1702) intended to vaccinate their children against COVID-19. Those employed part-time (compared to full-time) had lower intention to vaccinate their children (aOR = 1.73, 95% CI: 1.06–2.84), while those who spoke languages other than English, French, or Indigenous languages were less likely to have low intention (aOR = 0.55, 95% CI: 0.32–0.92). Low vaccination intention was also associated with children not receiving influenza vaccine pre-pandemic (aOR = 1.51, 95% CI: 1.04–2.21), parents having low intention to vaccinate themselves against COVID-19 (aOR = 9.22, 95% CI: 6.43–13.34), believing COVID-19 vaccination is unnecessary (aOR = 2.59, 95% CI: 1.72–3.91) or unsafe (aOR = 4.21, 95% CI: 2.96–5.99), and opposing COVID-19 vaccine use in children without prior testing (aOR = 3.09, 95% CI: 1.87–5.24).

Interpretation: Parents' COVID-19 vaccination intentions for their children are better predicted by previous decisions regarding influenza vaccination than routine childhood vaccines, and other perceptions of COVID-19 vaccine-related factors. Public communication should highlight the safety and necessity of COVID-19 vaccination in children to support a return to normal activities. Further research should assess actual COVID-19 vaccination uptake in children, particularly for underserved populations.

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1. Introduction

Vaccination is an essential strategy for controlling the ongoing COVID-19 pandemic. Children ≤ 17 years old represent 17.3% of the Canadian population [1,2], and although they usually experience less severe COVID-19 illness, vaccinating them against COVID-19 could aid in preventing COVID-19 transmission [3]. In addition, vaccination of children will likely promote a return to school and other social activities that have been disrupted [4]. COVID-19 vaccines are currently approved for Canadian children 12 years and older, and children < 12 years will soon become eligible. Thus, it is important to understand parents' perceptions and intentions regarding COVID-19 vaccination for their children.

Studies conducted between May and September 2020 in England, India, Philippines, and China have found that parental COVID-19 vaccine acceptability for their children differs between and within countries, and depends on factors such as perceptions of COVID-19 disease, and vaccine safety and effectiveness [5–9]. In Canada, older parental age, geographic location, more complete routine vaccinations, and prioritizing the risk of COVID-19 disease over vaccine side effects were associated with higher parental intention to vaccinate children against COVID-19 [10]. However, few nationally representative Canadian studies examine how these factors and other sociodemographic characteristics influence parents' intentions to vaccinate their children [10]. Canadian studies are limited to those focusing on local geographical areas [6,11,12]. While sociodemographic differences in COVID-19 vaccine self-intention have been reported among adults [13–15], characteristics such as languages spoken at home, ethnicity, and employment have not been explored nationally among Canadian parents [12].

Understanding factors that influence Canadian parents' decision to vaccinate their children against COVID-19 will enable the implementation of strategies to improve access and promote uptake. Therefore, the objective of this study was to assess a national sample of Canadian parents regarding COVID-19 vaccination perceptions and intentions, and identify factors that influence their decision to vaccinate their children. At the time of this study, COVID-19 vaccines had just been approved in Canada for individuals ≥ 18 years of age. As such, parents would have had limited information on the safety and effectiveness of COVID-19 vaccines in children.

2. Methods

2.1. Study design and participants

We conducted a cross-sectional national online survey with respondents selected from a panel of $> 400,000$ Canadians from a well-established national polling firm [16]. The overall sample ($N = 5028$) was representative for population size in all provinces, and by sex and age based on data from the latest Census [17]. Respondents were adults who have access to the internet and are proficient in reading English or French. To ensure rigor and validity, respondents had unique URLs and 15% of respondents were contacted by telephone for identity verification [18].

We purposively sampled minimum quotas of targeted populations of interest. This included a quota of respondents who identified having one or more children 0–17 years old in their home. Parents' responses related to all of their children aged 0–17 years, with the exception of the question about preschool and school-aged routine vaccines. Sample size calculations estimated the minimal size of each target population to be 402, based on the maximum variability possible in the outcome variable in the population (i.e., a proportion of 0.50), with a margin of error of $\pm 5\%$ and 95% confidence intervals (CI).

The online questionnaire, which took approximately 22 minutes to complete, included 75 questions and was conducted from December 10–24, 2020, just as two mRNA COVID-19 vaccines (i.e., Pfizer and Moderna) were authorized for use in adults [19,20]. The survey was developed by drawing from a previous survey of Canadians' acceptance of routine childhood vaccines [21], previously validated questions about perceptions of vaccination [22], areas of focus for our policy partners (including the National Advisory Committee on Immunization Secretariat), and the expertise of our national team of immunization researchers and policy advisors. The draft questionnaire was reviewed by three public health experts, pre-tested with team members, and then pilot tested with 20 members of the public and revised accordingly. This study received approval from the Health Research Ethics Board at the University of Alberta.

2.2. Measures

Our primary outcome variable was parents' intention to vaccinate their children against COVID-19. Respondents were asked the following: "If a safe and effective COVID-19 vaccine is available, I will get my child/children vaccinated", using a 5-point Likert scale (ranging from strongly disagree to strongly agree). For analysis, response categories were recoded into binary categories for comparability with similar studies [5,8]: high intention to vaccinate (scores of 4–5, which was the reference category) and low intention to vaccinate (scores of 1–3).

Independent variables of interest included children's uptake of routine and influenza vaccines before the pandemic, parents' perceptions of COVID-19 disease (i.e., severity, personal risk), COVID-19 vaccines (i.e., safety, necessity, use in children without having been tested in children), and everyday constraints to accessing COVID-19 vaccination (i.e., having competing priorities or multiple time-sensitive demands). Sociodemographic characteristics included: parents' age, gender, level of education, employment status, annual household income, marital status, number of children, province, newcomer status (i.e., arrival in Canada within the last 5 years), language most often spoken at home, ethnicity and Indigenous self-identification, and Indigenous parents' location of residence (i.e., reserve, rural, urban). Variables that were measured on a 5-point Likert scale were collapsed into two categories for analysis ('Agree', scores of 4–5, and 'Neutral/disagree', scores of 1–3), based on natural patterns in the data identified in preliminary analyses. Survey questions can be found in the Appendix (Table A1).

2.3. Statistical analysis

We calculated descriptive statistics (i.e., frequencies and percentages for categorical, mean and standard deviation [SD] for continuous) of the independent variables. We then assessed the association between parents' intention to vaccinate their children against COVID-19 and the independent variables using binomial logistic regression, reporting both adjusted and unadjusted odds ratios with 95% CIs. The unadjusted model included the independent variables listed above except number of children and Indigenous parents' location of residence (which were only included in the study for descriptive purposes). Variables included in the adjusted model were characteristics commonly associated with vaccination behaviours from previous literature, as well as those with a p-value below 0.20 in the unadjusted model. Linearity was assessed for the continuous predictor and multicollinearity between variables was checked; all had a variance inflation factor below 5. No data were missing due to the online survey completion requirements. Responses of 'prefer not to answer', 'not eligible', or 'don't know/remember' were considered missing and excluded

from the multivariable regression analysis by listwise deletion as they represented a small proportion of overall responses. SPSS version 26.0 (IBM, Chicago, IL, USA) was used for the descriptive analysis, while R version 4.0.2 (R Foundation, Vienna, AT) was used for the regression analysis.

3. Results

3.1. Sample description

The final parent sample consisted of 1702 individuals, after 267 respondents were removed as they were determined to have likely been older siblings or grandparents. Table 1 describes the sociodemographic characteristics of the sample.

Table 1
Sociodemographic characteristics of parents (n = 1702).

| Variable | Category | n | % |
|---|--|--------------|---------|
| Parent's age, mean ± SD, (range in years) | | 39.21 ± 8.44 | (17–65) |
| Gender | Woman | 942 | 55.3 |
| | Man | 748 | 44.0 |
| | Other | 12 | 0.7 |
| Highest level of education | High school or less | 205 | 12.0 |
| | Non-university certificate or diploma (college/apprenticeship) | 539 | 31.7 |
| | University certificate or Bachelor's degree | 656 | 38.5 |
| | More than a Bachelor's degree | 291 | 17.1 |
| | Prefer not to answer | 11 | 0.7 |
| Employment status | Full-time (35 or more hours per week) | 1163 | 68.3 |
| | Part-time (<35 h per week) | 233 | 13.7 |
| | Unemployed | 267 | 15.7 |
| | Prefer not to answer | 39 | 2.3 |
| Household income | Less than \$40,000 | 228 | 13.4 |
| | Between \$40,000 and \$79,999 | 471 | 27.7 |
| | \$80,000 and more | 885 | 52.0 |
| | Prefer not to answer | 118 | 6.9 |
| Marital status | Not married | 316 | 18.6 |
| | Married or common-law | 1379 | 81.0 |
| | Prefer not to answer | 7 | 0.4 |
| Number of children 0–17 years old in the household | 1 | 862 | 50.6 |
| | 2 | 614 | 36.1 |
| | 3 or more | 226 | 13.3 |
| Children's age ^a | 0–6 years old | 961 | 37.1 |
| | 7–11 years old | 759 | 29.3 |
| | 12–17 years old | 868 | 33.6 |
| Province | British Columbia | 206 | 12.1 |
| | Alberta | 182 | 10.7 |
| | Saskatchewan | 64 | 3.8 |
| | Manitoba | 82 | 4.8 |
| | Ontario | 613 | 36.0 |
| | Quebec | 434 | 25.5 |
| | Atlantic Provinces | 121 | 7.1 |
| Parents new to Canada in the past 5 years | Yes | 195 | 11.5 |
| | No | 1507 | 88.5 |
| Language spoken most often at home | English | 1064 | 62.5 |
| | French | 381 | 22.4 |
| | Indigenous | 6 | 0.4 |
| | Other | 251 | 14.7 |
| | White | 998 | 58.6 |
| Self-identified ethnicity ^b | Visible minority or White-visible minority mixed ethnicity | 520 | 30.6 |
| | Indigenous (First Nations, Métis, or Inuk) | 143 | 8.4 |
| | Prefer not to answer or don't know | 41 | 2.4 |
| | First Nations | 69 | 48.2 |
| Indigenous groups ^c | Métis | 60 | 42.0 |
| | Inuk | 8 | 5.6 |
| | Indigenous, unspecified/Prefer not to answer | 6 | 4.2 |
| | Reserve, settlement, or other Indigenous community | 48 | 33.5 |
| | Rural | 23 | 16.1 |
| Location of residence for Indigenous parents ^c | Urban | 70 | 49.0 |
| | Prefer not to answer | 2 | 1.4 |

^a As parents could have more than one child, there were 2588 children under 18 years of age reported on by parents in the study.
^b Ethnicity self-identified as White (e.g., Caucasian, European) and Visible minority groups (e.g., Black, Latin/Central American, Arabic/West Asian/North African, East Asian, South Asian, Other). Visible minorities are defined as non-White persons, other than Indigenous peoples [23].
^c Only reported on by respondents who self-identified as Indigenous (n = 143).

Table 2
Outcome and independent variables (n = 1702).

| Variable | Category | n | % |
|---|---|------|------|
| Parents' COVID-19 vaccination intention for their children (outcome variable) | | | |
| If a safe and effective COVID-19 vaccine is available, I will get my child/children vaccinated | Agree | 1074 | 63.1 |
| | Disagree/Neutral | 628 | 36.9 |
| Parents' COVID-19 vaccination intention for themselves | | | |
| If a safe and effective COVID-19 vaccine is available to me, I plan to get vaccinated | Agree | 1100 | 64.6 |
| | Disagree/Neutral | 602 | 35.4 |
| Receipt of routine childhood vaccination | | | |
| Pre-pandemic routine pre-school vaccines received for children 0–6 years old | All vaccines received | 761 | 81.1 |
| | Some vaccines received | 106 | 11.3 |
| | No vaccines received | 59 | 6.3 |
| | Don't know | 12 | 1.3 |
| Pre-pandemic routine school aged vaccines received for children 7–17 years old | All vaccines received | 869 | 83.5 |
| | Some vaccines received | 105 | 10.1 |
| | No vaccines received | 46 | 4.4 |
| | Don't know | 21 | 2.0 |
| Pre-school and school-aged children combined: Pre-pandemic routine vaccines received for children 0–17 years old | All vaccines received | 1381 | 81.1 |
| | Some vaccines received | 207 | 12.2 |
| | No vaccines received | 84 | 4.9 |
| | Don't know | 30 | 1.8 |
| Receipt of childhood influenza vaccination | | | |
| Child(ren) received influenza vaccine last year | All children received | 643 | 37.8 |
| | Some children received | 104 | 6.1 |
| | No children received | 874 | 51.4 |
| | Children not eligible in their jurisdiction | 38 | 2.2 |
| | Don't remember | 43 | 2.5 |
| Parents' perceptions of COVID disease (not specific to children) | | | |
| Believe COVID-19 disease is severe | Agree | 1263 | 74.2 |
| | Disagree/Neutral | 439 | 25.8 |
| Believe at risk of COVID-19 disease | Agree | 734 | 43.1 |
| | Disagree/Neutral | 968 | 56.9 |
| Parents' perceptions of COVID vaccines (not specific to children) | | | |
| Believe vaccination against COVID-19 is necessary | Agree | 1191 | 70.0 |
| | Disagree/Neutral | 511 | 30.0 |
| Confident that the COVID-19 vaccines will be safe | Agree | 927 | 54.5 |
| | Disagree/Neutral | 775 | 45.5 |
| Constraints won't prevent access to the COVID-19 vaccine | Agree | 1061 | 62.3 |
| | Disagree/Neutral | 641 | 37.7 |
| Parents' acceptance of COVID vaccine for populations in which it has not originally been tested | | | |
| Would get my child(ren) vaccinated against COVID-19 even if the vaccine had not been originally tested in children | Agree | 376 | 22.1 |
| | Disagree/Neutral | 1326 | 77.9 |
| COVID-19 vaccine(s) should be given to specific population groups even if it hasn't been originally tested in that population group | Agree | 550 | 32.3 |
| | Disagree/Neutral | 1152 | 67.7 |

vaccination against COVID-19 is necessary, however only 54.5% had confidence that the COVID-19 vaccines available would be safe. Most parents did not support giving COVID-19 vaccines to their children (77.9%) or other populations (67.7%) if the vaccines had not been tested in these groups. Thirty-eight percent of respondents reported that everyday constraints would limit their access to COVID-19 vaccines.

3.3. Multivariable logistic regression

Few sociodemographic characteristics were associated with vaccination intention in the multivariable analysis. As shown in Table 3, parents who were employed part-time were more likely to have low intention to vaccinate their children against COVID-19, in comparison to parents who were employed full-time (aOR = 1.73, 95% CI: 1.06–2.84). Parents who mostly spoke lan-

guages other than English, French, or Indigenous languages at home were less likely to have low intention (i.e., they had higher intention) to vaccinate their children, compared to English speakers (aOR = 0.55, 95% CI: 0.32–0.92).

Some vaccination-related factors were associated with COVID-19 vaccination intention in the multivariable analysis. Parents of children who did not receive the influenza vaccine pre-pandemic were more likely to have low intention (i.e., were less likely) to vaccinate their children against COVID-19 (aOR = 1.51, 95% CI: 1.04–2.21), compared to those whose children received the influenza vaccine. Although the provinces of Quebec and British Columbia do not have publicly-funded influenza vaccination programs for all children, a sensitivity analysis removing respondents from these provinces confirmed no change in the association between children's previous influenza vaccination and COVID-19 vaccination. Parents who had low intention to vaccinate themselves

Table 3

Unadjusted and adjusted odds ratios for the association between various independent variables and parents' COVID-19 vaccination intention for their child (low intention versus the reference category of high intention; higher OR indicates stronger association with low intention to vaccinate).

| Independent variables | Unadjusted ORs (95% CI) | p-value | Adjusted ORs (95% CI) | p-value |
|--|-----------------------------|------------------|---------------------------|------------------|
| Parents' age^a | 0.88 (0.78, 0.99) | 0.03 | 0.89 (0.72, 1.09) | 0.26 |
| Gender | | | | |
| Woman (ref) | – | | – | |
| Man | 0.92 (0.75, 1.12) | 0.40 | 1.31 (0.91, 1.89) | 0.15 |
| Other | 1.65 (0.51, 5.32) | 0.39 | 1.73 (0.23, 13.51) | 0.60 |
| Highest level of education | | | | |
| More than Bachelor's degree (ref) | – | | – | |
| High school or less | 1.74 (1.20, 2.52) | 0.004 | 1.16 (0.61, 2.22) | 0.65 |
| Non-university certificate or diploma (college/apprenticeship) | 1.72 (1.27, 2.33) | <0.001 | 1.09 (0.65, 1.84) | 0.74 |
| University certificate or Bachelor's degree | 1.12 (0.84, 1.52) | 0.44 | 1.10 (0.68, 1.78) | 0.71 |
| Employment status | | | | |
| Full-time (ref) | – | | – | |
| Part-time | 1.58 (1.18, 2.10) | 0.002 | 1.73 (1.06, 2.84) | 0.029 |
| Unemployed | 1.55 (1.18, 2.03) | 0.001 | 1.39 (0.83, 2.32) | 0.21 |
| Household income | | | | |
| \$80,000 and more (ref) | – | | – | |
| <\$40,000 | 2.26 (1.69, 3.03) | <0.001 | 0.79 (0.44, 1.40) | 0.42 |
| Between \$40,000 and \$79,999 | 1.57 (1.25, 1.97) | <0.001 | 0.89 (0.60, 1.31) | 0.55 |
| Marital status | | | | |
| Married/common-law (ref) | – | | – | |
| Not married | 1.57 (1.22, 2.01) | <0.001 | 1.12 (0.72, 1.72) | 0.61 |
| Province | | | | |
| British Columbia (ref) | – | | – | |
| Alberta | 1.09 (0.72, 1.65) | 0.68 | 1.33 (0.65, 2.71) | 0.44 |
| Saskatchewan | 1.05 (0.58, 1.86) | 0.87 | 1.16 (0.45, 2.95) | 0.76 |
| Manitoba | 0.81 (0.47, 1.39) | 0.45 | 1.07 (0.44, 2.58) | 0.88 |
| Ontario | 1.05 (0.76, 1.46) | 0.78 | 1.02 (0.59, 1.79) | 0.94 |
| Quebec | 1.06 (0.75, 1.50) | 0.74 | 1.46 (0.68, 3.13) | 0.34 |
| Atlantic provinces | 0.83 (0.51, 1.33) | 0.44 | 0.99 (0.45, 2.18) | 0.98 |
| Newcomer | | | | |
| No (ref) | – | | – | |
| Yes | 0.93 (0.68, 1.26) | 0.64 | 1.14 (0.63, 2.07) | 0.67 |
| Language spoken most often at home | | | | |
| English (ref) | – | | – | |
| French | 1.10 (0.87, 1.40) | 0.42 | 1.00 (0.53, 1.92) | 0.99 |
| Indigenous | 1.70 (0.31, 9.23) | 0.52 | 0.28 (0.01, 4.81) | 0.37 |
| Other | 0.81 (0.60, 1.08) | 0.16 | 0.55 (0.32, 0.92) | 0.02 |
| Self-identified ethnicity | | | | |
| White (ref) | – | | – | |
| Visible minority and White-Visible minority ethnicity | 0.94 (0.75, 1.17) | 0.59 | 1.34 (0.87, 2.05) | 0.18 |
| Indigenous | 1.17 (0.82, 1.67) | 0.38 | 0.69 (0.38, 1.26) | 0.23 |
| Pre-pandemic routine vaccines received | | | | |
| All vaccines (ref) | – | | – | |
| Some vaccines | 2.42 (1.80, 3.26) | <0.001 | 1.13 (0.69, 1.85) | 0.62 |
| No vaccines | 3.24 (2.07, 5.13) | <0.001 | 0.99 (0.48, 2.08) | 0.98 |
| Child(ren) received influenza vaccine last year | | | | |
| All children received (ref) | – | | – | |
| Some received | 3.32 (2.16, 5.10) | <0.001 | 1.18 (0.60, 2.32) | 0.64 |
| None received | 3.36 (2.67, 4.24) | <0.001 | 1.51 (1.04, 2.21) | 0.03 |
| Believes COVID-19 disease is severe | | | | |
| Agree (ref) | – | | – | |
| Disagree/Neutral | 5.56 (4.40, 7.04) | <0.001 | 1.37 (0.91, 2.05) | 0.13 |
| Believes at risk of COVID-19 disease | | | | |
| Agree (ref) | – | | – | |
| Disagree/Neutral | 2.91 (2.36, 3.60) | <0.001 | 1.06 (0.75, 1.50) | 0.74 |
| Parents' COVID-19 vaccination intention for themselves | | | | |
| Agree (ref) | – | | – | |
| Disagree/Neutral | 31.09 (23.77, 41.03) | <0.001 | 9.22 (6.43, 13.34) | <0.001 |
| Believes vaccination against COVID-19 is necessary | | | | |
| Agree (ref) | – | | – | |
| Disagree/Neutral | 5.68 (4.55, 7.12) | <0.001 | 2.59 (1.72, 3.91) | <0.001 |
| Confident that COVID-19 vaccines will be safe | | | | |
| Agree (ref) | – | | – | |
| Disagree/Neutral | 15.46 (12.08, 19.94) | <0.001 | 4.21 (2.96, 5.99) | <0.001 |

(continued on next page)

Table 3 (continued)

| Independent variables | Unadjusted ORs (95% CI) | p-value | Adjusted ORs (95% CI) | p-value |
|--|---------------------------|------------------|--------------------------|------------------|
| Would get my child(ren) vaccinated against COVID-19 even if the vaccines had not been originally tested in children | | | | |
| Agree (ref) | – | – | – | – |
| Disagree/Neutral | 7.13 (5.08, 10.29) | <0.001 | 3.09 (1.87, 5.24) | <0.001 |
| Constraints won't prevent access to COVID-19 vaccines | | | | |
| Agree (ref) | – | – | – | – |
| Disagree/Neutral | 2.52 (2.05, 3.09) | <0.001 | 1.34 (0.92, 1.94) | 0.13 |

Notes. CI = confidence interval; OR = odds ratio.

^a Odds ratio reported for a 10-year unit increase in age.

against COVID-19 were nine times more likely to have low intention to vaccinate their children, compared to parents who had high intention to vaccinate themselves (aOR = 9.22, 95% CI: 6.43–13.34). Furthermore, parents who reported that COVID-19 vaccination was unnecessary and lacked confidence in the safety of COVID-19 vaccines were two and four times (respectively) more likely to have low vaccination intention for their children (aOR = 2.59, 95% CI: 1.72–3.91; aOR = 4.21, 95% CI: 2.96–5.99). Finally, opposing COVID-19 vaccination for their children if vaccines had not yet been tested in children was also associated with parents' low vaccination intention (aOR = 3.09, 95% CI: 1.87–5.24). Factors not significant in the multivariable model included children's routine vaccination status pre-pandemic, parents' perception of COVID-19 disease risk and severity, and perceived everyday constraints to accessing COVID-19 vaccination.

4. Discussion

This cross-sectional survey of Canadian parents, conducted December 2020, just as COVID-19 vaccines were approved for adults, found that most parents (63.1%) intended to vaccinate their children against COVID-19, if a safe and effective vaccine was available. Other surveys have found varying proportions of parents willing to vaccinate their children against COVID-19 in England (55.8%; May 2020) [5], Canada (60.4%; June 2020) [6], and China (72.6%; September 2020) [8].

On May 5, 2021, the Pfizer-BioNTech vaccine was approved for use in Canadian adolescents aged 12 years and older [19]. As of September 11, 2021, 80.9% of children aged 12–17 years had received at least one dose of this vaccine [24], which is higher than the estimated proportion of parents who intended to vaccinate their children against COVID-19 in this study and others [5,6,8]. This difference may be due to the timing of these studies, which were completed before widespread vaccination campaigns began, and there was limited information on the vaccines among the general population.

4.1. Routine and influenza vaccination

Previous research has shown that parents often make the decision to vaccinate their children with a newly developed vaccine based upon attitudes and perceptions towards established vaccines [21,25]. Earlier studies of parents' intentions regarding COVID-19 vaccines are consistent with these findings [6,10,15,26]. Contrarily, we found that routine childhood vaccination status before the pandemic was associated with parents' intention to vaccinate their children against COVID-19 in the unadjusted model, but not in the adjusted model. We controlled for additional variables in the adjusted model, including language most often spoken at home, newcomer status, and Indigenous self-identification, which could explain why this association changed.

We did find an association between COVID-19 vaccine intentions and previous influenza vaccination, similar to findings from

Hetherington and colleagues [6]. This was also observed during the H1N1 pandemic, in which those who had previously received the influenza vaccine were 21 times more likely to receive the H1N1 vaccine [27]. Therefore, our study suggests that parents' intentions about COVID-19 vaccination are better predicted by previous decisions regarding influenza vaccination than routine childhood vaccination. This is concerning given the historical low rates of influenza uptake in children [10,28,29], which may be due to parental concerns with the effectiveness or necessity of the vaccine in comparison to routine childhood vaccines [30]. Thus, those who vaccinate their children against influenza may be 'pro-vaccine', and are therefore more willing to accept COVID-19 vaccination.

4.2. COVID-19 vaccine-related factors

Parents' intention to receive a COVID-19 vaccine themselves was the most important independent factor associated with vaccination intention for their children, consistent with a recent study from the United States [31]. This finding suggests that efforts to reduce vaccine hesitancy and improve uptake among parents will likely improve uptake in children.

We also found a strong association between parents' COVID-19 vaccination intent for their children and their perceptions of vaccine safety. This is consistent with previous studies, which found that the newness, rapid development, and unknown long-term safety of COVID-19 vaccines was concerning to parents [5–7]. Additionally, our study and one other [7] found that opposing the use of COVID-19 vaccines in children without prior testing in children was significantly associated with parents' vaccination intention. As such, it is crucial that parents are made aware of recent studies that have assessed COVID-19 vaccine safety and effectiveness in younger populations [32].

We also found that parents who believed that vaccination against COVID-19 was unnecessary had lower intention to vaccinate their children against COVID-19. This finding is consistent with other studies of COVID-19 [5,10] and other diseases, including varicella and influenza [30,33]. At the time of the survey, COVID-19 cases in children were low, with severe cases occurring in older populations [34].

4.3. Sociodemographic characteristics

We examined potential differences in parents' COVID-19 vaccine intentions for their children among certain underserved population groups. As Canada is a multicultural nation, identifying predictors of parents' COVID-19 vaccination intention across diverse population groups is critical for inclusive and accessible vaccine delivery and messaging [35]. Although we found no differences in intention for newcomers to Canada and respondents who self-identified as Indigenous or a visible minority, parents who spoke languages other than English, French, or Indigenous languages at home were more likely to intend to vaccinate their children against COVID-19 than English speakers. This issue has not

been well-studied, other than in one Australian study, which found no association [36]. We hypothesize that parents who speak other languages may have lived in areas with higher rates of childhood morbidity and mortality from vaccine-preventable diseases, and thus may place higher value on vaccination.

Parents who were employed part-time had low COVID-19 vaccination intention for their children compared to those employed full-time. Few studies have investigated employment status as a predictor of parents' vaccination intention, other than Bell et al. [5], who did not find an association. We suggest that parents who work part-time may have increased capacity to stay home with children and reduce the risk of exposure to COVID-19, and therefore have less intention to vaccinate.

It is well-documented that some sociodemographic characteristics are associated with low vaccination rates in some underserved groups [37,38]. However, it is challenging to isolate relationships between individual characteristics due to overlap and interdependencies [29,37–39]. Parents in our study who had lower levels of education and income, were unemployed, and single, had lower COVID-19 vaccination intention for their children in the unadjusted model. However, after adjusting for other variables, these sociodemographic characteristics were not statistically significant. This suggests that these characteristics were not explanatory factors of vaccine intention, and rather may reflect other factors included in our model, such as perceptions about disease and/or vaccines [29,38,40].

4.4. Implications

Vaccination of children may decrease disease transmission and enable a return to social and recreational activities that are critical to maintaining their physical and mental health. As children 12–17 years old are now eligible for COVID-19 vaccination, and children < 12 years old will likely be eligible in the coming months, it is important to understand parents' perceptions and intentions toward COVID-19 vaccines. Our study provides perspective on this issue at a time when vaccines were first approved in Canada, but not yet offered to children. Research has shown that health care providers have significant influence on parents' decision-making around routine [41,42], influenza [29], and H1N1 vaccination [10,25], and thus may be important in encouraging COVID-19 vaccination. Messaging on social media platforms could also directly target this group to promote uptake.

4.5. Strengths and limitations

We collected information from a nationally representative sample of parents regarding their perceptions and intentions to vaccinate their children at a critical time, just as adult COVID-19 vaccination programs were beginning in Canada. Our study assessed novel factors in relation to parents' COVID-19 vaccination intention, including among diverse and underserved groups, and the use of COVID-19 vaccines in populations they were not originally tested in. However, our sample was selected from a pre-existing panel of individuals, so may exclude respondents who do not have easy access to computers or reading proficiency in English or French. Parents' general perceptions of COVID-19 disease and vaccination were asked, not in relation to their children. Information on how parents perceive COVID-19 disease and the effectiveness and safety of COVID-19 vaccination for their children may be more relevant for assessing vaccination intent for children. Lastly, some parents had multiple children, and we did not have information on which child their responses referred to. As such, we could not determine if parents' COVID-19 vaccination intention for their children differed based on age or between children.

5. Conclusion

Our findings show that perceptions of vaccine-related (e.g., safety, necessity) factors were more important predictors of parents' low COVID-19 vaccination intention for their children than sociodemographic characteristics. Children's influenza vaccination status pre-pandemic was a stronger predictor of COVID-19 vaccination intention than routine childhood vaccination. Public communication should highlight children's potential return to normal activities through vaccination and the safety and necessity of COVID-19 vaccination in children. Future research should also examine actual COVID-19 vaccination uptake in children, especially in underserved population groups, and assess the effectiveness of targeted strategies that promote vaccine uptake.

Authors' Statement

All authors attest that they meet the ICMJE criteria for authorship.

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Contributors

SM, RH were involved in conceptualization, investigation, formal analysis, writing (original draft, review, and editing).

HS was involved in formal analysis, writing (original draft, review, and editing).

ED, NM, JR, MD, MS, SBM, SW, KB assisted with conceptualization, methodology, writing (review and editing).

SL-P provided statistical analyses, writing (review and editing).

SM provided supervision and funding acquisition.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: MS has been an investigator on projects funded by GlaxoSmithKline, Merck, Pfizer, Sanofi-Pasteur, Seqirus, Symvivo and VBI Vaccines. All funds have been paid to his institute, and he has not received any personal payments. All other authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2021.10.002>.

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