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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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A R T I C L E   I N F O

Article history:
Received 28 July 2021
Received in revised form 29 September 2021
Accepted 4 October 2021
Available online 8 October 2021

Keywords:
COVID-19
Pandemic
Vaccination
Immunization
Parent
Intention
Perceptions

A B S T R A C T

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: 1.04–2.15), 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 intent 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 children aged routine vaccines. Sample size calculations estimated the minimum sample size needed for 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 in final analysis.
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.

3.2. Descriptive statistics

Sixty-five percent (64.6%) of our sample reported that if a safe and effective COVID-19 vaccine was available, they would get themselves vaccinated, and 63.1% would get their children vaccinated (Table 2). Most parents reported that their children received all routine vaccines before the pandemic (81.1%). Slightly less children < 7 years old received all routine vaccines before the pandemic (81.1%), compared to children 7–17 years old (83.5%). For the influenza season preceding the pandemic (2019–2020), less than half of parents reported that all (37.6%) or some (6.1%) of their children received the influenza vaccine.

Most respondents believed that COVID-19 disease is severe (74.2%), but less than half believed they were at risk of getting sick themselves (43.1%). Seventy percent of parents believed that

| Variable | Category | n | % |
|----------|----------|---|---|
| Parent's age, mean ± SD, (range in years) | 39.21 ± 8.44 (17–65) | 942 | 55.3 |
| Gender | Woman | 748 | 44.0 |
| | Man | 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 | 201 | 11.7 |
| | 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 | 1163 | 68.3 |
| | Married or common-law | 233 | 13.7 |
| | Prefer not to answer | 267 | 15.7 |
| 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 | 0–6 years old | 961 | 56.1 |
| | 7–11 years old | 759 | 44.6 |
| | 12–17 years old | 868 | 51.0 |
| Province | British Columbia | 434 | 25.5 |
| | Alberta | 206 | 12.1 |
| | Saskatchewan | 64 | 3.8 |
| | Manitoba | 82 | 4.8 |
| | Ontario | 613 | 36.0 |
| | Quebec | 233 | 13.7 |
| | Atlantic Provinces | 116 | 6.8 |
| | Prefer not to answer | 39 | 2.3 |
| Parents new to Canada in the past 5 years | Yes | 1163 | 68.3 |
| | No | 233 | 13.7 |
| Language spoken most often at home | English | 1163 | 68.3 |
| | French | 39 | 2.3 |
| | Indigenous | 6 | 0.4 |
| | Other | 267 | 15.7 |
| Self-identified ethnicity | White | 998 | 56.8 |
| | 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 |
| Indigenous groups | First Nations | 69 | 48.2 |
| | Métis | 50 | 33.3 |
| | Inuk | 31 | 21.5 |
| | Indigenous, unspecified/Prefer not to answer | 41 | 2.8 |
| Location of residence for Indigenous parents | Reserve, settlement, or other Indigenous community | 48 | 32.0 |
| | Rural | 23 | 15.7 |
| | 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).
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 languages 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 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  | 83.5 |
|                                                                        | Some vaccines received                   | 196  | 13.1 |
|                                                                        | 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                   | 195  | 20.1 |
|                                                                        | 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 |
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<sup>a</sup> | 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 | 0.80 (0.50, 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)
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 = 3.08, 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 not yet offered to children. Research has shown that health care providers have significant influence on 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.

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.

Funding

This work was funded by the Canadian Institutes of Health Research.

Contributors

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

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

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Acknowledgments

This research is part of a larger project conducted by the COVID-19 study team, which included the named authors as well as: J Bettinger; M Kiely; and E Rafferty. We express thanks to Applied Immunization (AImm) Research Program team members A Assi, L Reifferscheid, and E Marfo, who provided editorial support.

Appendix A. Supplementary data

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

References

[1] Statistics Canada. Table 39-10-0041-01 Census families with children by age of children and children by age groups [Internet]. Ottawa: Government of Canada; 2021. [updated 2021 Jul 22; cited 2021 Jul 22]. Available from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3910004101.

[2] Statistics Canada. Table 17-10-0005-01 Population estimates on July 1st, by age and sex [Internet]. Ottawa: Government of Canada; 2020. [updated 2021
Wang Z, She R, Chen X, Li L, Li L, Huang Z, et al. Parental acceptability of COVID-19 vaccine: A multi-methods study in England. Vaccine 2020;38(49):7789–98. https://doi.org/10.1016/j.vaccine.2020.10.027.

Hetherington E, Edwards SA, MacDonald SE, Racine N, Madigan S, McDonald S, et al. SARS-CoV-2 vaccination intentions among mothers of children aged 9 to 12 years: a survey of the All Our Families cohort. CMAJ Open 2021;9(2):E548–55. https://doi.org/10.9778/cmao.2020.0039.

Skjefte M, Ngirbabul M, Akeju O, Escudero D, Hernandez-Diaz S, Wyszynski DF, et al. COVID-19 vaccine acceptance among pregnant women and mothers of young children: results of a survey in 16 countries. Eur J Epidemiol 2021;36(2):197–211. https://doi.org/10.1007/s10654-021-00728-4.

Zhang KC, Fang Y, Cao H, Chen H, Hu T, Chen YQ, et al. Parental acceptability of COVID-19 vaccination for children under the age of 18 years: Cross-sectional online survey. JMIR Pediatr Parent 2020;3(2):e24827. https://doi.org/10.2196/24827.

Wang Z, She R, Chen X, Li L, Li L, Huang Z, et al. Parental acceptability of COVID-19 vaccination for children under the age of 18 years among Chinese doctors and nurses: a cross-sectional online survey. Hum Vacc Immunother 2021;17(9):3322–12. https://doi.org/10.1080/25785491.2021.1942640.

Lackner CL, Wang CH. Demographic, psychological, and experiential correlates of SARS-CoV-2 vaccination intentions in a sample of Canadian families. Vaccine 2021;8:100091. https://doi.org/10.1016/j.vaccine.2021.10.001.

Afifi TO, Salmon S, Tailleur T, Stewart-Tufescu A, Fortier J, Driedger SM. Older adolescents and young adults willingness to receive the COVID-19 vaccine: Implications for informing public health strategies. Vaccine 2021;39(26):3473–9. https://doi.org/10.1016/j.vaccine.2021.05.026.

McKinnon B, Quach C, Dubé É, Nguyen CT, Zinszer K. Social inequalities in COVID-19 vaccine acceptance and uptake for children and adolescents in Montreal, Canada: a cross-sectional study. MedRxiv [Preprint] 2021. https://doi.org/10.1101/2021.02.25.21252402.

Nguyen LH, Joshi AD, Drew DA, Merino J, Ma W, Lo C-H, et al. Racial and ethnic differences in COVID-19 vaccine hesitancy and uptake. MedRxiv [Preprint] 2021. https://doi.org/10.1101/2021.01.07.21233277.

Razai MS, Osama T, McKechnie DGJ, Majeed A. Covid-19 vaccine hesitancy among ethnic minority groups. BMJ 2021;372:https://doi.org/10.1136/bmj.n3513.

Rhodes ME, Sundstrom B, Ritter E, McKeever BW, Mckeever R. Preparing for a COVID-19 vaccination: Who do we vaccinate? Eur J Epidemiol 2021;36(1):332–22. https://doi.org/10.1007/s10654-020-00791-6.

Li Z, Doan Q, Dobson S. Determinants of influenza immunization uptake in Canadian youths. Vaccine 2020;28(19):3462–6. https://doi.org/10.1016/j.vaccine.2011.05.014.

Schmid P, Rauber D, Betsch C, Lidolt G, Denker M-L. Barriers of influenza vaccine intention and behavior – A systematic review of influenza vaccine hesitancy, 2005–2016. PLoS ONE 2017;12(1):e0170550. https://doi.org/10.1371/journal.pone.0170550.

Kemp A, Saville AW, Clunies R, Zimet G, Breek A, Helmink L, et al. Parental hesitancy about routine childhood and influenza vaccinations: A national survey. Pediatrics 2020;146(1):e20193852. https://doi.org/10.1542/peds.2019-3852.

Zilazog PS, Shah MD, Delgado JR, Thomas K, Vizueta N, Cui Y, et al. Parents' intentions and perceptions about COVID-19 vaccination for their children: results from a national survey. Pediatrics 2021;148(4):e2021052335. https://doi.org/10.1542/peds.2021-052335.

Frenck RW, Klein NP, Kirchin N, Gurtman A, Absalon J, Lockhart S, et al. Safety, immunogenicity, and efficacy of the BNT162b2 Covid-19 vaccine in adolescents. N Engl J Med 2021;385(23):39–50. https://doi.org/10.1056/NEJMoa2107456.

Bedford H, Lamersley M. More vaccines for children? Parents' views. Vaccine 2007;25(45):7818–23. https://doi.org/10.1016/j.vaccine.2007.08.057.

Public Health Agency of Canada (PHAC). COVID-19 daily epidemiological update, Figure 2: COVID-19 cases in Canada by date of illness onset and 10-year age groups [Internet]. Ottawa: PHAC; 2021. https://doi.org/10.1542/peds.2021-052335.

Thompson E, Edjour R, Archenzi N, Strika M, Gabrani-Juma I, Dawson T. COVID-19 vaccine: what for the case for collection by Canada’s drug product. Can Commun Dis Rep 2021;47(7):8(300–4). https://doi.org/10.14745/ccdr.v47i7a80.d.

Rhodes A, Hoq M, Messey M, Danchin M. Intention to vaccinate against COVID-19 in Australia. Lancet Infect Dis 2021;21:e110. https://doi.org/10.1016/S1473-3099(21)00066-3.

Ismail SJ, Hardy K, Tunis MC, Young K, Scard N, Quach C. A framework for the systematic consideration of ethics, equity, feasibility, and acceptability in vaccine program recommendations. Vaccine 2020;38(36):5861–76. https://doi.org/10.1016/j.vaccine.2020.05.051.

The SAGE Vaccine Hesitancy Working Group. Report of the SAGE working group on vaccine hesitancy [Internet]. Geneva: World Health Organization; 2014 [cited 2021 Apr 12]. 63 p. Available from: https://www.who.int/vaccine-access/sage/meetings/2014/04/1_Report_WORKINGGROUP_vaccine_hesitancy_final.pdf.

Brewer NT, Chapman GR, Rothman AJ, Leask J, Kempe A. Increasing vaccination: Putting psychological science into action. Psychol Sci Public Interest 2017;18(3):149–207. https://doi.org/10.1177/1529100617705521.

Karlsson LC, Soveri A, Lewandowski-Skylin L, Karlsson L, Nolvi S, et al. Fearing the disease or the vaccine: The case of COVID-19. Pers Individ Differ 2021;172:110590. https://doi.org/10.1016/j.paid.2021.110590.

Gellin BG, Malbich BW, Marcuse EK. Do parents understand immunizations? A national telephone survey. Pediatrics 2000;106(5):1097–102. https://doi.org/10.1542/peds.106.5.1097.

Gust DA, Darling N, Kennedy A, Schwartz B. Parents with doubts about vaccines: which vaccine and reasons why. Pediatrics 2008;122(4):718–25. https://doi.org/10.1542/peds.2007-0538.