Childhood Vaccination among Underserved Populations in Canada During the COVID-19 Pandemic: A Sequential Mixed Methods Approach Using Intersectionality Theory

by

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ABSTRACT

Background. Low routine childhood vaccination coverage and increased incidence of vaccine preventable diseases (VPDs) have been identified within some ethnocultural groups in Canada (i.e., Racialized minorities, newcomers). Inequities have been attributed to systemic barriers to accessing vaccines, and differential constraints associated with one's social location (i.e., age, education). The socioeconomic impact of the COVID-19 pandemic and disruptions to routine vaccine services created further accessibility challenges. Although a decline in childhood vaccination was reported in Canada early in the pandemic (i.e., 2020 and 2021), few Canadian studies have explored acceptance of childhood vaccines among parents of diverse ethnocultural groups and social locations during the pandemic. Quantitative methodologies measure determinants of routine vaccination within specified populations, and qualitative methodologies have the unique ability to contextualize associations among intersections of ethnocultural identities and social locations. Therefore, my paper-based dissertation project utilized mixed methods to assess how the COVID-19 pandemic influenced Canadian parents' perceptions and intentions towards routine vaccination, and access to services for their children ≤17 years old, across diverse ethnocultural identities and social locations.

Objectives. There are three dissertation objectives. The first study longitudinally explored parents' shifting perceptions and intentions toward routine vaccines and access for their children ≤17 years over time, and determined differences across sociodemographic factors. The second study cross-sectionally characterized perceptions and acceptance of childhood vaccination during the pandemic, among parents who self-identified as Indigenous, Racialized minorities, newcomers, those who primarily speak a minority language, and a reference group of parents who did not identify with these ethnocultural identities. The third study descriptively explored

more deeply how intersections of ethnocultural identities and social locations influenced parents' perceptions and acceptance of childhood vaccination.

Methods. There are three distinct methods, each as a stand-alone study; all three studies are complementary and integrative within a sequential mixed methods design. Intersectionality theory guided study development, analysis, and interpretation of results. Study methods included: (1) longitudinal analysis of two national surveys during the pandemic (Dec 2020 and Oct-Nov 2021) using McNemar-Bowker tests to assess changes over time in parents' perceptions, intentions, and access to vaccines for their children, and differences across sociodemographic factors; (2) regression analysis to assess differences across ethnocultural populations, and a reference group of parents, who reported in survey two (Oct-Nov 2021) about their perceptions of childhood vaccines, including discriminatory experiences; and (3) structured interviews (Feb-Mar 2023) with parents who self-identified with historically underserved groups. Participants described their ethnocultural identity, social locations, and vaccination experiences within and outside of Canada, and contextualized how these influenced vaccine decision-making during the pandemic. Qualitative descriptive analysis focused on emerging themes.

Results. Of the 650 parents in the first longitudinal study, 25.1% with child(ren) ≤6 years and 20.5% with child(ren) 7-17 years perceived that routine childhood vaccines were more important because of the pandemic. Over time parents' acceptance of routine vaccines increased (82.9% to 86.5%, p=.021), but more parents were undecided about influenza vaccination (12.6% to 20.3%, p=.002). Of the 2531 parents in the second study, 21.8% self-identified as Racialized minorities, 7.7% Indigenous, 23.3% newcomers, and 10.0% spoke minority languages most often. Significant findings included 36.6% of Indigenous parents who reported that routine vaccines were more important because of the pandemic, compared to 16.7% of newcomers.

Discrimination when accessing health services was most often experienced by Indigenous (27.8%) and Racialized minorities (20.2%), compared to the reference group (4.8%). Racialized minorities were more likely to report low acceptance compared to the reference group (aOR=2.19, 95% CI: 1.18–4.05). Themes identified through 17 semi-structured interviews with parents of ethnocultural groups in the third study include: (1) accessible vaccination but uncertain processes; (2) ethnocultural diversity protects against racialized discrimination; (3) normalization and socialization of vaccination fosters inclusivity; (4) challenges for newcomers without social supports; and (5) polarized perceptions towards different vaccines.

Conclusions. During the spotlight of COVID-19, parents' confidence in routine vaccines, engagement in decision-making, and vaccination acceptance increased. Differences in parents' acceptance of routine and influenza vaccines for their children highlight the need for targeted communication strategies for specific vaccines. Public health decision-makers should ensure equitable access to vaccination that targets inclusion of ethnocultural groups, who may experience disproportionate barriers and resultant low vaccine acceptance. Canada's multiculturalism fosters inclusive services for parents of ethnocultural groups.

PREFACE

Quantitative data collection for the national cross-sectional online survey (as detailed in manuscripts one and two) occurred within a large national study known as the *COVImm study*, (*Vaccination in a Pandemic: The impact on routine vaccinations and future COVID-19 vaccine acceptance*, Principal Investigator Dr. Shannon MacDonald), which was funded by the Canadian Institute for Health Research (CIHR) and the Canadian Immunization Research Network (CIRN). As co-investigator, I have been involved in the COVImm project since its inception and was actively involved in survey development. The COVImm study, of which this dissertation project is a part, received research ethics approval from the University of Alberta Research Ethics Board: *Vaccination in a pandemic - The impact on routine vaccinations and future COVID-19 vaccine acceptance*, Pro00102401, 2020-05-01. I received additional research ethics approval from the University of Alberta Research Ethics Board for the qualitative aspect of my dissertation study: *Acceptance and access to childhood routine vaccines among diverse Canadian populations during the COVID-19 pandemic*, Pro00116703, 2023-01-05.

This dissertation is my original work. Dr. Shannon MacDonald supervised this research project, having significant contributions to this dissertation with respect to its conceptualization and feedback provided on study methods, data collection and analysis. Dr. Joanne Olson and Dr. Shannon Scott (Faculty of Nursing, University of Alberta), and Dr. Eve Dubé (Centre de recherche du CHU de Québec-Université Laval) served as committee members for my dissertation, provided feedback at various stages of the dissertation, and are included as co-authors on three manuscripts. All aspects of the studies presented in chapters two to four are my original work, other than data collection for chapters two and three.

Published quantitative papers one and two are provided after the dissertation introduction chapter, followed by qualitative manuscript three.

1. Humble RM, Scott SD, Dubé E, Olson J, MacDonald SE. The impact of the COVID-19 pandemic on parents' perceptions and acceptance of routine childhood vaccination in Canada: a national longitudinal study. *Vaccine*. 2023; 41(2), 407–415. https://doi.org/10.1016/j.vaccine.2022.11.052 [Published, refereed, and open access]
2. Humble RM, Dubé E, Olson J, Scott SD, MacDonald SE. Routine childhood vaccination among ethnocultural groups in Canada during the COVID-19 pandemic: a national cross-

sectional study. *Preventive Medicine Reports.* 2023;36:102435. https://doi.org/10.1016/j.pmedr.2023.102435 [Published, refereed, and open access]

3. Humble, R.M., Olson, J., Scott, S.D., Dubé, E., & MacDonald, S.E. Ethnocultural perspectives on routine childhood vaccination during the COVID-19 pandemic: "Here in Canada, we're multicultural people, right?" Planned submission to the *Canadian Journal of Public Health*.

Contributions of authors in reference to the three above manuscripts: RH was involved in conceptualization, investigation, formal analysis, interpretation of findings, writing (original draft, review, and editing). SM, SS, JO, ED were involved in conceptualization, interpretation of findings, writing (review and editing); SM provided supervision and funding acquisition. All authors approved the final version of published manuscripts.

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CHAPTER ONE

Introduction

The known determinants of childhood vaccination in Canada may have shifted within the context of the COVID-19 pandemic. The socio-economic impact of the pandemic and disruptions to vaccine service delivery may have created additional challenges for some parents to vaccinate their children with routine vaccines.[1] Concomitantly, an increased focus on the importance of infectious disease prevention due to the pandemic may have positively affected parents' intention to vaccinate their children.[2] The pandemic also increased polarization and politicization of vaccination in Canada. While government mandates and recommendations promoted vaccination as an effective agent in the prevention of disease transmission and severity,[3] national groups protested against mandated COVID-19 vaccination.[3] What remains uncertain is how parents' perceptions, acceptance, and access to childhood vaccines may have changed within the context of the COVID-19 pandemic, and if there are differences among historically underserved ethnocultural groups.[4-6]

The overarching purpose of my paper-based dissertation assessed how the COVID-19 pandemic influenced Canadian parents' perceptions and intentions towards routine vaccination, and access to services for their children ≤17 years old, across diverse ethnocultural identities and social locations. Three individual study objectives and methods included in this dissertation are as follows: (1) Describe how parents' perceptions and acceptance of routine vaccines for their children ≤17 years changed during the pandemic and determine intersectional differences across sociodemographic factors. For the longitudinal analysis, I used data collected from two national surveys of the same respondents (N=650) during the pandemic (Dec 2020 and Oct-Nov 2021), and assessed the proportion and direction of difference between parents' responses at two time points; (2) Cross-sectionally characterize differences in perceptions and acceptance of childhood vaccination during the pandemic (Oct-Nov 2023) among parents (N=2531) who self-identified as Indigenous, Racialized minorities, newcomers, those who primarily speak a minority language, and a reference group of parents who did not identify with these ethnocultural identities. Discriminatory experiences when accessing health services were also assessed; and (3) Descriptively explore more deeply how intersections of ethnocultural identities and social locations influenced parents' perceptions and acceptance of childhood vaccination during the

COVID-19 pandemic among a sub-sample of parents (N=17) who participated in semi-structured interviews.

In the following sections of this introductory chapter, I situate my own ethnocultural identity and social location within the research topic and profession of nursing. I then provide a background to childhood vaccination in Canada and the associated rationale for the dissertation project. I discuss intersectionality as a guiding theory in study design, data collection, analysis and interpretation of results,[7] discuss how the Canadian National Advisory Committee on Immunization (NACI) equity matrix[8,9] was utilized to identify ethnocultural identities and social locations of parents (including definitions of each), and how the '5C psychological antecedents of vaccination' model[10] was used to measure parents' perceptions and intentions towards childhood vaccination. I describe the research methods and design for each of the three study objectives, followed by an assessment of the validity and reliability of quantitative and qualitative methods, risk for bias, study limitations, and mitigation strategies. Finally, I discuss ethical considerations, data storage and preservation processes, and how integrated and engaged knowledge users were incorporated throughout my dissertation project.

Chapters two through four include published objectives one and two studies, and the objective three study manuscript. In chapter five, I summarize the overall purpose of the dissertation project as a unified piece of work, and provide a comprehensive integrated discussion of the overall *sequential mixed methods design,*[11] including how each individual study built-upon each other to explore, compliment, and contribute towards addressing the overall purpose of the dissertation. In the conclusion, I discuss key implications for public health policy and practice, and provide recommendations for future research.

Positionality

It is important to situate my own ethnocultural identity and social location within this dissertation research. I was raised half on land, half submerged in the ocean, within a tiny community on Vancouver Island. Immersed in nature, my parents instilled deeply rooted respect as we harvested land and sea with gratitude and reciprocity. As a White European settler woman, I grew up alongside First Nations communities, many who had survived the atrocities of a nearby residential school. Social and health inequities within my community revealed underlying privilege and oppression yet, throughout my youth, remained unspoken. The silence perpetuated discriminations, and sparked in me an unsettling journey of reconciliation and social justice.

This journey continued throughout my work as a registered nurse among underserved communities in northern Canada and international settings. Profound experiential learning working as a registered nurse in Katutura, Namibia and rural Zambia revealed 'inclusion' and 'agency' as sacred surrogates of social justice. I tangibly observed the life-saving power of childhood vaccines, and the stark opposite where parents' opportunity to choose did not exist. My dissertation research remains grounded in these experiences, some of irreconcilable loss, that persist in the forefront of my intentions as I continue as a nurse educator and researcher.

Background

Routine childhood vaccines protect children from potentially life-threatening infectious diseases such as measles, mumps, and rubella (MMR).[12] In Canada, childhood vaccination is responsible for eradicating polio and has caused a 90-95% reduction in pertussis and measles infections.[13] Even so, in 2021, measles vaccination coverage for children at 7 years of age within Canada was 79.2%,[14] more than 15% below national targets, contributing to periodic outbreaks.[12,14-16] The determinants of low coverage are multiple and varied.

Determinants of vaccination include factors that influences the outcome behaviour of vaccine uptake.[17] ***Vaccine uptake*** refers to the proportion of a specified population that has received a vaccine.[17] Access to vaccines is one such factor, and is influenced by service delivery methods (e.g., location and hours of vaccination), socio-economic factors, and other social locations and intersections that impact a person's agency to engage with vaccine services. Furthermore, a person's perceptions, beliefs, and intention to get vaccinated influences vaccine uptake.[18] ***Vaccine hesitancy*** is defined as, "… a motivational state of being conflicted about, or opposed to, getting vaccinated; this includes intentions and willingness."[19] Vaccine hesitancy is understood as an intention or motivation, and is separate from the behaviour of accepting, delaying, or rejecting vaccination.[19,20]

Models of the determinants of vaccination include micro- and macro-level models that seek to identify and/or measure individual factors and environmental contexts that are related to vaccination decision-making and vaccine uptake. Developed in Germany by Betsch et al.,[10] the ***5C model*** provides a validated predictor of vaccination behaviour that measures psychological antecedents of vaccination. Within the 5C model, determinants of vaccine uptake include confidence (trust in the effectiveness and safety of vaccines and delivery systems), complacency (the perception of a disease's level of risk), constraints (psychological, social, and structural

barriers), calculation (level of engagement in acquiring vaccine knowledge), and collective responsibility (willingness to protect others).[10] An interplay exists between vaccine hesitancy, acceptance, intention to get vaccinated, access to services, and social contexts that create intersections on which the behaviour of vaccine uptake is dependent. Therefore, it is critical to understand that an individual's attitudes and beliefs are shaped and formed within social, political, religious, economic, and ethnocultural contexts that cannot be segregated from our pursuit of understanding vaccine hesitancy.[19]

Disparities exist in routine childhood vaccine uptake within some historically underserved ethnocultural groups in Canada.[2,4,15,21-23] The term '***underserved***' means that there is an increased likelihood that individuals within some population groups may experience difficulties in accessing vaccine and other health services, may receive a lower standard of care, or may experience different treatment from health care providers compared to other population groups.[4,5] An ***ethnocultural group*** is defined by shared characteristics such as country of origin, ethnicity, cultural traditions, language, or physical traits,[6] whereas ***social location*** (i.e., gender, age, income, education) describes an individual's relative status on a continuum of privilege and oppression, in comparison with the dominant social norms within their environment.[24] ***Underserved populations*** may include single-parent families, newcomers, refugees, those who primarily speak a minority language, Indigenous persons, or ethnocultural minorities, in addition to other social locations such as place of residence, gender identity, risk behaviours, religion, education, or age.[4,5,25] The ***equity matrix*** tool, developed by NACI, identifies potential inequities in vaccine uptake, reasons for inequities, and provides recommendations for interventions to reduce vaccine uptake inequity and improve access for identified underserved populations.[8,9] The equity matrix is a guiding framework that defines underserved populations by describing key factors and social intersections that contribute to health inequity. ***Intersectionality*** is the interconnection of social demographics, and as a theoretical approach, acknowledges overlapping and interdependent systems of discrimination or disadvantage.[26-28] Intersectionality theory and the NACI equity matrix are discussed at length in the following section.

The Chief Public Health Officer's Report on the State of Public Health in Canada[30] notes that although public health policies and programs should benefit all persons, persistent health inequalities exist within underserved populations, resulting from health systems and social discriminations that hinder access to health services.[8,12] For example, Bell et al.[31] found that in

Alberta, incomplete vaccination status (28.9%) for recommended routine childhood vaccines at 2 years of age was associated with multiple household moves, higher numbers of household children, and single marital status. Similarly, Cushon et al.[21] found MMR vaccination coverage rates at 2 years of age were significantly lower in low-income neighborhoods (43.7%) compared with affluent neighbourhoods (90.6%), and the rest of the city (69.1%). It is critical to note that low-income is not necessarily the cause of low vaccine uptake, but that other characteristics may intersect with low-income to confound vaccine uptake.[13,21] Unemployment, transportation constraints, decreased opportunity for post-secondary education, single parent status, housing insecurity, and being a member of a Racialized minority or Indigenous groups have been associated with low rates of vaccine uptake.[15,22] Low vaccination rates are also well documented within newcomer populations that may include immigrants, refugees, migrant workers and students, or trafficked and undocumented migrants.[23,32] Barriers to vaccination within newcomer populations are often attributed to culturally inappropriate services, misinformation regarding available vaccines, and inaccessible vaccine services due to language or other socio-cultural factors.[23,31-33] Overall, research has shown that childhood vaccination rates within some underserved and ethnocultural groups remain lower than mainstream populations who represent a social and cultural majority and are often associated with social privilege and higher socioeconomic status.[15,22,23,31-34]

Rationale, Guiding Theory, and Framework

Disruptions to routine vaccine service delivery, and other socio-economic constraints that occurred during the COVID-19 pandemic, may have created additional challenges for parents of some underserved groups to vaccinate their children.[1] Due to physical distancing measures to prevent the spread of COVID-19, many childhood vaccine programs across Canada experienced closures or difficulties in providing services.[1,35-37] International vaccination regulatory bodies raised awareness of declining childhood vaccinations in underserved populations globally,[38-40] due to disruptions to vaccine service delivery, school closures, economic hardship, and social measures implemented with the intention to stall the spread of COVID-19.[41,42] The World Health Organization called on countries to protect vaccine services to prevent other infectious disease outbreaks and minimize loss of life.[40,43] Canada responded to the growing crisis of decreasing vaccination rates, seeking to support routine vaccinations during the COVID-19 pandemic to reduce the re-emergence of other vaccine preventable diseases (VPDs).[44-46] However, as health

service provision is the responsibility of provincial and territorial governments within Canada, responses to this national call varied substantially across the county. [44-46]

The pandemic may have also had a positive effect on parents' perceptions and beliefs about the importance of vaccination against childhood VPDs.[2,25] For example, the pandemic may have caused increased awareness of the role of vaccination in preventing infectious disease morbidity and mortality, which may have motivated parents to vaccinate their children.[2] As posed by Harrison and Wu,[25] "Will the COVID-19 pandemic fix the problem of vaccine hesitancy?" What remains uncertain is how parents' perceptions, acceptance, and access to childhood vaccines may have changed within the context of the COVID-19 pandemic, and if there are differences among historically underserved groups.

Intersectionality theory

In 1989 Kimberlé Crenshaw and other women of colour coined the term intersectionality as a theory and analytical tool, using an intersection as a metaphor to describe Black women's experiences of multiple avenues of discrimination (e.g., racism, sexism, poverty) as they messily collide (intersect). [6] Intersectionality theory is the conceptualization of the ways in which social class, race, gender, and other social categories are shaped and interrelated through forces such as politics, colonialism, and social structures.[29] At the intersections of each, a continuum of power and oppression is created. Gaining momentum in social and health disciplines, intersectionality functions as a simple 'catch-all' term that metaphorically describes intersecting social complexities. The imperative of intersectionality is social justice and the explication of oppressive processes that drive inequalities.[27] Therefore, intersectionality theory is a mechanism for social action to transform the way we envision social diversities and the achievement of social justice by way of inclusion and health equity. Intersectionality theory guided my dissertation projects development, analysis, and interpretation of results.

Intrinsic to NACI's equity matrix, intersectionality assists in understanding the complexities of discrimination and disadvantage as exclusionary barriers to accessing vaccine services.[7] Intersectionality theory also provides a contextual lens to existing determinants of vaccination frameworks, such as the 5C model.[10] Furthermore, the primary tenet of intersectionality can be applied to vaccination service structures to actualize inclusive and accessible services.[24,27-29] In my dissertation project, I utilized an intersectional lens in all aspects of the study to gain understanding on how to create inclusive and accessible childhood

vaccination services for parents of ethnocultural groups and social locations historically underserved.

NACI equity matrix

I utilized NACI's equity matrix framework[8,9] to comprehensively identify underserved groups of parents, including ethnocultural identities such as those who self-identified as Indigenous, Racialized minorities, newcomers to Canada (i.e., being born outside of Canada), and parents who primarily spoke a language other than English or French. I chose the NACI equity matrix[8,9] as an equity seeking framework that explicitly outlines social locations and ethnocultural identities, and the intersections of each that contribute to vaccination inequities among historically underserved population groups in Canada. Furthermore, I utilized the equity matrix in the development of data collection tools (surveys and interview guide) and in guiding study analyses. Multiple social locations and the intersections of each were illustrated within study results, allowing for conceptualization of how these influenced parents' perceptions and intentions about childhood vaccination, and experiences when accessing services. The NACI equity matrix framework is provided in Table 1.1. Appendix 1 provides an example of the NACI equity matrix applied to a VPD.

Table 1.1 NACI Equity matrix: Vaccine preventable diseases, potential health inequities, and reasons of why inequities may exist

Factors that may contribute to health inequity	**Examples of why inequity may exist** (Differential access to healthcare, differential disease exposure/susceptibility/severity plus intersections with other factors)
Pre-existing condition (e.g., chronic disease, immunocompromise, pregnancy, disability)	Individuals who are immunocompromised may have an increased risk of developing some VPDs due to differential susceptibility and may be more likely to experience more severe disease and complications (differential severity and consequences). *Multiple possible intersections such as: age, socioeconomic status (SES), place of residence, social capital, racialization*
Place of residence (e.g., remote, overcrowding, homeless, institutionalisation)	Residents of care facilities may be more susceptible to VPDs due to chronic health conditions and may have increased exposure due to higher incidence of transmission in institutional environments. *Multiple possible intersections such as: pre-existing condition, SES, education/ literacy level, social capital, racialization*
Racialization (including ethnoracial and ethnocultural diversity, immigration or refugee status)	Racialized populations have differential access to healthcare and may experience stigmatisation and discrimination. Lower vaccination rates have been observed in immigrant children and seniors for some VPDs. *Multiple possible intersections such as: SES, place of residence, occupation, pre-existing conditions, social capital, education/literacy level*

Occupation	Transmission of infectious diseases (such as influenza) between HCW and vulnerable patients, who may be differentially susceptible, may result in higher incidence of morbidity and mortality. *Multiple possible intersections such as: SES, racialization, social capital*
Gender identity/sex	Men who have sex with men have a disproportionately high burden od some sexually transmitted infections (such as HPV) with differential exposure. *Multiple possible intersections such as: occupation, pre-existing conditions, SES, social capital, risk behaviours*
Religion/belief system	Religious beliefs about immunisation may result in differential access to vaccines. *Multiple possible intersections such as: racialization*
Education/literacy level	Those with lower education or literacy levels potentially have decreased access to healthcare. Lower levels of education (or parental education in the case of children) have been associated with lower vaccination rates in all age groups for various VPDs. *Multiple possible intersections such as: place of residence, occupation, pre-existing conditions, smoking, SES, racialization*
Socioeconomic status (SES) (including income, and coverage of healthcare and healthcare interventions)	Differential VPD severity has been shown to have large independent associations with low socioeconomic status. *Multiple possible intersections such as: place of residence, occupation, pre-existing conditions, social capital, education/literacy level, racialization*
Social capital (social support/ networks, trust)	Non-vaccination has been associated with single-parent families for some VPDs. *Multiple possible intersections such as: SES, place of residence, occupation, age, pre-existing conditions, education/literacy level*
Age	Age is a risk factor for developing some VPDs (such as herpes zoster) with differential disease severity for those of older age groups. *Multiple possible intersections such as: pre-existing conditions, social capital, SES*
Other factors (e.g., substance use disorders, smoking)	Some populations may have differential access to healthcare. *Multiple possible intersections such as: SES, social capital, place of residence, pre-existing conditions, education/literacy level*
Table adapted from: Ismail SJ, Tunis MC, Zhao L, Quach C. Navigating inequities: a roadmap out of the pandemic. *BMJ Global Health*. 2021;6(1):e004087-. https://doi.org/10.1136/bmjgh-2020-004087	

Methods of the Larger COVImm Project

This dissertation project is embedded within a large national study, known as the *COVImm study* (*Vaccination in a Pandemic: The impact on routine vaccinations and future COVID-19 vaccine acceptance*[47]) funded by the Canadian Institute for Health Research (CIHR) and the Canadian Immunization Research Network (CIRN). One component of the COVImm study was a series of national online surveys that focused on assessing perceptions and intentions of Canadians regarding routine and COVID-19 vaccines among diverse populations groups. As co-investigator, I was involved in the COVImm project since its inception and was actively

involved in development of the survey instruments. In addition to a national team of researchers, collaborators and knowledge users were involved in co-designing the COVImm national surveys. Knowledge users (described in detail in a following section) provided feedback at various points during survey development. In both surveys, NACI knowledge users also contributed specific survey questions to aid in the national prioritization and delivery of COVID-19 vaccination.[48] To address the first two objectives of this dissertation project, I conducted analyses of the national survey data.

Survey methods

The first data collection occurred by a web survey Dec 10-24, 2020. Respondents were randomly selected from the Leger Opinion panel,[49] which consists of 400,000 members from across every province and territory of Canada. An invitation email in English or French was sent to panelists with a custom web link to access the survey. The survey link remained active for a 2–3-week period and included a unique identification number for each respondent. Each questionnaire took 15-20 minutes for approximately 75 questions, including all sociodemographic variables, and open-ended questions. Leger Opinion members who completed each survey received financial remuneration as per their agreement as a member of the panel.[49]

The second web survey occurred Oct 14 - Nov 12, 2021 and utilized the same data collection methods described above for survey one. To facilitate longitudinal analysis between surveys, respondents who completed survey one were re-contacted requesting participation in survey two. Participant responses to both surveys were linked by a unique identification number. Additional participant recruitment occurred after re-contacting survey one respondents, until quotas were met for predetermined population groups. Purposive sampling of previously identified populations included: respondents new to Canada (i.e., newcomers), self-identified Indigenous and Racialized minorities, those whose first language was not English or French, among others. The research setting included 10 Canadian provinces, with population representation of the overall sample achieved by province and gender according to the most recent census.[50] Recruitment of respondents in the northern territories (i.e., Yukon, Northwest Territories, and Nunavut) was unsuccessful. The unweighted sample from both surveys that I used for my dissertation project included Canadian parents 15 years of age and older, who had at least one child ≤17 years old, had access to the internet, and who could read French or English.

Survey questionnaires

The survey questionnaires were based on a previous national survey of Canadians' acceptance of childhood vaccines[17] and a literature review of validated vaccination behaviour conceptual models and determinants of vaccination.[8,9,19,51-67] The surveys were created using the NACI equity matrix framework[8,9] to ensure potential and distinct inequalities were addressed in its development, the target sample, data collection, and outcome measures. The 5C psychological antecedents of vaccination model[10] was chosen as a validated measure of vaccine behaviours that determine the outcome of vaccine uptake. The 5C model is grounded in vaccine acceptance and hesitancy theoretical models and includes 5 category measures of vaccine uptake including confidence, complacency, constraints, calculation, and collective responsibility. The 5C model includes a short version (5-item scale questions) and long version (15 items) and has been tested internationally in 4 different studies.[10,51,68,69] The 5C questions utilized in the surveys are provided below in Table 1.2. The comprehensive 5C psychological antecedents of vaccination model[10] is provided in Appendix 2.

Table 1.2 5C questions included in the COVImm surveys

Instructions: How much you disagree or agree with the following statements. Response options: (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree). **Scoring:** mean scores of each sub-scale. **Short scale**: 5 bolded questions below. **Long scale:** includes an additional 10 questions (2 un-bolded long scale questions included below).	
Confidence. Trust in (i) the effectiveness and safety of vaccines, (ii) the system that delivers them, including the reliability and competence of the health services and health professionals, and (iii) the motivations of policymakers who decide on the need of vaccines.	
	Q. I am completely confident that vaccines are safe.
	Q. Vaccines are effective.
Complacency (where perceived risks of vaccine-preventable diseases are low and vaccination is not deemed a necessary preventive action)	
	Q. Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.
Constraints (when physical availability, affordability and willingness-to-pay, geographical accessibility, ability to understand (language and health literacy) and appeal of immunization service affect uptake)	
	Q. Everyday stress prevents me from getting vaccinated.
Calculation (an individuals' engagement in extensive information searching)	

	Q. When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.
Collective responsibility (willingness to protect others by one's own vaccination by means of herd immunity)	
	Q. When everyone is vaccinated, I don't have to get vaccinated too (Reverse coded).
	Q. Vaccination is a collective action to prevent the spread of diseases.
Table adapted from: Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Böhm R. Beyond confidence: development of a measure assessing the 5C psychological antecedents of vaccination. *PloS One*. 2018;13:e0208601. https://doi.org/10.1371/journal.pone.0208601	

Question branching within the surveys targeted relevant questions for subgroups and equity measures were vetted by three public health experts and other key informants who self-identify as Indigenous, were from a minority population, or whose first language was not English or French. The surveys were pre-tested, then validated on 20 members of the public, and revised as needed. Non-discriminatory and inclusive language was used throughout the surveys, as vetted by Dr. Devon Greyson,[70] an expert in health and social equity. A significant limitation is the questionnaire's availability only in English and French, considering the target population of parents whose first language is not English or French. In addition, the sample was drawn from a pre-existing panel,[49] and individuals who do not have access to the internet (e.g., due to remote location or low-income), are not reflected in the sample.

Survey data collection validity and reliability

The *Guide for Appraising Survey Reports*[71] was followed during survey development, and the *Checklist for Reporting Results of Internet E-Surveys* (CHERRIES)[72] was completed to reinforce validity and reliability of the collection tools (see Appendix 3 for the completed CHERRIES checklist). Prior to completing the surveys, respondents agreed to be contacted by phone for confirmation of identification, with 15% of participants contacted after completing each questionnaire. Of those contacted to confirm identification, the sample was considered valid and reliable if less than 10% failed to correctly confirm their identification. Respondents who failed confirmation of identification were replaced. Embedded consistency questions within the surveys cross-referenced the Leger Opinion panel database, to ensure the surveys were completed by the correct person. Unique URLs were required for each respondent and battery questions were monitored for "straight liners," where survey respondents might give identical answers when using the same response scale.[73,74]

Dissertation Objectives and Methods

I designed this sequential mixed methods dissertation with three distinct study methods. Each method addressed one specified objective as a stand-alone study; however, all three objectives and methods are complementary and integrative.

Objective one study methods

The research question for the first study was: How have parents' reported perceptions, intentions, access, and uptake of childhood vaccines for their children changed during the pandemic and does this differs across sociodemographic characteristics? Methods included longitudinal analysis of survey results collected at two points in time during the pandemic (Dec 2020 & Oct-Nov 2021) that assessed changes in parents' reported determinants of vaccination and uptake of childhood routine vaccines and assessed how these changes occurred across sociodemographic characteristics.

Study design. In this longitudinal study, I analysed differences in participants' responses at two time points during the pandemic, including parent-reported childhood vaccination status before (retrospective) and during the pandemic, perceptions of and access to vaccines, the 5C model,[10] and other known determinants of childhood vaccination.[8,19] The primary focus was the size and direction of differences between variables at two time-points during the pandemic that assessed changes in parents' perceptions and intentions over time. The analysis was stratified by sociodemographic characteristics. In general terms, I hypothesized that parents would report an increased acceptance and confidence of routine vaccines, and higher intentions to vaccinate their children for survey two in comparison with survey one and pre-pandemic (retrospective) reporting. I also hypothesized parents would report a decrease in routine childhood vaccine accessibility in survey two in comparison with survey one. Furthermore, I hypothesized that differences in parents' access to childhood vaccines by province (for example) may reflect jurisdictional measures implemented to prevent the transmission of COVID-19 disease (e.g., temporary closure of routine vaccination clinics).

Sample. The sample used for this study included parents of children ≤17 years old (N=650) from ten Canadian provinces who responded to both survey one and survey two.

Variables for analysis. My primary interest was the difference between the same variable at two points during the pandemic that assessed for changes in parents' perceptions and intentions over time. Variables were validated determinants of vaccination and included parent

reported: a) confidence in the safety of routine vaccines, b) necessity of routine vaccines, c) vaccination as a collective action to prevent the spread of disease, d) decision-making regarding routine vaccines, e) competing priorities that prevent routine vaccination, f) effectiveness of routine vaccines, g) views about whether routine vaccines should be mandated, h) routine and influenza vaccine intention and uptake before (retrospective) and during the pandemic, and i) a question that asked how the pandemic has changed the way parents think about routine vaccines (i.e., routine vaccines are more important, the pandemic has not changed how I think about routine vaccines, routine vaccines are less important). I stratified by sociodemographic variables, based-upon adequate sample sizes for individual demographic categories, and by focusing on social intersections that have been known to contribute towards inequitable access to vaccination (e.g., larger households, minority languages spoken most often, interprovincial differences).

Statistical methods. Descriptive statistics were used to assess frequency distributions, percentages, and mean/median/mode for central tendency of variables for each data collection time-point. I analysed descriptive statistics of sociodemographic factors collected from respondents for survey two to provide most recent demographic data (e.g., number of children, province of residence, income etc.). Respondents' data from survey one and survey two were paired and I utilized the McNemar-Bowker test (IBM SPSS Statistics Version 27) to assess the difference in participants' responses to the same survey questions at two time-points during the pandemic. To assess for time-point changes in survey responses across sociodemographic factors, I stratified respondents by key sociodemographic characteristics.

The three assumptions of the McNemar-Bowker test are (1) one variable is categorical with only two categories, and there is one variable with two paired groups (one variable at two time-points), (2) the two categories of the categorical variable must be mutually exclusive, and (3) the sample is a randomly selected.[75] The McNemar-Bowker test assesses the marginal homogeneity of two dichotomous variables in 2x2 contingency table. Therefore, I collapsed determinants of vaccination variables from a 5-point Likert scale into a binary variable of 'agree' (strongly agree/agree) versus 'neutral/disagree' (neutral/disagree/strongly disagree). Table 1.3 provides an example of one determinant of vaccination variable in a 2x2 contingency table.

Table 1.3 Example two-by-two contingency table of time-point measurements of matched pairs with parents' reported confidence in the safety of routine vaccines

	Survey 2: high confidence	**Survey 2:** low confidence	**Row total**
Survey 1: high confidence	*A*	*b*	*a + b*
Survey1: low confidence	*C*	*d*	*c + d*
Column total	*a + c*	*b + d*	*N*

In the above example, I hypothesized that parents would report an increased confidence in the safety of routine vaccines for survey two compared to survey one and, conversely, lower level of confidence in the safety of routine vaccines for survey one in comparison with survey two. Therefore, the null hypothesis of marginal homogeneity of confidence in the safety of routine vaccines states that the marginal probabilities for each outcome are the same (H_0:$P_b = P_c$, there is no difference in parents' level of confidence in safety of routine vaccines at two time-points during the pandemic). Whereas the alternative hypothesis of marginal homogeneity of confidence in the safety of routine vaccines states that the marginal probabilities for each outcome will be different (H_1:$Pb \neq Pc$, there will be a difference in parents' level of confidence in safety of routine vaccines at two time-points during the pandemic). I measured the difference in the proportion of parents' responses for each variable at two time-points using 95% confidence intervals ($p<.05$) for the sample as a whole and stratified across sociodemographic factors. I used post hoc tests to correct for multiple comparisons and stratum (e.g., Bonferroni's' and Stuart–Maxwell test marginal homogeneity in a square table with more than two columns/rows and the binomial sign test for consistency of difference between participants' pairs of observations).

Objective two study methods

The research question for the second study was: How have parents of various ethnocultural groups reported their perceptions and acceptance childhood routine vaccines 20 months after the start of the pandemic (Oct-Nov 2021), and are there differences between groups? I also assessed the relationship between reported discriminatory experiences when accessing health services and parents' childhood vaccination decision-making for their children.

Research design. For this cross-sectional study, I used survey two data (Oct-Nov 2021) from parents of children ≤17 years old among four ethnocultural groups, where discrimination and social intersections may contribute to health inequities,[8,22] and a reference group of parents who did not belong to any of the assesses ethnocultural groups. I examined the association between various predictors (e.g., determinants of vaccination), including experiences of discrimination, with the outcome, which was intentions and receipt of childhood vaccines during the pandemic.

To model characteristics associated with intent to receive/receipt of childhood vaccines (versus no intent to receive/no receipt), I conducted binary logistic regression analysis with various predictor variables. This analysis assisted in understanding the intersectionality of discrimination and exclusionary social locations to accessing vaccine services, as experienced by parents among ethnocultural groups.[4,30] This analysis was critical to evaluate if reported receipt/intention to receive childhood vaccines during the pandemic had changed since before the pandemic, and assess if differences existed among historically underserved ethnocultural groups.

Sample. The sample used for this study included parents of children ≤17 years old who responded to survey two (N=2531) who: self-identified as Indigenous or Racialized minority, newcomer (i.e., born outside of Canada), and/or minority language speakers, and a reference group of parents who do not self-identify with any of these ethnocultural identities. An intersectional variable also included mutually exclusive ethnocultural categories (i.e., one ethnocultural identity of Indigenous, Racialized minority, newcomer, or language minority; two identities of newcomer, Racialized, and/or language minority; three identities of newcomer, Racialized, and language minority; and a reference group of parents who do not self-identify with any of these ethnocultural identities). A larger sample of parents was intentionally recruited for survey two to enable my analysis.

Variables for analysis. For the outcome variable, I used the proportion of children ≤17 years old who were reported as having intent to receive/receipt of recommended childhood routine vaccines during the pandemic, compared to having no intent to receive/no receipt of routine vaccines during the pandemic. The following six categories of predictor variables were included: (1) four mutually exclusive ethnocultural groups and a reference group, (2) pre-pandemic childhood vaccination status, (3) perceptions of childhood vaccines, (4) barriers to accessing childhood vaccines, (5) discriminatory experiences when accessing health services,

and (6) intentions to vaccinate children against influenza. Sociodemographic variables of interest included province, age, level of education, employment status, annual household income, gender, marital status, and number and ages of children.

Sample size calculation. I chose the Indigenous population group (reference group: non-Indigenous) as the exposure variable used to estimate the required sample size, as it has been previously identified as a predictor of vaccination status.[76] An assumed effect size (aOR=.437) is based on the reference study by MacDonald et al.[76] who reported rotavirus vaccination status among Alberta's sub-populations. G*Power[77] sample calculations are provided in Appendix 4.

Statistical methods. I used descriptive statistics to assess frequency distributions, percentages, and mean/median/mode for central tendency of variables. I used multivariable logistic regression[78] (IBM SPSS Statistics Version 27) to measure the association between six categories of exposure variables with the binary outcome variable. The outcome of interest being predicted was parents who reported that they had no intent to receive/no receipt of routine childhood vaccines, as compared to having intent to receive/receipt of vaccines (the reference category). Unadjusted odds ratio (OR) and adjusted odds ratios (aOR) were estimated with 95% confidence intervals. Sociodemographic covariates were controlled for in the regression model. Interpretation of the regression analysis answered questions about the characteristics of parents who had intent to vaccinate/vaccinated their children during the pandemic, and characteristics of parents who had no intent to vaccinate/not vaccinated, and differences across ethnocultural groups.

Objective three study methods

The research question for the third study was: How have intersections of ethnocultural identities and social locations influenced perceptions about childhood vaccination and access to services during the COVID-19 pandemic, among a sub-sample of Racialized minorities, newcomers, Indigenous, and language minority parents? The qualitative study was guided and informed by objective two study results. Combined, the second and third studies utilized methodological triangulation,[79] and a *sequential mixed methods design.*[11] I collected and analysed quantitative data (objective two study) and based upon these findings, I then collected and analysed qualitative data (objective three study) with the purpose of gaining further understanding of quantitative results. In essence, the third study explored results from the

quantitative analysis that were surprising, and raised questions that would benefit from further exploration though a qualitative descriptive analysis.[80]

Research design. I used a qualitative descriptive study design. Semi-structured interviews were conducted with 17 parents, who were chosen from those who consented to be interviewed when responding to survey two (Oct-Nov 2021). Purposive selection of participants included parents of ethnocultural groups who met the NACI equity matrix[8,9] criteria of Racialized populations (i.e., ethnoracial and ethnocultural diversity, immigration or refugee status) who also reported intersecting sociodemographic characteristics commonly associated with underserved population groups (e.g., individuals who identify as Indigenous, newcomers to Canada, or those whose first language is not English or French). Interview guiding questions were informed by objective two study results and designed to explore silences and surprising findings. Furthermore, my third study explored how intersections of ethnocultural identities and social locations influenced parents' perceptions about childhood vaccinations, and experiences when accessing childhood vaccine services during the pandemic.

Participants. Of the parents of children ≤11 years of age who responded to survey two (Oct-Nov 2021), and who self-identified with one or more ethnocultural group of interest (N=536), 19.6% (n=105) consented to participate in a follow-up interview. I included purposive sampling of survey respondents to ensure representation of: (1) intersections of ethnocultural identities and social locations associated with underserved population groups,[8,9] (2) parents with varying intention to vaccinate their children against vaccine preventable diseases during the pandemic, and (3) parents among diverse sociodemographic characteristics (e.g., geographical location, age of parent, number and age of children, education, employment).

Recruitment. Email invitations were preferentially sent to parents who self-reported multiple ethnocultural identities to gain insights about intersectional influences on vaccination perceptions and decision-making for children. Email invitations included: (1) an introduction letter for the study, (2) a consent form, and (3) a request for dates and times when the participant was available for an interview. Of the 44 survey respondents invited to participate in an online semi-structured interview, 25 replied and consented to an interview. Data collection and analysis proceeded concurrently. Seventeen participants completed 20–40-minute semi-structured interviews between Feb 27 and Mar 27, 2023. I recruited participants until predetermined social intersections and ethnocultural diversities were represented and data saturation of identified

themes had been achieved. The online consent form and date/time schedule for an interview were managed using REDCap[81] electronic data capture tools hosted at the University of Alberta. Interviewees were provided a $50 gift card honorarium, as an expression of gratitude and reciprocity for their participation in the study. Processes for recruiting survey participants for an interview had been completed by the COVImm study previously. Therefore, I followed previous recruitment procedures as a guide for these methods.

Interview processes. Semi-structured interviews were conducted in English utilizing Zoom video conferencing and audio recording technology. Zoom audio recordings and transcriptions were downloaded onto the University of Alberta's secure Health Research Data Repository computer network, and subsequently deleted from the Zoom platform and any other online storage source. Interviews were transcribed by Microsoft Word transcription, reviewed for accuracy, cleaned, and revised minimally for readability and grammatical errors,[82] and to remove participant identifying information. All other participant correspondence and information was deleted after an allotted time when participants had opportunity to withdraw from the study (e.g., contact information and record of email communications). Interview processes described here followed previous interview processes conducted by the larger COVImm study research team.

Interview content. Interviews were conducted to explore silences and surprising findings of my objective two quantitative survey results. Therefore, participants were asked to describe their ethnocultural identities and social locations, including social and cultural perceptions of vaccination and previous experiences with vaccine preventable diseases. Questions explored participants' perceptions and beliefs regarding routine childhood vaccination, experiences of accessing vaccines during the COVID-19 pandemic, barriers and facilitators of vaccination, and whether participants had experienced discrimination and/or racism when accessing health services. Intersectionality remained a guiding focus in real-time throughout the semi-structured interview process as parents contextualized responses within their own ethnocultural identities and social locations. The interview guide is provided in Appendix 5. Final interview questions were developed after the completion of my objective two study and approved by the University of Alberta's Research Ethics Board prior to data collection (Project #00116703).

Data analysis. Descriptive thematic analysis was conducted according to methods described by Braun and Clarke.[83] I coded transcripts and developed a coding guide utilizing NVivo software (QSR International, Burlington, MA). The supervisory committee team

members (co-authors) reviewed coded transcripts for validation of identified themes. Inductive analysis explored emerging themes in the data, to determine whether participants' ethnocultural and social locations influenced their perceptions and experiences with regards to routine childhood vaccination during the COVID-19 pandemic. Parents' experiences are reported descriptively in common terms and verbatim, with low inference.[80] I described and summarized emerging themes across interviews.

Validity and Reliability of Study Methods

It is critical to assess the validity and reliability of quantitative and qualitative methods utilized within my dissertation project and to understand the risk for biases and limitations associated with each approach. The following sub-sections describe my understanding of issues related to validity and reliability of the study methods, and how I mitigated risk for biases and limitations known to be associated with methods utilized in this dissertation project.

Quantitative

Risk for bias and limitations. The online surveys completed by participants drawn from Leger's Opinion Panel[48] carried risk for bias and other inherent limitations. The sample included participants who were members of the panel, proficient in reading English or French and who had access to the internet. Therefore, a limitation is that individuals who could not read English or French were excluded from the study, as were those who did not have access to the internet. Considering that this study specifically sought to be inclusive of diversity and underserved populations, limitations of language and access to the internet threaten external and construct validity.[83] Survey participants self-reported their beliefs and behaviours, which may have introduced social desirability bias. Furthermore, participants self-reported population group membership, which may have introduced misclassification bias. Recall bias was also introduced when participants reported pre-pandemic vaccination status, 20 months after the start of the pandemic, as it may have been difficult for participants to accurately recall vaccination status of children prior to the start of the pandemic. Possible incorrect self-labeling (i.e., participants providing incorrect information) was a threat to construct validity with regards to sociodemographic outcomes assessed.

Leger provided representative sampling (by gender and age) for each province; however, in consideration of the described limitations, I could not assume the Opinion Panel was representative of the general Canadian population or the specified ethnocultural population

groups sampled. Therefore, internal validity of the study was threatened when considering between group comparisons of historically underserved populations. In addition, Leger was unsuccessful in recruiting participants from the Canadian territories, which threatens external validity, i.e., generalizability of results to that population.

Mitigation strategies for risk of bias and limitations. To support external validity, survey participants were selected at random from within Leger's Opinion Panel.[49] I assessed survey data from within population groups, between groups, and the overall sample for surface similarity and consistency, irrelevancies (implausible values), outliers (in the way of straightlining[73] or non-randomized missing data), and causal explanation between covariates.[84] I checked coding valences and potential participant misinterpretation of questions with the strategically situated open-ended questions to facilitate confirmation and interpretation of data. I assessed interpolation and extrapolation (projecting trends in the obtained data)[83] based upon existing literature on the determinants of childhood vaccination. I used statistical conclusion validity to assess confidence intervals for width and overlap when assessing validity of effect size between the outcome and exposure variables.[84] For my second study, I assigned sample size quotas of ethnocultural groups and the reference group to support the power and validity of inferences. National, provincial, and ethnocultural group generalizability was a purpose of this study, in addition to observed characteristics of the study sample population. I reported study limitations when publishing or presenting results. Survey language limitations were also discussed with regard to the population group of parents whose first language is not English or French.

Missing data and tests of assumptions. No survey data were missing due to data collection methods which meet sampling quotas based upon fully completed survey responses. Irrespective, I used frequency tables to confirm data were complete. Logistic regression was an appropriate statistical test for the second study analysis as it used a binary dependent variable, and observations that are independent of each other and do not arise from matched data or repeated measurements.[78] Logistic regression does not require some key assumptions associated with linear regression such as homoscedasticity, linear relationships between outcome and exposure variables, and normal distribution of residuals.[78] Tests of assumptions conducted for the logistic regression included an analysis of multicollinearity among the exposure variables by conducting independent logistic regression modeling. This test ensured exposure variables were

not too highly correlated with each other. I excluded variables from the regression model where a variance inflation factor (VIF) was found to be 5 or greater. I also created frequency tables for all categorical exposure variable pairs. Univariate logistic regression was conducted for each exposure variable to assess for confounding and multicollinearity and initial unadjusted results of each variable was provided on its own. There were no continuous independent variables, thus it was not necessary to assess for linearity related to the log odds.[78] Exposure variables included in the model were characteristics associated with vaccination behaviors that have been validated by previous research. Socio-demographic characteristics found to be statistically significant in the unadjusted regression model were included in the adjusted model.

Qualitative

Rigor and quality reporting. The notion of rigor is that by which integrity, competency, and legitimacy of the research process is achieved, irrespective of epistemological underpinnings,[84] and typically address a study's validity, reliability, and generalizability.[83-85] I utilized strategies for determining validity and reliability in qualitative research as described by Morse[85] during data collection, analysis, and reporting of results. These included peer review and debriefing, and rich description of data results (validity), development of a coding system and triangulation with survey data results (reliability).[86] Furthermore, I utilized the criteria of the *Consolidated Criteria for Reporting Qualitative Research (COREQ)*[87] when reporting qualitative data, analysis, and results. Appendix 6 provides the completed 32-item checklist.

Limitations and mitigating strategies. My objective three study included a small number of interview participants from diverse ethnocultural groups. Purposive sampling included multiple intersecting social locations and ethnocultural identities. Generalization of study results is not within the scope of my third study; rather, 'thick description' and verbatim were utilized for transferability[82] when reporting results. Although sociodemographic diversity was sought with purposive sampling, not all social diversities (as described by the NACI equity framework)[8,9] were represented. Rather, each participant's experiences and intersections of social locations are identified as unique to that individual. As a limitation, participants were selected based upon English comprehension and correspondence, which excluded non-English speaking participants from the study.

There are benefits and limitations to conducting virtual interviews using Zoom technology. Studies have found interviewees value the ease of participating from home with

reduced travel time and costs compared to in-person interviews.[88,89] Researchers report on the convenience of Zoom recording and transcribing technology, reduced costs, and the ability to recruit across large and diverse geographies.[88,89] Limitations include relying upon fallible technology for audio-visual, recording, transcription, and internet connectivity.[88,89] Further challenges include the loss of nuances, facial expression, and in-person social connection.[89] To mitigate technological challenges, I anticipated technology problem-solving in the scheduling of interviews. I also provided participants an 'introduction and tips for Zoom' document and offered the option to test audio-visual a few minutes prior to the scheduled interview for those not familiar. Finally, I provided an inviting and confidential space, clear lighting to assist with capturing facial expressions, and remained adaptable, giving ample opportunity for participants to communicate during the interview. No challenges with audio-visual technologies, recording, and transcription were encountered during the data collection process.

Ethical Considerations

Respondents from each study could self-identify as Indigenous or from a Racialized minority group. In addition to ethics approval obtained from the University of Alberta's Research Ethics Board, I utilized TCPS2: Chapter 9- Research Involving First Nations, Inuit and Métis Peoples of Canada[90] as a guideline for respectful, reciprocal, and collaborative research involving First Nations, Inuit, and Métis Peoples of Canada. I have also completed the principles OCAP©[91] (ownership, control, access, and possession) training that establish First Nations sovereignty and governance of how data and information is collected, shared, used, or protected. For the objective three study, I ensured that interview procedures abided by OCAP© principles for participants who self-identified as Indigenous.

Data Storage and Preservation

Data management for all three objectives followed the Tri-Agency Statement of Principles on Digital Data Management.[92] Data will be stored for five years in the University of Alberta's Health Research Data Repository; which is a secure and confidential virtual research environment, accessible only by express permission. I have not downloaded or saved any data on any personal or work computer, or held any study files within a 'cloud' storage system.

Integrated and Engaged Knowledge Users

The larger COVImm study team included a national knowledge user (Executive Secretary for NACI), and public health knowledge users in Alberta (Secretariat for the Alberta

Advisory Committee on Immunization), Québec (Comité sur l'immunisation du Québec), and British Columbia (BC Centre for Disease Control). Multidisciplinary team members included clinicians, epidemiologists, social scientists, vaccine experts, and policy-advisors. To note, contributors to the development of the NACI Equity Matrix[8,9] and the 5C model for vaccination behaviors[10] are included as knowledge users, as these theoretical frameworks are heavily relied upon within the COVImm study. The COVImm team is committed to equity, diversity and inclusion, and includes self-identified members of underserved groups, including multiple gender identities, Indigenous researchers, and Racialized groups.

Collaborators and knowledge users were involved in co-designing the COVImm project, including the grant application process and the national surveys. For my dissertation project, survey results and results of statistical analyses were provided to knowledge users prior to publication to support coordination of national and provincial public health responses and to support routine vaccination during the pandemic. In addition, I followed the criteria of the *TCPS2: Chapter 9- Research Involving First Nations, Inuit and Métis Peoples of Canada*,[90] including consulting with Indigenous partners before presenting findings. Survey one and two questions used for this dissertation project are available as published appendices to the articles for objectives one and two.

Conclusion

The pandemic has generated urgency for researchers and academics to understand how the pandemic has impacted perceptions of VPDs in general, and acceptance and uptake of vaccines among diverse population groups in Canada. Much of the focus on vaccination for children during the pandemic was on COVID-19 vaccination, with less research on understanding how perceptions and acceptance of routine vaccination has been affected by the pandemic. This dissertation includes one of the first Canadian studies to longitudinally explore how the pandemic has influenced parents' perceptions, intentions, and uptake of childhood vaccines, among a diverse national sample of parents. The project contributes knowledge about: (1) how the pandemic has affected parents' perceptions, intentions, and access to childhood vaccines; (2) potential barriers and enablers to accessing routine childhood vaccines during the pandemic; and (3) how parents' perceptions and experiences of accessing childhood services differ among intersections of social locations and ethnocultural identities. In the following chapters, I provide the three studies, each addressing a distinct objective of my dissertation.

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CHAPTER TWO

Objective One Paper

Title: The impact of the COVID-19 pandemic on parents' perceptions and acceptance of routine childhood vaccination in Canada: A national longitudinal study

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Abstract

Background. A decline in routine vaccination was reported by some countries early in the COVID-19 pandemic. In the context of the pandemic, determinants of routine childhood vaccination may have changed. Changes over time in parents' perceptions of routine vaccines and intentions for their children during the pandemic have not been fully explored. Understanding changes provides opportunities to promote routine childhood vaccines and address factors that may compromise parents' acceptance.

Methods. We conducted longitudinal analysis of two sequential national surveys during the pandemic (Dec 2020 and Oct-Nov 2021) to assess changes over time in Canadian parents' perceptions of routine childhood vaccines, intentions to vaccinate, access for their children ≤17 years, and differences among sociodemographic characteristics. McNemar-Bowker tests were used to determine changes in parents' responses collected at two time points.

Results. Of the 650 parents in the sample, 25.1% with a child ≤6 years and 20.5% with a child 7-17 years perceived that routine childhood vaccines were more important because of the pandemic. Between the two time points, parents' confidence in the safety (72.8% to 80.2%, p<.001) and effectiveness (81.7% to 85.2%, p=.007) of routine vaccines increased, parents were more engaged in vaccine decision-making (73.4% to 79.8%, p=.006), and everyday stress preventing vaccination decreased (78.8% to 68.5%, p<.001). Acceptance of routine vaccines increased (82.9% to 86.5%, p=.021), but more parents were undecided about influenza vaccination (12.6% to 20.3%, p=.002). Compared to parents with 1 child, those with 2 children reported increased vaccination acceptance (82.6% to 87.4%, p=.024).

Interpretation. Under the spotlight of COVID-19, parents' confidence in routine vaccines, engagement in decision-making, and vaccination acceptance increased. Vaccination providers should support parents' decision-making as they navigate routine childhood vaccine uncertainties. Differences in parents' acceptance of routine and influenza vaccines for their children highlight the need for targeted communication strategies for specific vaccines.

Key words: Vaccine, immunization, child, parents, COVID-19, pandemic

Introduction

SARS-CoV-2 has raised global awareness of the importance of infectious disease prevention, highlighting vaccine innovation and its critical role in the transition from pandemic to endemic.[1] The focus on COVID-19 vaccination raises questions about whether the pandemic has influenced perceptions towards existing routine childhood vaccines and parents' intentions to vaccinate. Prior to the pandemic, significant research focused on vaccine hesitancy as a key determinant of low routine childhood vaccination uptake.[2-5] As posed by Harrison and Wu,[6] "Will COVID-19 fix the problem of vaccine hesitancy?"

A stark decline in routine childhood vaccination was reported by many countries during the first waves of the pandemic (i.e., 2020 and 2021),[7-13] while others experienced an increase in uptake.[14] In 2019 before the COVID-19 pandemic, 78% of 2-year-old children in Canada had received all recommended doses of pertussis-containing vaccine,[15] with a notable decline in coverage reported in some provinces at the start of the pandemic (i.e., March-July 2020).[16,17] Declines were often attributed to stay-at-home orders, school closures, constraints on health resources and services (i.e., access to personal protective equipment, facility closures), and parents' fear of COVID-19 transmission when accessing vaccine services.[7,16-19] Regional,[20] national,[21,22] and international[23,24] immunization regulatory bodies provided urgent recommendations outlining the importance of continued vaccination services during the pandemic, fearing infectious disease outbreaks in at-risk populations.[25,26] Although routine vaccination rates trended towards pre-pandemic levels by January 2021, many regions reported time-delays in recommended coverage targets specific to the vaccine and age of the child.[16-19,27] These studies focus on administrative data and compare routine vaccination rates early in the pandemic to pre-pandemic levels. Few studies[28,29] have explored changes over time during the pandemic, in parents' perceptions of routine vaccines and their intentions to vaccinate their children.

The determinants of routine childhood vaccination may have changed within the context of the COVID-19 pandemic. Exploring these changes may present a timely opportunity for health officials and policy makers to identify areas to improve vaccination for a potentially captive audience. Therefore, this longitudinal study explores a national sample of parents' perceptions of routine childhood vaccines, intentions to vaccinate, and access to routine vaccines

for their child(ren) ≤17 years at two time points during the pandemic, and whether changes in vaccine acceptance vary by sociodemographic characteristics.

Methods

Study design and participants

We conducted two cross-sectional national online surveys with respondents selected from a panel of >400,000 Canadians from a well-established national polling firm.[30] Initial data collection occurred Dec 10-24 2020 just as the first COVID-19 vaccine, BNT162b2 (Pfizer-BioNTech), was approved by Health Canada, with prioritized administration for adults most at risk for COVID-19 disease (i.e., long term care residents and healthcare workers).[31] COVID-19 vaccines were readily available for those ≥12 years during the second data collection period (Oct 14 - Nov 12, 2021), however COVID-19 vaccination had not yet been approved for children aged 5-11 years.[32] The overall sample for each survey (Survey one, Dec 2020, N=5028; Survey two, Oct-Nov 2021, N=6,026) was representative for population size in all provinces, and by sex and age, based on data from the latest Census.[33] Respondents were adults who had access to the internet and were proficient in reading English or French. To ensure rigor and validity,[34] respondents had unique URLs and 15% of respondents were contacted by telephone for identity verification.

We purposively sampled minimum quotas of targeted populations. This included a quota of respondents who identified as being a primary caregiver to one or more children ≤17 years of age in their home. For longitudinal analysis, parents from 10 Canadian provinces who responded to both surveys were included in this study (N=650). Two age groups were assessed: children 0-6 years and 7-17 years old. Consistent with other studies,[35,36] if parents had multiple children within an age group, they were asked to respond for their youngest child in that group. We estimated the minimal sample size of the target parent 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 +/- 5% and 95% confidence intervals (CI).

Each of the approximately 75-question online surveys took an average of 19 minutes to complete. The survey instrument was developed by drawing from a previous survey of Canadians' acceptance of routine childhood vaccines,[35] previously validated questions about perceptions of vaccination (i.e., 5C psychological antecedents of vaccination),[37] 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 questionnaires were reviewed by public health experts, pre-tested with team members, and pilot tested with members of the public and revised accordingly. This study received approval from the Health Research Ethics Board at the University of Alberta.

Measures

Our primary focus was the proportion and direction of difference between each variable at two points during the pandemic to assess for changes in parents' perceptions and intentions over time. Variables were based on determinants of routine vaccination and included parents' confidence in the safety, necessity, and effectiveness of routine vaccines, vaccination as a collective action to prevent the spread of disease, vaccination decision-making, competing priorities that prevent vaccination, mandated vaccination, routine childhood and influenza vaccine intention and receipt before and during the pandemic, and a direct question that asked how the pandemic had changed the way that parents think about routine vaccines. Sociodemographic variables included: province, age, level of education, employment status, annual household income, gender, relationship status, number and ages of children, self-identified ethnicity, citizenship, new to Canada in the past 5 years, and languages most often spoken at home. Survey questions are provided as Appendix 7.

Statistical analysis

We calculated descriptive statistics (i.e., frequencies and percentages) for variables at each data collection time point. Respondents' paired data from survey one and survey two were analyzed using the McNemar-Bowker test with a significance level of .05 and 95% CIs to assess differences in participants' responses to the same survey question at two time-points during the pandemic. Sociodemographic factors from survey two were analyzed to reflect the most recent demographic data, including stratification by key characteristics. Post hoc tests were used to correct for multiple comparisons and stratum (i.e., Bonferroni's correction and Stuart–Maxwell test marginal homogeneity in a square table with more than two columns/rows). No data were missing due to the online survey completion requirements. We analyzed data using SPSS version 26.0 (IBM, Chicago, IL, USA).

Results

Sociodemographic characteristics of parent sample

The sample of parents who answered both surveys (N=650) was proportionately

representative of the national population by self-identified ethnicity, language spoken most often at home, citizenship, marital status of parents, and number of children.[38] As seen in Table 2.1, 65.4% of parents were from the provinces of Ontario and Quebec, followed by Alberta and British Columbia (21.4%), and 77.2% were between the ages of 30-49. Over half of parents had a university degree (59.5%), an annual household income ≥ $80,000 (56.6%), and 74.2% were employed full-time. Over half of respondents identified as a woman (55.4%), 86.5% were married or in a common-law relationship. Half of parents had 1 child (50.9%), with the remaining parents having two or more children (49.1%). One-third of parents (32.6%) had only preschool-aged children (0-6 years), 52.2% only had school-aged children (7-17 years), and 15.2% had children in both age categories. Two-thirds of parents self-identified as White (62.3%), were a Canadian citizen by birth (68.8%), and spoke English most often at home (61.1%). Thirty-seven percent of parents self-identified as a Racialized minority and 8.2% of parents were new to Canada within the past 5 years.

Table 2.1 Sociodemographic characteristics of parents of children ≤17 years old (N=650)

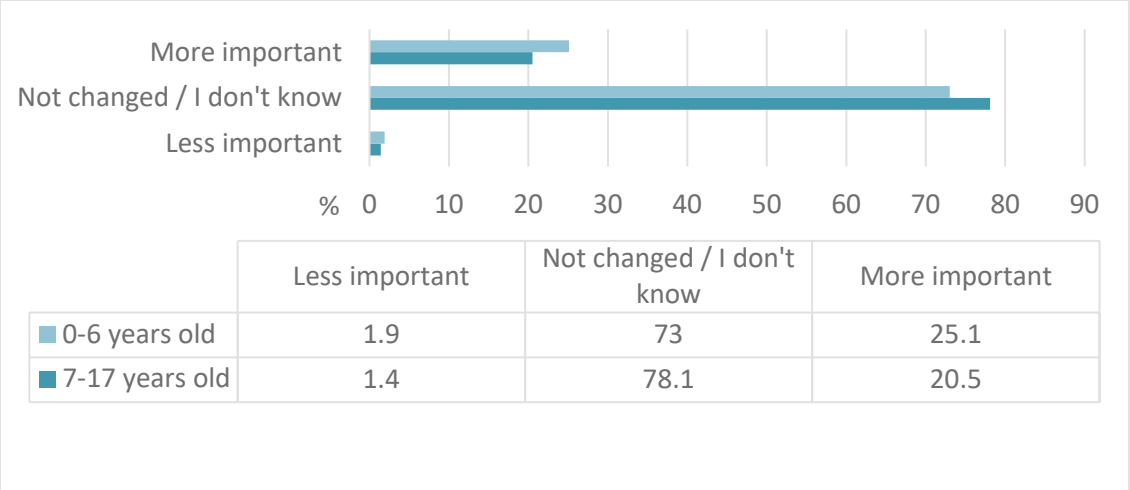
Characteristics[a]	**Category**	**Total n (%)**
Province of residence	British Columbia	68 (10.5)
	Alberta	71 (10.9)
	Saskatchewan and Manitoba	47 (7.2)
	Ontario	241 (37.1)
	Quebec	184 (28.3)
	Atlantic provinces[b]	39 (6.0)
Age	15-29 years	46 (7.1)
	30-39 years	231 (35.5)
	40-49 years	271 (41.7)
	50-59 years	96 (14.8)
	≥ 60 years	6 (0.9)
Highest level of education	High school or less	61 (9.4)
	Non-university certificate or diploma (college/apprenticeship)	196 (30.2)
	University degree/Bachelor's or more than a Bachelor's	387 (59.5)
	Prefer not to answer	6 (0.9)
Employment status	Full-time (≥37 hours per week)	482 (74.2)
	Part-time (<37 hours per week)	73 (11.2)
	Unemployed	77 (11.8)
	Prefer not to answer	18 (2.8)
Annual household income	< $40,000	58 (8.9)
	$40,000-79,000	170 (26.2)
	≥ $80,000	368 (56.6)
	Prefer not to answer	54 (8.3)
Gender	Woman	360 (55.4)

	Man	288 (44.3)
	Others	2 (0.3)
Relationship status	Not married	85 (13.1)
	Married/common-law	562 (86.5)
	Prefer not to answer	3 (0.5)
Number of children in household (0-17 years old)	1 child	331 (50.9)
	2 children	247 (38.0)
	3 or more children	72 (11.1)
Parents with a preschool and/or school aged child(ren)	Preschool aged child(ren) (0-6 years old) only	212 (32.6)
	School aged child(ren) (7-17 years old) only	339 (52.2)
	Preschool and school-aged children (0-6 & 7-17 years)	99 (15.2)
Ethnic or cultural origin	White	405 (62.3)
	Racialized minority[c]	207 (31.8)
	Indigenous[d]	34 (5.2)
	Prefer not to answer	4 (0.6)
Citizenship	Canadian citizen by birth	447 (68.8)
	Canadian citizen by immigration	135 (20.8)
	Permanent resident[e]	55 (8.7)
	Temporary resident[f]	12 (1.9)
	Prefer not to answer	1 (0.2)
New to Canada within the last 5 years	Yes	53 (8.2)
	No	597 (91.8)
Language spoken most often at home	English	397 (61.1)
	French	162 (24.9)
	Other languages	91 (14.0)

Notes.
[a] Sociodemographic characteristics provided from survey 2; data collection Oct-Nov 2021.
[b] Atlantic provinces include Prince Edward Island, Nova Scotia, New Brunswick, and Newfoundland and Labrador.
[c] Racialized minority groups including Black, Latin/Central American, Arabic/West Asian/North African, East Asian, South Asian, and any respondents who selected one of these groups and White.
[d] Indigenous respondents are individuals who self-identified as First Nations, Métis, or Inuk.
[e] Permanent resident refers to a landed immigrant.
[f] Temporary resident includes non-permanent residents, such as those in Canada on a work or study visa.

Parents' perceptions of routine vaccination during the COVID-19 pandemic

Figure 2.1 shows that 25.1% of parents with a child aged 0-6 years and 20.5% of parents with a child aged 7-17 years reported in survey two (Oct-Nov 2021) that they perceived routine childhood vaccines as being more important because of the COVID-19 pandemic.



	Less important	Not changed / I don't know	More important
0-6 years old	1.9	73	25.1
7-17 years old	1.4	78.1	20.5

Figure 2.1 How the pandemic has changed parents' perceptions of routine childhood vaccines, as reported in survey two

Note: variable data collection occurred only during survey 2, therefore change over time is not reported

As seen in Table 2.2, there were statistically significant increases over time in parents' confidence in routine vaccines (72.8% to 80.2%, p<.001), agreement that they weigh the benefits and risks of vaccination to make the best decision possible (73.4% to 79.8%, p=.006), and that routine vaccines are effective (81.7% to 85.2%, p=.007). Parents increasingly disagreed that everyday stress would prevent them from getting a routine vaccine over time (68.5% to 78.8%, p<.001). There was an increase over time in parents' acceptance of routine childhood vaccines during the pandemic (82.9% to 86.5%, p=.021), and a decrease in parents who reported no intent/receipt of routine childhood vaccines (12.5% to 8.3%, p=.021). Finally, parents were increasingly undecided about vaccinating their children against influenza (12.6% to 20.3%, p=.002).

Table 2.2 Changes in parents' responses at two time-points during the pandemic

Variable	Category	Survey 1 Dec 2020 N (%)	Survey 2 Oct-Nov 2021 N (%)	McNemar Bowker p-value
Parents' perceptions of routine vaccines				
How has the pandemic changed the way you think about routine vaccines in general?[a]	Routine vaccines are more important	149 (22.9)	176 (27.1)	p =.166
	The pandemic has not changed how I think about routine vaccines	480 (73.8)	459 (70.6)	
	Routine vaccines are less important	21 (3.2)	15 (2.3)	

I am completely confident that routine vaccines are safe[a]	Agree, more likely to vaccinate	**473 (72.8)**	**521 (80.2)**	**p <.001**
	Neutral	**112 (17.2)**	**78 (12.0)**	
	Disagree, less likely to vaccinate	65 (10.0)	51 (7.8)	
Routine vaccination is necessary because vaccine-preventable diseases are common[a]	Agree, more likely to vaccinate	476 (73.2)	457 (70.3)	p =.268
	Neutral	98 (15.1)	97 (14.9)	
	Disagree, less likely to vaccinate	76 (11.7)	96 (14.8)	
Vaccination is a collective action to prevent the spread of disease[a]	Agree, more likely to vaccinate	550 (84.6)	559 (86.0)	p =.698
	Neutral	64 (9.8)	55 (8.5)	
	Disagree, less likely to vaccinate	36 (5.5)	36 (5.5)	
When I think about getting vaccinated, I weigh the benefits and risks to make the best decision possible[a]	Agree, more likely to vaccinate	**477 (73.4)**	**519 (79.8)**	**p =.006**
	Neutral	110 (16.9)	94 (14.5)	
	Disagree, less likely to vaccinate	**63 (9.7)**	**37 (5.7)**	
Everyday stress (such as competing priorities or many demands on my time) prevents me from getting vaccinated[a]	Disagree, more likely to vaccinate	**445 (68.5)**	**512 (78.8)**	**p <.001**
	Neutral	**130 (20.0)**	**68 (10.5)**	
	Agree, less likely to vaccinate	75 (11.8)	70 (10.8)	
Vaccines are effective[a]	Agree	**531 (81.7)**	**554 (85.2)**	**p =.007**
	Neutral	**90 (13.8)**	**57 (8.8)**	
	Disagree	29 (4.5)	39 (6.0)	
It should be mandatory for children to get the recommended childhood vaccines	Agree	456 (70.2)	445 (68.5)	p =.207
	Neutral	106 (16.3)	109 (16.8)	
	Disagree	88 (13.5)	96 (14.8)	
Routine childhood and influenza vaccine acceptance				
Parents' routine childhood vaccination intent/receipt for their children during the COVID-19 pandemic	Intent/receipt	**539 (82.9)**	**562 (86.5)**	**p =.021**
	No intent/no receipt	**81 (12.5)**	**54 (8.3)**	
	I don't know	30 (4.6)	34 (5.2)	
Child's reported receipt of seasonal influenza vaccine[b c]	Received	279 (42.9)	252 (38.8)	p =.087
	Not received	349 (53.7)	367 (56.5)	
	Not eligible	11 (1.7)	19 (2.9)	
	I don't remember	11 (1.7)	12 (1.8)	
Parents' influenza vaccination intent for their children[c d]	Intent to vaccinate	**296 (45.5)**	**277 (42.6)**	**p =.002**
	Undecided	**82 (12.6)**	**132 (20.3)**	
	No intent to vaccinate	**256 (39.4)**	**221 (34.0)**	
	Not eligible	16 (2.5)	20 (3.1)	

[a] Parents responded in reference to routine vaccines in general, not specific to routine childhood vaccines
[b] Parents reported children's receipt of seasonal influenza vaccine for the 2019-2020 influenza season in survey 1, and for the 2020-2021 influenza season in survey 2.
[c] Influenza vaccination is not publicly funded for healthy children in some Canadian provinces.
[d] Parents reported intention to vaccinate their child against influenza for the 2020-2021 influenza season in survey 1, and the 2021-2022 influenza season in survey 2.

Of the 111 parents in survey one who were uncertain or would not accept routine childhood vaccination during the pandemic, 19.8% reported that they were waiting for the pandemic to be over and 18.0% were worried about COVID-19 transmission at the appointment (Figure 2.2). Of the 88 parents in survey two who were uncertain or would not accept routine childhood vaccination during the pandemic, parents were less concerned about COVID-19 transmission at the appointment (9.1%), were waiting for the pandemic to be over (19.3%) or were not sure if appointments were happening (17.0%).

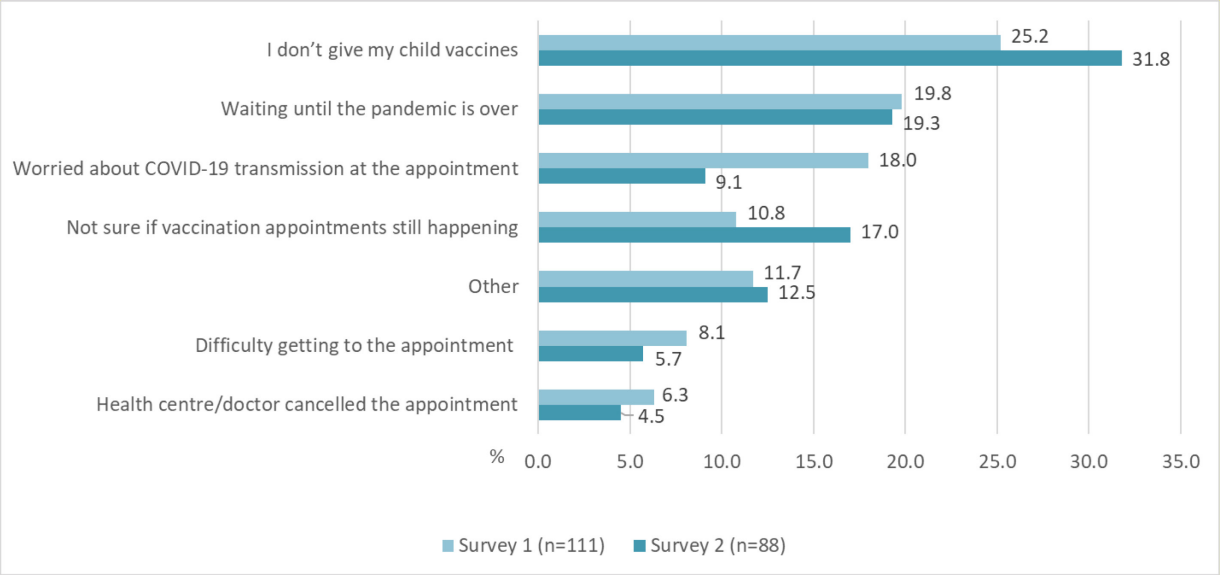


Figure 2.2 Parents' reasons for not accepting routine childhood vaccines during the pandemic, among parents who indicated they were uncertain or declining routine vaccines

Table 2.3 shows parents' acceptance of routine childhood vaccines stratified by sociodemographic characteristics. Compared to other provinces, those from Ontario reported an increase over time in vaccine acceptance for their children during the pandemic (80.4% to 87.1%, p=.007) and a decrease in no intent/no receipt (15.4% to 7.5%, p=.007). Parents with two children reported an increase over time in routine vaccine acceptance for their children (82.6% to 87.4%, p=.024), and a decrease in no intent/no receipt (11.3% to 6.1%, p=.024), compared to parents with one child. No other sociodemographic factors were significant (See Appendix 8).

Table 2.3 Routine childhood vaccine acceptance during the pandemic stratified by sociodemographic characteristics

Variable		Category	Survey 1 N (%)	Survey 2 N (%)	McNemar p-value
Language	English (n=397)	Intent/receipt	327 (82.4)	343 (86.4)	p =.15
		No intent/no receipt	51 (12.8)	35 (8.8)	
		I don't know	19 (4.8)	19 (4.8)	
	French (n=162)	Intent/receipt	136 (84)	138 (85.2)	p =.103
		No intent/no receipt	18 (11.1)	10 (6.2)	
		I don't know	8 (4.9)	14 (8.6)	
	Other (n=91)	Intent/receipt	76 (83.5)	81 (89.0)	p =.429
		No intent/no receipt	12 (13.2)	9 (9.9)	
		I don't know	3 (3.3)	1 (1.1)	
Province	BC Prairies[a] (n=186)	Intent/receipt	155 (83.3)	161 (86.6)	p =.559
		No intent/no receipt	20 (10.8)	18 (9.7)	
		I don't know	11 (5.9)	7 (3.8)	
	Ontario (n=241)	Intent/receipt	**194 (80.5)**	**210 (87.1)**	**p =.007**
		No intent/no receipt	**37 (15.4)**	**18 (7.5)**	
		I don't know	10 (4.1)	13 (5.4)	
	Quebec (n=184)	Intent/receipt	155 (84.2)	159 (86.4)	p =.053
		No intent/no receipt	21 (11.4)	12 (6.5)	
		I don't know	8 (4.3)	13 (7.1)	
	Atlantic (n=39)	Intent/receipt	35 (89.7)	32 (82.1)	p =.407
		No intent/no receipt	3 (7.7)	6 (15.4)	
		I don't know	1 (2.6)	1 (2.6)	
Number of Children	1 child (n=331)	Intent/receipt	278 (84.0)	285 (86.1)	p =.488
		No intent/no receipt	42 (12.7)	32 (9.7)	
		I don't know	11 (3.3)	14 (4.2)	
	2 children (n=247)	Intent/receipt	**204 (82.6)**	**216 (87.4)**	**p =.024**
		No intent/no receipt	**28 (11.3)**	**15 (6.1)**	
		I don't know	15 (6.1)	16 (6.5)	
	≥ 3 children (n=72)	Intent/receipt	57 (79.2)	61 (84.7)	p =.611
		No intent/no receipt	11 (15.3)	7 (9.7)	
		I don't know	4 (5.6)	4 (5.6)	

[a] Prairie provinces include Alberta, Saskatchewan, and Manitoba (collapsed due to sample size).

Table 2.4 shows parents' reported vaccination status of their children before the pandemic, in comparison with parents' vaccine acceptance for their children at two points during the pandemic. Compared to children's pre-pandemic vaccination status, parents of children aged 0-6 and 7-17 years reported a decrease in routine vaccine acceptance at the time of survey one (93.5% to 85.5% and 92% to 80.9% respectively). Parents reported a slight increase in routine vaccine acceptance for survey two (89.7% and 84.9% respectively). However, these results are not significant, as CIs overlap.

Table 2.4 Parents' acceptance of routine childhood vaccines before and during the pandemic

Variable	Category	Survey 1 Pre-pandemic[a] receipt % (CI), n	Survey 1 Dec 2020 intent/receipt % (CI), n	Survey 2 Oct-Nov 2021 intent/receipt % (CI), n
Parents of preschool-aged children (0-6 years) routine childhood vaccination intent/receipt (survey 1 N=388; survey 2 N=311)[b]	Intent/receipt	93.5 (87.4 - 97.1), 316	85.5 (77.6 - 91.4), 289	89.7 (82.6 - 94.5), 279
	No intent/no receipt	5.3 (2.1 - 11), 18	12.4 (7.0 - 19.9), 42	7.7 (3.7 - 14.1), 24
	I don't know	1.2 (0.2 - 4.9), 4	2.1 (0.5 - 6.4), 7	2.6 (0.7 - 7.2), 8
Parents of school-aged children (7-17 years) routine childhood vaccination intent/receipt (survey 1 N=423; survey 2 N=438)[b]	Intent/receipt	92.0 (85.5 - 96.1), 389	80.9 (72.4 - 87.7), 342	84.9 (76.9 - 90.9), 372
	No intent/no receipt	5.7 (2.4 - 11.6), 24	13.9 (8.2 - 21.7), 59	10.0 (5.3 - 17.0), 44
	I don't know	2.4 (0.6 - 6.9), 10	5.2 (2.1 - 10.9), 22	5.0 (1.9 - 10.6), 22
Parents of children aged 0-17 years routine childhood vaccination intent/receipt[c] (N=650)	Intent/receipt	92.3 (85.9 - 96.3), 600	82.9 (74.6 - 89.3), 539	86.5 (78.8 - 92.1), 562
	No intent/no receipt	5.8 (2.4 - 11.7), 38	12.5 (7.1 - 20.0), 81	8.3 (4.1 - 14.9), 54
	I don't know	1.8 (0.3 - 5.9), 12	4.6 (1.7 - 10.1), 30	5.2 (2.1 - 10.9), 34

[a] Pre-pandemic routine childhood vaccination status reported by parents in Survey 1, Dec 20, 2020.
[b] Differences in survey 1 and survey 2 N is due to children changing age groups between data collection points.
[c] Variable for parents with children 0-6 years and 7-17 years old combined. Responses of parents who had a child in each age group (0-6 years and 7-17 years old), and who answered both "received" and "not received" was coded as "I don't know."

Discussion

Changes in parents' perceptions of routine childhood vaccines

In Oct-Nov 2021 during the second wave of the COVID-19 pandemic [i.e., when the Delta variant (B.1.617.2) was prominent and prior to the Omicron variant (B.1.1.529)], almost 25% of parents in our study reported that they perceived routine childhood vaccination as being more important as a result of the COVID-19 pandemic. We found an increase over time in parents' perceived importance of routine vaccines in general (e.g., childhood and adult routine vaccines) and significant increases in parents' reported confidence in their safety and effectiveness. Findings suggest that the COVID-19 pandemic has positively influenced Canadian

parents' perceptions about the importance of routine vaccines in preventing infectious diseases. Conversely, a study from the United States[29] found an increase in parents' routine childhood vaccine hesitancy and risk perception, and unchanged confidence in routine vaccines during the pandemic (Sept 2020 - Feb 2021). However, this was a regional study (N=252) and measures of perceived risk and confidence in routine vaccines focused on trustworthiness in government and health systems.[4,29] Therefore, differences in population characteristics, government policy, and vaccine delivery may account for discrepancies.

Parents in our study reported an increase over time in weighing the benefits and risks of routine vaccines when engaging in decision-making. It is possible that the global attention on the benefits, risks, and efficiency of COVID-19 vaccines in conjunction with parents' ongoing (over a long period of time) active engagement in COVID-19 vaccine decision-making for their children, may have translated into active-engagement in routine vaccine decision-making. Research has shown that trusting relationships with health care providers supports parents' confidence and acceptance of routine vaccines when deciding whether to vaccinate their children.[4,18] Our results demonstrate that under the spotlight of the pandemic, parents are actively weighing the benefits and risks of routine vaccines. Therefore, a critical opportunity exists for frontline care providers to support parents' decision-making as they navigate vaccination uncertainties.

Over time more parents agreed that everyday stress would not prevent access to routine vaccines, suggesting that everyday stressors were perceived less as a barrier to accessing vaccines as the pandemic progressed. Along with increased perceptions of the importance, safety, and effectiveness of routine vaccines, parents in our study may have been more motivated to actively overcome perceived barriers to accessing routine vaccines. It is noteworthy that parents in Canada were less likely to encounter barriers to accessing routine childhood vaccines later in the pandemic due to the resumption of preschool-aged and school-based vaccination programs.[39,40]

Changes in parents' acceptance of routine and influenza vaccines

We found a significant increase over time in parents' acceptance of routine vaccines for their children during the pandemic. Results may be explained in-part by parents' perceptions that routine childhood vaccines were more important, safe, and effective. It is also noteworthy that parents' lower acceptance reported in Dec 2020 may be reflective of stay-at-home measures,[7,16]

school and vaccination service disruptions,[40] initial absence of COVID-19 vaccines (i.e., Pfizer-BioNTech was approved in Canada Dec 9, 2020),[41] and fear of COVID-19 transmission at vaccination appointments.[8,12,18] Accordingly, our results suggest that parents were more concerned about COVID-19 transmission at vaccination appointments in Dec 2020 than they were in Oct-Nov 2021, when COVID-19 vaccines were widely accepted and available for persons aged 12 year and older within Canada.[42] Furthermore, parents in our study reported high routine childhood vaccination receipt before the pandemic, with a marked decrease in routine childhood vaccine acceptance in Dec 2020, and subsequent increasing acceptance in Oct-Nov 2021. Results are consistent with other Canadian[17,19,27] and international[9,10] studies that found a significant decrease in routine childhood vaccination rates early in the pandemic, compared to before the pandemic, with a gradual recovery in vaccination rates as the pandemic progressed. Data collection in our study occurred prior to the more contagious COVID-19 Omicron variant (B.1.1.529), which may have further affected parents' perceptions and acceptance of routine childhood vaccines.

A pan-Canadian environmental scan[40] from our research team reported disruptions to routine childhood vaccination services in all provinces. Of particular interest are differences in the recovery of vaccination rates between provinces, which are likely influenced by differences in vaccine service delivery. Studies conducted in provinces whose preschool-aged and infant vaccinations are primarily administered by nurses in community health centres reported a return to pre-pandemic vaccination rates by May-June 2020.[17,27] In Ontario, preschool-aged and infant routine vaccines are primarily administered by family physicians and pediatricians, therefore were directly impacted by the suspension of in-person appointments.[19,43] Accordingly, studies found continued delays in the recovery of routine vaccination rates and coverage as late as Nov-Dec 2020.[16,19,44,45] Parents from Ontario in our study also reported the lowest routine vaccination acceptance in Dec 2020, compared to other provinces, with the highest increase in acceptance Oct-Nov 2021. Results suggest that routine childhood vaccination delivery methods in Ontario were more negatively impacted by public health measures to prevent the spread of COVID-19 than other provinces. In 2020, the World Health Organization's list of 13 global health threats for the next decade included delivering health during crises and stopping infectious diseases.[46] Thus, it is critical that the delivery of routine childhood vaccines is safeguarded through tailored strategies that ensure accessibility and inclusion.[18,26]

Finally, over time parents were increasingly undecided about whether to vaccinate their children against influenza. Similar to our study, Sokol and Grummon[47] found that the COVID-19 pandemic may exacerbate polarity between routine childhood and influenza vaccination, with a marked decrease in parents' influenza vaccination intentions for their children. Childhood influenza vaccination is typically lower than that of routine vaccines,[48,49] with parents reporting concerns with its necessity and effectiveness compared to routine childhood vaccines.[5] In the context of the COVID-19 pandemic, determinants of influenza vaccination in children are poorly understood. Considering the low prevalence of influenza disease during the pandemic, it is possible that parents prioritized COVID-19 and routine vaccines over influenza vaccine for their children.

Strengths and limitations

We collected novel information from a nationally representative sample of parents at two critical time points during the pandemic, just as the first COVID-19 vaccine was approved for persons ≥ 18 years in Canada, and before their approval in those aged 5-11 years. Our study captured how parents' perceptions and intentions about routine childhood vaccines were influenced by the COVID-19 pandemic, and how these factors changed overtime. However, our sample was selected from a pre-existing panel of individuals, so even though representative by province, age, and sex, respondents may have characteristics and responses different from the general Canadian population. Data were self-reported, therefore some variables (i.e., children's pre-pandemic routine vaccination status) may be affected by recall and desirability bias. Finally, parents' routine vaccination intentions and receipt of vaccines for their children were collected as one variable in our survey. Intentions to vaccinate may not translate into future receipt of vaccines, therefore further research is needed to understand whether differences in parents' perceptions and intentions for their children have influenced the behavior of routine vaccine uptake.

Conclusion

Routine vaccination is an effective public health intervention that prevents the transmission of infectious diseases. The COVID-19 pandemic has highlighted the importance of vaccination in the prevention of COVID-19 disease, which consequently has highlighted the importance of routine vaccines. Our study demonstrates that the pandemic has positively influenced parents' confidence in and acceptance of routine vaccines for their children. As the

pandemic progressed, parents were increasingly engaged in vaccine decision-making and motivated to overcome barriers to access vaccines. Therefore, within the spotlight of the COVID-19 pandemic, a unique opportunity exists for vaccine service providers to support parents' decision-making as they navigate routine vaccine uncertainties. Differences in parents' acceptance of routine and influenza vaccines for their children highlight the need for targeted communication strategies for specific vaccines.

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RH was involved in conceptualization, investigation, formal analysis, interpretation of findings, writing (original draft, review, and editing)
SM, SS, JO, ED were involved in conceptualization, interpretation of findings, writing (review and editing)
SM provided supervision and funding acquisition
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CHAPTER THREE

Objective Two Paper

Title: Routine childhood vaccination among ethnocultural groups in Canada during the COVID-19 pandemic: A national cross-sectional study

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Abstract

Background. Some ethnocultural groups in Canada experience low routine childhood vaccination, with social locations and discriminations contributing to inequities. This study aimed to characterize routine childhood vaccination in the context of the COVID-19 pandemic, including the influence of discriminatory experiences when accessing health services.

Methods. We conducted a cross-sectional national survey to assess parents' acceptance of routine vaccines for their children ≤17 years in Oct-Nov 2021. Descriptive statistics were used to explore differences among ethnocultural groups and logistic regression to assess associations with parents' low acceptance.

Results. Of 2531 parents, 21.8% self-identified as Racialized minorities, 7.7% Indigenous, 23.3% newcomers, 10.0% spoke minority languages most often, and 69.6% belonged to a reference group who did not report these characteristics. Statistically significant findings included 36.6% of Indigenous parents reporting that the pandemic made them realize that routine vaccines were more important compared to 16.7% of newcomers. Discrimination/racism when accessing health services was most often experienced by Indigenous (27.8%) and Racialized minorities (20.2%), compared to the reference group (4.8%). Racialized minorities were more likely to report low acceptance of routine vaccination (aOR=2.19, 95% CI: 1.18–4.05), and younger parents and those with only preschool-aged children were less likely to have low acceptance (aOR=0.59, 95% CI: 0.37–0.94; aOR=0.53, 95% CI: 0.36, 0.79). Low acceptance was associated with everyday stress preventing vaccination (aOR=2.18, 95% CI: 1.41–3.38).

Conclusions. Public health decision-makers should ensure equitable access to routine childhood vaccination that targets inclusion of ethnocultural groups, who may experience disproportionate barriers and low acceptance.

Keywords: routine, vaccine, child, Racialized minority, COVID-19

Introduction

An ethnocultural group is defined by shared characteristics unique to that group, such as country of origin, language, self-identified ethnicity, cultural traditions, or physical traits.[1] Canada is an ethnoculturally diverse nation of 37 million people, of which 6.2% self-identify as Indigenous (i.e., First Nations, Métis, and Inuit),[2] 21.9% are newcomers (i.e., born outside of Canada), 26.5% self-identify as a Racialized minority (i.e., persons who are non-Caucasian in race or non-white in colour),[3] and 12.7% primarily speak a minority language.[4,5] Intersectionality is the interconnection of social determinants and, as a theoretical approach, acknowledges overlapping and interdependent systems of discrimination.[6] Intersectional social determinants may include ethnocultural identities (e.g., newcomers, Racialized minority, Indigenous) and social locations (e.g., household income, education) that when combined, may perpetuate health inequities.[7,8]

Historically, routine childhood vaccination in Canada has eradicated polio and caused a 90-95% reduction in pertussis and measles infections.[9] Even so, in 2019, only 78% of 2-year-old children in Canada had received all recommended doses of pertussis-containing vaccine.[10] Measles vaccination coverage for children at 7 years of age within Canada remains at 83.3%, 10% below national targets,[11] contributing to periodic outbreaks.[12] Although a wealthy country with universal healthcare (e.g., free health services), low vaccination coverage and increased incidence of vaccine-preventable diseases has been noted within some ethnocultural groups (i.e., Racialized minority, Indigenous, newcomers).[12-15] Vaccination inequities are often attributed to differential access to health services, such as a delay in healthcare coverage, language barriers, a lack of culturally relevant care, disproportionate constraints,[16-18] and experiences of discrimination when accessing health services.[19,20]

During the first waves of the COVID-19 pandemic (i.e., 2020 and 2021), a decline in routine childhood vaccination was reported by many countries.[21-23] However, few Canadian studies[19,24,25] have explored acceptance of routine childhood vaccination among ethnocultural groups during the COVID-19 pandemic. Furthermore, it is not well understood if COVID-19 infection prevention measures (i.e., stay at home orders, school closures) created further challenges for some parents of ethnocultural groups to access routine vaccines for their children during the pandemic.

Therefore, this study aimed to characterize perceptions and acceptance of routine childhood vaccination during the COVID-19 pandemic, among a national sample of parents who self-identified as Indigenous, Racialized minorities, newcomers, those who primarily speak a minority language, and a reference group of parents who do not identify with these ethnocultural characteristics. This study sought to provide information for public health decision-makers that will support inclusive and equitable access to routine childhood vaccination for ethnocultural groups within Canada, who may experience disproportionate barriers to services.

Methods

Study design and participants

We conducted a cross-sectional national online survey in Oct-Nov 2021, just before the first pediatric COVID-19 vaccine (BNT162b2, Pfizer-BioNTech, 10 micrograms/dose) was approved for children aged 5–11 years in Canada. Survey respondents were randomly selected from a panel of >400,000 adults from a well-established national polling firm, who lived in Canada, were proficient in reading French or English, and who had access to the internet.[26] An invitation to participate and informed consent was sent by email. The overall survey sample (N=6,026) was representative for population size in all provinces, and by age and sex, based on the latest Census data.[27] To ensure rigor and validity,[28] embedded consistency questions were cross referenced for respondent authenticity and battery questions monitored for inattentiveness and straight lining. Respondents had unique URLs and 15% were contacted by telephone for identity verification. Appendix Three provides the quality Checklist for Reporting Results of Internet E-Surveys.[28]

We purposively sampled minimum quotas of targeted populations. This included respondents who were primary caregivers to one or more children ≤17 years old in their home, respondents who self-identified as Indigenous (i.e., First Nations, Métis, and Inuit), Racialized minorities, those who spoke minority languages most often, and newcomers. We estimated the minimal sample size of the target population groups 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 +/- 5% and 95% confidence intervals (CIs).

The 75-question survey took approximately 19 minutes to complete. The survey instrument was developed by drawing from previously validated questions about perceptions of routine vaccination (i.e., 5C psychological antecedents of vaccination),[29] a previous survey of

Canadian parents' acceptance of routine childhood vaccination,[30] areas of focus for our policy partners (including the National Advisory Committee on Immunization Secretariat), and expertise of our national team of immunization researchers. The draft survey was reviewed by public health experts, pre-tested with team members, and pilot tested with members of the public and revised accordingly. This study received approval from the Health Research Ethics Board at the University of Alberta.

Measures

Our outcome variable was parents' self-reported acceptance of routine vaccines for their children during the COVID-19 pandemic. Respondents were asked, "If your child was due to receive a routine vaccine (e.g., MMR/ measles, whooping cough, rotavirus) during the pandemic (since March 2020) did you, or would you, have them get it?" with the following response options: 1) Yes, my child was due for a routine vaccine and they received it, or I would have them get it if one was due; 2) No, they did not receive it, or I would not have them get it if one was due; and 3) I don't know. For binary analysis, 'no' and 'I don't know' categories were combined and are defined as low vaccination acceptance.

Predictor variables were based on determinants of routine vaccination including: the 5C psychological antecedents of vaccination,[29] influenza vaccination behaviors, mandated routine and COVID-19 vaccination, experiences of discrimination and/or racism when accessing health services, and how the pandemic has changed parents' perceptions about routine vaccination. Ethnocultural variables included: self-identified Indigenous or Racialized minority, newcomer (i.e., born outside of Canada), minority language speakers, and an intersectional variable of mutually exclusive ethnocultural categories (i.e., one ethnocultural identity of Indigenous, Racialized minority, newcomer, or language minority; two identities of newcomer, Racialized, and/or language minority; and three identities of newcomer, Racialized, and language minority; and a reference group of parents who do not self-identify with any of these ethnocultural identities). Sociodemographic variables included: province, age, level of education, employment status, annual household income, gender, marital status, and number and ages of children. Survey questions are provided as Appendix 9.

Statistical analysis

We calculated descriptive statistics (i.e., frequencies and percentages) of the predictor variables, in addition to 95% CIs to explore differences in parents' vaccination perceptions

among ethnocultural intersectional groups. We then assessed the association between parents' low acceptance of routine childhood vaccination and the predictor variables using binary logistic regression. We reported both unadjusted and adjusted odds ratios with 95% CIs. Variables included in the adjusted model were those previously associated in the literature with routine childhood vaccination, in addition to variables with a p-value below 0.20 in the unadjusted model. Multicollinearity was assessed between variables, and all had a variance inflation factor below 5. Due to the online survey completion requirements, no data were missing. SPSS version 26.0 (IBM, Chicago, IL, USA) was used for the descriptive and regression analyses.

Results

Characteristics of the sample

Of the 2531 parents in our sample, 21.8% self-identified as Racialized minorities, 7.7% Indigenous, 23.2% were newcomers to Canada, 10.0% spoke minority languages most often, and 69.6% belonged to a reference group who did not report these ethnocultural characteristics (Table 3.1). Further characteristics are provided in supplementary Table A3.

Table 3.1 Sociodemographic characteristics of a sample of Canadian parents of children aged ≤17 years (N=2531), Oct-Nov 2021

Characteristic	Category	Total n (%)
Ethnocultural characteristics		
Ethnic or cultural origin	White	1769 (69.9)
	Racialized minority[1]	554 (21.8)
	Indigenous[2]	194 (7.7)
	Prefer not to answer	14 (0.6)
Newcomer status	Canadian born	1945 (76.8)
	Born outside of Canada	586 (23.2)
	Arrived 2016-2021 (n = 195)	
	Arrived before 2016 (n = 391)	
Newcomer citizenship status (N=586)	Canadian citizen	346 (59.0)
	Permanent resident[3]	200 (34.1)
	Temporary resident[4]	37 (6.3)
	Refugee	1 (0.2)
	Prefer not to answer	2 (0.3)
Language spoken most often at home	English	1487 (58.8)
	French	790 (31.2)
	Minority languages[5]	254 (10.0)
Intersectionality of sample[6] (mutually exclusive groups)	Indigenous	194 (7.7)
	Newcomer	138 (5.5)
	Racialized minority	119 (4.7)

	Language minority[7]	0 (0)
	2 Intersecting identities (newcomer, Racialized, or language minority)[8]	273 (10.8)
	3 Intersecting identities (newcomer, Racialized, and language minority)[8]	191 (7.5)
	Reference group	1616 (63.8)
Socioeconomic characteristics		
Province of residence	British Columbia	257 (10.2)
	Alberta	289 (11.4)
	Prairies[9]	163 (6.4)
	Ontario	789 (31.2)
	Quebec	876 (34.6)
	Atlantic provinces[10]	157 (6.2)
Age	15-29 years	278 (11.0)
	30-39 years	983 (38.8)
	40-49 years	873 (34.5)
	50-59 years	336 (13.3)
	≥60 years	61 (2.4)
Highest level of education	High school or less	297 (11.7)
	Non-university certificate or diploma(college/apprenticeship)	829 (32.8)
	University degree/bachelor's or more than bachelor's	1391 (55.0)
	Prefer not to answer	14 (0.6)
Employment status	Full-time (≥37 hours per week)	1775 (70.1)
	Part-time (<37 hours per week)	336 (13.3)
	Unemployed	250 (13.8)
	Prefer not to answer	70 (2.8)
Annual household income	<$40,000	271 (10.7)
	$40,000-79,000	646 (25.5)
	≥$80,000	1430 (56.5)
	Prefer not to answer	184 (7.3)
Gender	Woman	1533 (60.6)
	Man	991 (39.2)
	Gender minority[11]	7 (0.3)
Marital status	Married/common-law	2107 (83.2)
	Not married/common-law	408 (16.1)
	Prefer not to answer	16 (0.6)
Number of children in household (0-17 years old)	1 child	1228 (48.5)
	2 children	983 (38.8)
	3 or more children	320 (12.6)
Age category of child(ren)	Preschool-aged child(ren) only	878 (34.7)

	(0-6 years old)	
	School-aged child(ren) only (7-17 years old)	1246 (49.2)
	Pre- and school-aged children (0-17 years old)	407 (16.1)

Notes.
[1] Racialized minority groups including Black, Latin/Central American, Arabic/West Asian/North African, East Asian, South Asian, and any respondents who selected one of these groups and white
[2] Indigenous respondents are individuals who self-identified as First Nations, Métis, or Inuk
[3] Permanent resident refers to a landed immigrant
[4] Temporary residents include non-permanent residents such as those in Canada on a work or study visa
[5] Appendix 10 provides minority languages spoken most often at home
[6] Mutually exclusive categories of respondents who self-identify as Indigenous, belonging to a Racialized minority group, newcomers to Canada, those who spoke a minority language most often at home, and a reference group of parents who do not self-identify with any of these categories
[7] All respondents who spoke a minority language most often at home also self-identified as either a Racialized minority or newcomer
[8] Respondents who self-identified as Indigenous did not self-identify as a newcomer or a Racialized minority and spoke English or French most often at home
[9] Prairie provinces include Saskatchewan and Manitoba
[10] Atlantic provinces include PEI, Nova Scotia, New Brunswick, and Newfoundland and Labrador
[11] Respondents who selected one of the following categories: gender non-conforming, transgender, two-spirit, and "not listed please specify"

Descriptive statistics

Eighty-seven percent (87.9%) of parents reported that they would accept routine vaccination for their children during the COVID-19 pandemic, whereas 8.1% had no intention and 4.0% remained undecided (Table 3.2). Parents' reasons for low acceptance of routine childhood vaccines during the pandemic are provided in Figure 3.1.

Table 3.2 Outcome and predictor variable descriptive statistics for a sample of Canadian parents of children aged ≤17 years (N=2531), Oct-Nov 2021

Variable	Category	Total n (%)
Childhood routine and influenza vaccination intent and receipt		
Routine childhood vaccination intent/receipt during the COVID-19 pandemic[1]	Intent to receive/receipt	2224 (87.9)
	No intent to receive/no receipt	206 (8.1)
	I don't know	101 (4.0)
Influenza vaccination intent for child(ren) for the 2021/22 flu season	Agree, more likely to vaccinate	1022 (40.4)
	Undecided	458 (18.1)
	Disagree, less likely to vaccinate	942 (37.2)
	Not eligible	109 (4.3)
Have you experienced discrimination and/or racism when accessing health services for yourself or your child(ren)?	Yes	251 (9.9)
	No	2230 (88.1)
	Don't know/prefer not to answer	50 (2.0)
Parents' perceptions of routine vaccination		
Has the pandemic changed the way you think about routine vaccines for your child(ren)?[1]	The pandemic has made me realize that routine vaccines are more important	535 (21.1)
	The pandemic has not changed how I think about routine vaccines	1944 (77.0)
	The pandemic has made me realize that routine vaccines are less	47 (1.9)

	important	
I am completely confident that routine vaccines are safe[2]	Agree, more likely to vaccinate	1980 (78.2)
	Neutral	336 (13.3)
	Disagree, less likely to vaccinate	215 (8.5)
Routine vaccination is necessary because vaccine-preventable diseases are common[2]	Agree, more likely to vaccinate	1820 (71.9)
	Neutral	391 (15.4)
	Disagree, less likely to vaccinate	321 (12.6)
Vaccination is a collective action to prevent the spread of disease[2]	Agree, more likely to vaccinate	2167 (85.6)
	Neutral	207 (8.2)
	Disagree, less likely to vaccinate	157 (6.2)
When I think about getting vaccinated, I weigh the benefits and risks to make the best decision possible[2]	Agree, more likely to vaccinate	1995 (78.8)
	Neutral	329 (13.0)
	Disagree, less likely to vaccinate	207 (8.2)
Everyday stress (such as competing priorities or many demands on my time) prevents me from getting vaccinated[2]	Disagree, more likely to vaccinate	1959 (77.4)
	Neutral	311 (12.3)
	Agree, less likely to vaccinate	261 (10.3)
Vaccines are effective[2]	Agree	2122 (83.8)
	Neutral	267 (10.5)
	Disagree	142 (5.6)
It should be mandatory for children to get the recommended childhood vaccines	Agree	1713 (67.7)
	Neutral	416 (16.4)
	Disagree	402 (15.9)
COVID-19 vaccination in Canada should be:	Mandatory for everyone (with exceptions based on medical reasons)	1313 (51.9)
	Mandatory for certain groups (e.g., health care workers)	312 (12.3)
	Mandatory for certain activities (e.g., travel, recreational/social activities)	165 (6.5)
	Voluntary for everyone	669 (26.4)
	I don't know	72 (2.8)
Have any of your children had COVID-19 disease?	Yes[3]	278 (11.0)
	No	2190 (86.5)
	Don't know/prefer not to answer	63 (2.5)

Notes.
[1] Outcome variable for regression analysis
[2] Parents responded in reference to routine vaccines in general, not specific to childhood routine vaccines
[3] Responses include COVID-19 cases confirmed by COVID-19 testing and presumed positive cases

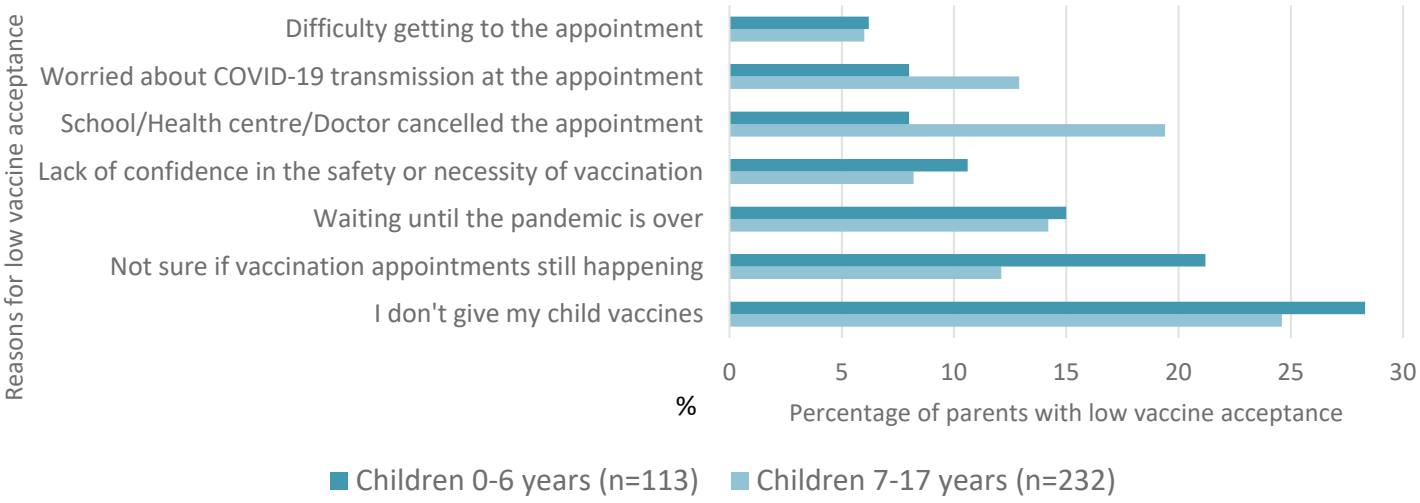

Figure 3.1 Parents' reasons for low acceptance of routine vaccines during the pandemic for their children aged 0-6 years (n=113) & 7-17 years (n=232) *Respondents provided reasons for low acceptance separately for children 0-6 years and 7-17 years.

Ethnocultural identities and vaccination-related factors

Respondents who self-identified as a Racialized minority or those with two intersecting identities reported the lowest routine childhood vaccination acceptance (16.0% and 16.1% respectively) (Table 3.3). Statistically significant findings included 36.6% of Indigenous parents who reported that the pandemic made them realize that routine vaccines were more important, compared to 16.7% of newcomers and 16.9% of the reference group. Discrimination/racism when accessing health services was most often experienced by Indigenous (27.8%) and Racialized minority (20.2%) parents, compared to 4.8% of the reference group.

Table 3.3 Vaccination-related descriptive statistics among ethnocultural identities of Canadian parents of children aged ≤17 years (N=2531), Oct-Nov 2021

Variable		**Indigenous** (N=194) % (CI), n	**Racialized minority** (N=119) % (CI), n	**Newcomer** (N=138) % (CI), n	**Two Intersecting identities[1]** (N=273) % (CI), n	**Three Intersecting identities[2]** (N=191) % (CI), n	**Reference group[3]** (N=1616) % (CI), n
Routine vaccination acceptance during the pandemic	Yes	85.1 (79.5-89.5), 165	84.0 (76.7-89.8), 100	85.5 (78.9-90.6), 118	83.9 (79.2-87.9), 229	90.1 (85.2-93.7), 172	89.1 (87.5-90.6), 1440
	No/ uncertain	14.9 (10.5-20.5), 29	16.0 (10.2-23.3), 19	14.5 (9.4-21.1), 20	16.1 (12.1-20.8), 44	9.9 (6.3-14.8), 19	10.9 (9.4-12.5), 176

How the pandemic has changed the way parents think about routine vaccines for their children	More important	36.6 (28.6-46.2), 71	24.4 (16.3-35.0), 29	16.7 (10.6-25.0), 23	30.0 (24.2-37.7), 83	29.8 (22.6-38.7), 57	16.9 (14.9-19.0), 273
	No change	62.4 (51.8-74.5) 121	73.9 (59.3-91.1), 88	81.9 (67.5-98.4), 113	67.8 (58.4-78.3), 185	68.6 (57.3-81.4), 131	81.1 (76.8-85.6), 1311
	Less important	1.0 (0.1-3.7) 2	1.7 (0.2-6.1), 2	1.4 (0.2-5.2), 2	2.2 (0.8-4.8), 6	1.6 (0.3-4.6), 3	2.0 (1.4-2.8), 32
Experiences of discrimination and/or racism when accessing health services	Yes	27.8 (21.9-34.4), 54	20.2 (13.7-28.0), 24	8.7 (4.8-14.3), 12	19.8 (15.4-24.8), 54	15.7 (11.1-21.4), 30	4.8 (3.8-5.9), 77
	No/ prefer not to answer	72.2 (65.6-78.1), 140	79.8 (72.0-86.3), 95	91.3 (85.7-95.2), 126	80.2 (75.2-84.6), 219	84.3 (78.6-88.9), 161	95.2 (94.1-96.2), 1539

Notes.
[1]Intersecting identities include two of either newcomer, Racialized, or language minority characteristics
[2]Intersecting identities include newcomer, Racialized, and language minority characteristics
[3]Reference group of parents who do not self-identify with these ethnocultural identities (i.e., Indigenous, Racialized minority, newcomer and language minority)

Multivariable logistic regression

Parents who self-identified as a Racialized minority were more than twice as likely to report low routine vaccination acceptance for their children, compared to the reference group (aOR=2.19, 95% CI: 1.18–4.05) (Table 3.4). Younger parents were less likely to experience low routine vaccination acceptance (i.e., they had higher acceptance) compared to parents ≥50 years (15-29 years: aOR=0.35, 95% CI: 0.19–0.66 and 30-39 years: aOR=0.59, 95% CI: 0.37–0.94). Parents who only had preschool-aged children (0-6 years) were less likely to experience low routine vaccination acceptance compared to parents of only school-aged children (7-17 years) (aOR=0.53, 95% CI: 0.36, 0.79). No other socioeconomic characteristics were associated with parents' low routine childhood vaccine acceptance.

Parents who perceived that routine childhood vaccines were less important because of the COVID-19 pandemic were 4 times more likely to have low vaccination acceptance (aOR=4.16, 95% CI: 1.98–8.73). Those who were neutral or did not intend to vaccinate their child against influenza during the pandemic, were over three times more likely to experience low vaccination acceptance compared with parents who intended to vaccinate their child against influenza (aOR=3.42, 95% CI: 2.18–5.38 and aOR=3.46, 95% CI: 2.24–5.32, respectively). Low acceptance of routine vaccines was associated with parents' perceptions that vaccination was unnecessary (aOR=2.22, 95% CI: 1.48–3.31) or unsafe (aOR=2.95, 95% CI: 1.75–4.98), and that

everyday stress (such as competing priorities or many demands on my time) would prevent vaccination (aOR=2.26, 95% CI: 1.45–3.52).

Table 3.4 Unadjusted and adjusted odds ratios for the association between predictor variables and Canadian parents' routine childhood vaccination acceptance during the pandemic (low acceptance versus the reference category of high acceptance) (N=2351)

Predictor variables	Category	Unadjusted ORs (95% CI)	Adjusted ORs (95% CI)	p-value
Ethnocultural identities (ref: Reference group)[1]	Racialized minority	1.55 (0.93, 2.60)	**2.19 (1.18, 4.05)**	**0.01**
	Newcomer	1.39 (0.84, 2.28)	1.27 (0.71, 2.27)	0.42
	2 Intersecting identities[2]	**1.57 (1.10, 2.25)**	1.52 (0.96, 2.40)	0.08
	3 Intersecting identities[3]	0.90 (0.55, 1.49)	1.04 (0.56, 1.93)	0.90
	Indigenous	1.44 (0.94, 2.20)	1.41 (0.82, 2.45)	0.22
Province (ref: Ontario)	British Columbia	0.66 (0.41, 1.07)	0.61 (0.35, 1.06)	0.08
	Alberta	0.91 (0.60, 1.38)	1.11 (0.68, 1.82)	0.67
	Prairies[4]	1.10 (0.67, 1.81)	0.86 (0.46, 1.61)	0.64
	Quebec	1.01 (0.76, 1.35)	0.95 (0.66, 1.38)	0.80
	Atlantic provinces[5]	1.15 (0.70, 1.89)	1.58 (0.85, 2.93)	0.15
Age (ref: ≥ 50 years)	15-29 years	0.70 (0.44, 1.11)	**0.35 (0.19, 0.66)**	**0.001**
	30-39 years	**0.61 (0.43, 0.85)**	**0.59 (0.37, 0.94)**	**0.03**
	40-49 years	0.81 (0.58, 1.13)	0.76 (0.51, 1.15)	0.19
Gender (ref: Woman)	Man	1.26 (0.99, 1.60)	1.14 (0.85, 1.53)	0.39
Marital status (ref: Married/common-law)	Not married/ common-law	**1.80 (1.35, 2.39)**	1.21 (0.83, 1.75)	0.33
Household income (ref: ≥$80,000)	<$40,000	**2.24 (1.58, 3.19)**	1.39 (0.86, 2.23)	0.18
	$40,000- $79,999	**1.63 (1.23, 2.16)**	1.17 (0.82, 1.67)	0.39
	Prefer not to answer	**1.81 (1.17, 2.79)**	1.42 (0.85, 2.37)	0.18
Highest level of education (ref: University bachelor's or more)	High school or less	**1.68 (1.19, 2.38)**	0.91 (0.58, 1.43)	0.67
	Non-university certificate/diploma	1.22 (0.93, 1.59)	0.91 (0.65, 1.27)	0.58
Age category of child(ren) (ref: School-aged child(ren) 7-17 years)	Preschool-aged child(ren) (0-6y)	**0.51 (0.38, 0.67)**	**0.53 (0.36, 0.79)**	**0.002**
	Pre- & school-aged children (0-17y)	0.82 (0.59, 1.15)	0.94 (0.61, 1.43)	0.76
Experiences of discrimination and/or racism (ref: No)	Yes	1.28 (0.88, 1.86)	0.68 (0.43, 1.08)	0.11
	Don't know/Prefer not to answer	**2.69 (1.41, 5.12)**	1.33 (0.61, 2.91)	0.48
How the pandemic changed parents' perceptions about routine childhood vaccines (ref: Not changed)	Less important	**12.60 (6.88, 23.06)**	**4.16 (1.98, 8.73)**	**<.0001**
	More important	0.93 (0.69, 1.27)	1.36 (0.92, 1.99)	0.12
Influenza vaccination intention (fall 2021/ winter 2022) (ref: Agree)	Disagree	**5.88 (4.12, 8.39)**	**3.46 (2.24, 5.32)**	**<.0001**
	Neutral	**4.58 (3.06, 6.86)**	**3.42 (2.18, 5.38)**	**<.0001**
	Not eligible	**3.32 (1.72, 6.43)**	**3.03 (1.39, 6.61)**	**0.005**
Routine vaccines are effective (ref: Agree)	Disagree	**7.04 (4.83, 10.26)**	1.03 (0.53, 2.00)	0.93
	Neutral	**6.62 (4.91, 8.92)**	1.18 (0.74, 1.89)	0.49
I am completely confident that routine vaccines are	Disagree	**9.38 (6.77, 13.00)**	**2.95 (1.75, 4.98)**	**<.0001**
	Neutral	**5.49 (4.08, 7.40)**	1.52 (0.98, 2.36)	0.06

safe (ref: Agree)				
Routine vaccination is necessary because vaccine-preventable diseases are common (ref: Agree)	Disagree	**4.53 (3.30, 6.20)**	**2.22 (1.48, 3.31)**	**<.0001**
	Neutral	**5.36 (4.02, 7.15)**	**1.90 (1.29, 2.80)**	**0.001**
Vaccination is a collective action to prevent the spread of disease (ref: Agree)	Disagree	**6.65 (4.64, 9.54)**	1.34 (0.74, 2.42)	0.34
	Neutral	**7.20 (5.23, 9.93)**	1.49 (0.91, 2.42)	0.11
When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible (ref: Agree)	Disagree	1.32 (0.87, 2.00)	0.92 (0.52, 1.61)	0.77
	Neutral	**1.77 (1.29, 2.43)**	1.12 (0.73, 1.72)	0.61
Everyday stress (such as competing priorities or many demands on my time) will prevent me from getting vaccinated (ref: Disagree)	Agree	**2.54 (1.80, 3.58)**	**2.26 (1.45, 3.52)**	**<.0001**
	Neutral	**3.93 (2.93, 5.28)**	**2.13 (1.44, 3.16)**	**<.0001**
It should be mandatory for children to get the recommended childhood routine vaccines (ref: Agree)	Disagree	**6.29 (4.72, 8.38)**	**1.85 (1.18, 2.91)**	**0.008**
	Neutral	**3.12 (2.28, 4.29)**	1.07 (0.70, 1.63)	0.76
COVID-19 vaccination in Canada should be: (ref: Mandatory for everyone)	Mandatory for certain groups	**1.94 (1.29, 2.92)**	0.98 (0.61, 1.57)	0.93
	Mandatory for certain activities	**2.46 (1.51, 4.00)**	1.60 (0.89, 2.88)	0.11
	Voluntary for everyone	**3.89 (2.92, 5.19)**	1.06 (0.70, 1.60)	0.80
	Don't know	**5.18 (2.93, 9.14)**	**2.27 (1.12, 4.60)**	**0.02**
COVID-19 disease status of child(ren) (ref: No)	Yes	**1.72 (1.23, 2.41)**	1.28 (0.85, 1.95)	0.24
	Prefer not to answer/don't know	**2.74 (1.53, 4.91)**	1.60 (0.78, 3.26)	0.20

Notes. CI = confidence interval; OR = odds ratio; bold results significant when p≤0.05

[1]Reference group of parents who do not self-identify with any ethnocultural characteristics (i.e., Indigenous, Racialized minority, newcomer and language minority)

[2]Intersecting identities include two of either newcomer, Racialized, or language minority

[3]Intersecting identities include newcomer, Racialized, and language minority

[4]Prairie provinces include Saskatchewan and Manitoba

[5] Atlantic provinces include PEI, Nova Scotia, New Brunswick, and Newfoundland and Labrador

Discussion

Intersectional characteristics

It is challenging to assess interdependent intersections of social determinants (i.e., ethnocultural identities and social locations), and their associations with routine vaccine acceptance.[31,32] Outside of assessing sociodemographic characteristics (e.g., income, education), compounding social intersections and how these may influence parents' decision-making and access to routine childhood vaccines have not been readily explored.[13,33] In the context of the

COVID-19 pandemic, parents may have experienced further challenges accessing routine vaccines.[18] Therefore, we intentionally sought to assess intersections of ethnocultural identities and how these may have influenced acceptance of routine childhood vaccines during the pandemic.

Racialized minority and intersectional identities

Parents who self-identified as a Racialized minority, and those with two intersecting identities (i.e., newcomer, language minority, or Racialized minority) reported the lowest acceptance of routine childhood vaccination during the COVID-19 pandemic. We found that Racialized minority parents were twice as likely to report low acceptance, compared to parents who did not report any of the assessed ethnocultural identities. Similarly, Bell et al[33] noted that Racialized minority parents in England experienced increased barriers to accessing routine vaccines during the pandemic, subsequently influencing their low acceptance. A study in the United States[34] also noted increased routine childhood vaccine hesitancy and risk perceptions among Racialized minority parents and those with lower household incomes. We found no association between parents' social locations (i.e., income, education) and acceptance of routine childhood vaccines. However, younger parents in our study (15-39 years), and those with only preschool-aged children (0-6 years), reported higher acceptance compared to parents ≥50 years and those who only had school-aged children (7-17 years). Younger children who, compared to older children, receive a higher number of recommended routine vaccines, and have an increased risk of morbidity and mortality from vaccine-preventable diseases. Therefore, parents in our study with young children may be more motivated to accept vaccination. Conversely, research has shown increased hesitancy and incomplete childhood vaccination among younger parents.[35,36] Further research regarding the association of parents' age and routine vaccine acceptance is required.

Indigenous parents

Low routine childhood vaccination coverage levels have been shown within some Indigenous populations in Canada.[12,13] However, data is limited and health services have a long history of discriminatory practices directed at Indigenous peoples, causing significant harm and mistrust for some First Nations, Métis, and Inuit peoples.[37-39] Indigenous parents in our study had high intentions to vaccinate their children, and were significantly more likely to report that the pandemic has made them realize that routine vaccines were more important, compared to the

reference group of parents. A Canadian study[18] that assessed routine childhood vaccination processes in a First Nations community noted that parents were highly motivated and working hard to vaccinate their children. However, this study showed that entrenched colonial processes and policies placed unrealistic expectations on families, in order to receive childhood vaccines. For example, prior to the pandemic, "one child, one appointment" policies were a noteworthy barrier to accessing childhood vaccination for some First Nations parents.[18] This challenge may have been exacerbated during the pandemic when "one parent, one child, one appointment" policies further inhibited siblings and/or additional parents from attending vaccination appointments or utilizing waiting room areas.[33] How impossible it might seem, then, for highly motivated parents to access childhood vaccines considering school and daycare closures that might otherwise support "one parent, one child" vaccination appointments? The COVID-19 pandemic serves as an opportunity to highlight the necessity of inclusive and accessible vaccination services for families.

Discrimination when accessing health services

In Canada over 25% of the population have reported experiences of discrimination based on ethnocultural identities and social locations; racial discrimination, being most commonly reported.[20,40] Parents in our study who self-identified as Indigenous or a Racialized minority experienced discrimination/racism significantly more often when accessing health services, compared to the reference group. Similarly, when assessing COVID-19 vaccination intentions in Canada, Lin[19] found a two-fold increase in newcomers' perceptions of anticipating racial stigmatization. Another Canadian study found that many Racialized minorities and newcomers experienced discrimination, which subsequently negatively influenced their health-related psychological, social, and environmental quality of life.[16] Importantly, an association exists between past experiences of discrimination and decreased health service seeking behaviors.[7,41]

The 2019 Chief Public Health Officer's Report on the State of Public Health in Canada[20] noted that although public health policies and programs should benefit all persons, health inequalities exist within some ethnocultural populations, often as a result of health systems and social discriminations that hinder access.[42] These inequities were highlighted during the pandemic, with regards to accessing COVID-19 related health services.[7] For example, a study from Israel[8] found decreased COVID-19 testing, vaccination, and an increase in confirmed COVID-19 disease among Racialized minorities and those with a lower socioeconomic status.

This study demonstrated how intersections of low socioeconomic status and Racialized identities were associated with widening health disparities during the pandemic. Similarly, a Canadian study identified how intersecting forms of discrimination constrained COVID-19 vaccination decision-making for Racialized minority and Indigenous peoples.[43]

Before the COVID-19 pandemic, barriers to routine childhood vaccination for some ethnocultural groups were identified as decreased access to health services (i.e., language barriers, inadequate transportation), vaccine hesitancy, gaps in vaccination service knowledge, and other cultural determinants (i.e., religious beliefs).[17,44] Therefore, culturally relevant services are required to support meaningful engagement in vaccination decision-making.[7,44]

Routine vaccination acceptance among all parents

Routine childhood vaccination during the COVID-19 pandemic (Oct-Nov 2021) among our full sample of parents (N=2531) was higher than pre-pandemic 7-year-old children and 14-year-old adolescents national coverage levels.[10] Although vaccination intention does not necessarily translate to uptake, it is noteworthy that almost a quarter of parents in our study reported that the COVID-19 pandemic made them realize that routine vaccines were more important. A study from the United Kingdom also reported increases in parents' acceptance of routine vaccines for their children during the pandemic.[45] Increasing acceptance is attributed to growing awareness of the importance and effectiveness of childhood vaccines due to the spotlight on COVID-19 vaccination and its role in preventing adverse disease outcomes and enabling a return to normal socioeconomic activities.[21,45] Our study's finding of parents' increasing acceptance is critical in light of the decrease in routine childhood vaccine uptake that occurred early in the COVID-19 pandemic.[21,22,46] Importantly, most countries who reported the alarming decrease, had returned to pre-pandemic levels, or higher, by January 2021.[46,47] This rebound may be due to effective public health communication, improved access to vaccines, and parents who were increasingly motivated to vaccinate their children.[33,48,49]

Reasons for low acceptance among all parents

Of the overall sample of parents, 12.1% reported low acceptance of routine vaccines during the pandemic. A small percentage of these reported that either they do not vaccinate their children at all or lack confidence in the safety or necessity of vaccines. Most parents cited COVID-19 related disruptions (i.e., health centre closures) or uncertainties (i.e., COVID-19 transmission at the appointment) as their rationale for low acceptance. Our findings are similar to

other studies,[25,33] that found parents' acceptance of routine childhood vaccines was negatively impacted by concerns of COVID-19 transmission during vaccination appointments, and a lack of clarity around the availability of services during times of restrictive public health measures. Furthermore, parents' low acceptance was significantly associated with beliefs that routine vaccination was unnecessary, unsafe, and that everyday stress prevented access. Our results are similar to research that shows parents' hesitancy is often rooted in concerns about the safety and efficacy of vaccines, rather than an outright refusal.[50] Parents' concerns regarding accessing routine vaccines may also reflect the timing of our survey (Oct-Nov 2021), when the swiftly circulating delta variant (B.1.617.1) resulted in further public health restrictive measures aimed to protect against a new wave of COVID-19 disease.

Parents' low routine vaccine acceptance was associated with low seasonal influenza vaccine acceptance. Parents were equally likely to accept or decline influenza vaccination for their child during the pandemic, with a large majority who remained undecided. Similarly, a study from the United States[51] found that the COVID-19 pandemic may amplify polarity in childhood influenza vaccine acceptance. For instance, parents may prioritize routine and COVID-19 vaccines over concerns of multiple vaccinations, thereby delaying influenza vaccination.[34,52] Others may prioritize influenza vaccination for their child, seeking protection against a potential second respiratory illness during the pandemic.[53,54]

In the context of the COVID-19 pandemic, it is important to understand how routine childhood vaccine hesitancy may have been perpetuated. Parents in our study with low acceptance were almost four times as likely to report that they believed routine childhood vaccines were less important because of the pandemic. Similarly, a study from the UK found that many parents believed their children were at less risk for acquiring vaccine-preventable diseases due to social distancing measures.[33] Furthermore, mandated COVID-19 vaccination and measures implemented to prevent the spread of COVID-19 disease created significant social and economic hardship for many parents.[34] Although mandates and public health measures aimed to protect the greater population, some parents may have been disproportionately impacted, subsequently influencing decision-making and beliefs about vaccination.

Implications

Early COVID-19 vaccination in Canada was based on equitable allocation to populations who may have had differential access to health services (i.e., remote and isolated communities),

Indigenous populations, and other identified at-risk populations.[7,55] This vaccination prioritization framework aimed to reduce health inequities and prevent further discrimination within some populations.[55] Similarly, public health officials in Canada should consider a routine childhood vaccination framework that prioritizes equitable access for some ethnocultural groups, where known social discriminations and inequities to accessing services exist.

Strengths and Limitations

We collected novel information from a nationally representative sample of parents Oct-Nov 2021 during the COVID-19 pandemic, just before the first pediatric COVID-19 vaccine was approved for children aged 5–11 years in Canada. Minimum recruitment quotas ensured adequate representation of parent groups in our study (Indigenous, Racialized and language minorities, and newcomers). Our study captured how parents' perceptions and acceptance of routine childhood vaccines were influenced by the COVID-19 pandemic, including experiences of discrimination/racism when accessing health services, and how these factors differed across ethnocultural groups. Our sample was selected from a pre-existing panel that excludes respondents who do not have access to internet or strong reading proficiency in English or French. Therefore, results may not reflect those of the larger Canadian population, nor those who may experience socioeconomic inequities relevant to ethnocultural groups included in this study. Data were self-reported, therefore some variables may be affected by recall and desirability bias. Parents' acceptance of routine vaccines for their children (i.e., intentions and receipt of vaccines) were collected as one variable in our survey. Intentions to vaccinate may not necessarily result in future receipt of vaccines, therefore further research is required to better understand whether differences in parents' perceptions and intentions for their children influence the behavior of vaccine uptake.

Conclusions

Before the COVID-19 pandemic, some ethnocultural groups in Canada experienced low acceptance and access to routine childhood vaccination, where one's social location and associated discriminations may have contributed to inequities in uptake. The pandemic may have further exacerbated these challenges for some parents. Under the spotlight of the pandemic, public health decision-makers should ensure equitable access to routine childhood vaccination that targets the inclusion of ethnocultural groups, who may experience disproportionate barriers to services.

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CHAPTER FOUR

Objective Three Manuscript

Title: Ethnocultural perspectives on routine childhood vaccination during the COVID-19 pandemic: “Here in Canada, we're multicultural people, right?”

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Abstract

Objectives. An ethnocultural group is defined by shared characteristics such as country of origin, ethnicity, cultural traditions, or physical traits. Low vaccination coverage and increased incidence of vaccine-preventable diseases (VPDs) have been identified within some ethnocultural groups in Canada. We explored how intersections of ethnocultural identity and social location influenced perceptions about childhood vaccination and access to services during the COVID-19 pandemic, among Racialized minorities, newcomers, Indigenous, and language minority parents.

Methods. Using a qualitative descriptive approach, we conducted semi-structured virtual interviews with parents of children aged 2-11 years. Participants were from 6 provinces, and self-identified with ethnocultural groups known to be at risk for experiencing vaccination inequities. Participants were asked to describe their ethnocultural identity, social location, and vaccination experiences within and, if applicable, outside of Canada, and contextualize how these influenced routine childhood vaccinations during the pandemic. Analysis focused on emerging themes and utilized intersectionality theory.

Results. Of the 17 participants, 4 self-identified as Indigenous, 11 primarily spoke minority languages, and 13 immigrated to Canada from outside of North America. Themes included: (1) newcomers found Canadian routine childhood vaccination accessible, although unfamiliarity with vaccine schedules and processes created uncertainty; (2) ethnocultural diversity was a protective factor against Racialized minority discrimination; (3) newcomers experienced challenges navigating vaccine services without social networks; (4) vaccination inclusivity consisted of normalization and socialization processes, and was more than just a convenient ‘location’; and (5) polarized perceptions placed high importance on routine vaccines but increased hesitancy towards influenza and COVID-19 vaccines for children.

Conclusions. Our findings suggest that previous social and cultural perceptions of vaccination and experiences with VPDs shaped parents' positive perceptions and acceptance of routine vaccines for their children. Canada’s multiculturalism fosters respectful and inclusive services.

Introduction

An ethnocultural group is defined by shared characteristics such as country of origin, ethnicity, cultural traditions, language, or physical traits,[1] whereas social location (i.e., gender, age, education) describes an individual's relative status on a continuum of privilege and oppression, in comparison with dominant social norms.[2] Canada is an ethnoculturally diverse and inclusive nation, of which 5.0% self-identify as Indigenous[3] (First Nations, Métis, and Inuit), 26.5% as a Racialized minority[4] (i.e., persons who are visibly non-Caucasian in race or non-white in colour), and 12.7 % of the population primarily speaks a language other than English or French.[5] Persons born outside of Canada (i.e., newcomers) make up 23.0% of the population,[6] with an additional 500,000 immigrants and refugees expected to arrive yearly from 2023-2025.[7]

In Canada, low childhood vaccination coverage and increased incidence of vaccine preventable diseases (VPDs) have been identified within some ethnocultural groups (i.e., Racialized minority, Indigenous, newcomers).[8-10] Inequities have been attributed to differential constraints associated with one's social location, such as transportation and childcare challenges, lack of culturally relevant care, and unfamiliarity with recommended vaccination schedules and processes.[11-13] Therefore, intersections of some ethnocultural identities and social locations may further influence parents' acceptance and/or access to routine childhood vaccines.[14-16] In the absence of disaggregated data, however, it is challenging to assess the interdependent and compounding influence of ethnocultural identities and social location on routine vaccine acceptance. Inequities may in fact be present, where no evidence yet exists.

Although a decline in routine childhood vaccination was reported in Canada early in the COVID-19 pandemic[17] (i.e., 2020 and 2021), few Canadian studies have explored acceptance of childhood vaccines among ethnocultural groups and social locations during the COVID-19 pandemic.[18-20] Our previous study found that parents who self-identified as a Racialized minority, and those with two ethnocultural intersecting identities reported the lowest acceptance of routine childhood vaccination, in comparison with parents who did not report any of the assessed ethnocultural identities.[20] Indigenous parents in this study reported high intentions to vaccinate and perceived routine vaccines as being more important because of the pandemic, compared to a reference group (i.e., parents who did not self-identify as Indigenous, language minority, newcomer, or Racialized minority).[20] This large quantitative study (N=2531) assessed associations across ethnocultural characteristics. However, qualitative research would further

contextualize experiences of parents from various ethnocultural groups and social locations when accessing childhood vaccines during the pandemic. Therefore, the purpose of this descriptive study was to explore how intersections of social locations and ethnocultural identities influenced perceptions and access to routine childhood vaccination during the COVID-19 pandemic, among Racialized minority, newcomer, Indigenous, and language minority parents.

Intersectionality theory and reflexivity

Intersectionality theory is the conceptualization of the ways in which social class, race, gender, and other categories are shaped and interrelated through forces such as politics, colonialism, and social structures.[15] At the intersections of each exists a continuum of power and oppression. Gaining momentum in health disciplines, intersectionality has functioned as a 'catch all' term that metaphorically describes intersecting social complexities. However, the imperative of intersectionality is social justice and the explication of oppressive processes that drive health inequalities.[21] Therefore, intersectionality theory is a mechanism for social action to transform the way we envision social diversities, and the pursuit and achievement of social justice by way of inclusion and health equity. The Canadian National Advisory Committee on Immunization (NACI) equity matrix[22] utilizes intersectionality theory to identify potential and distinct inequities in vaccination among social groups, reasons for inequities, and interventions to improve access. The equity matrix outlines social locations and ethnocultural identities described as "P^{2}ROGRESS And Other Factors" [22] depicting the convergence of intersections. Intersectionality theory and the equity matrix informed objectives, data collection, and the analysis process for this study. The primary author who conducted interviews, self-identifies as a white settler woman with diverse experiences working alongside ethnocultural groups in many health settings with historically underserved population groups.

Methods

Prior to the study reported here, our team conducted a national cross-sectional online survey (N=6,026) 20 months after the start of the pandemic (Oct 14 to Nov 12, 2021) to gather perspectives about routine and COVID-19 vaccination in Canada. Survey respondents were randomly selected from a well-established national panel[23] of >400,000 adults who were proficient in reading English or French, and had internet access. We purposively sampled minimum quotas of ethnocultural groups of interest including those who self-identified as Indigenous (i.e. First Nations, Métis, Inuit), a Racialized minority, newcomers (having been born

outside of Canada), those who spoke minority languages most often at home, and parents of children ≤11 years of age living in their home. Targeted ethnocultural groups and social locations reflected the NACI equity matrix[22] to identify population groups at risk for experiencing inequities in vaccine uptake. Of the parents of children ≤11 years of age who completed the survey and self-identified with ethnocultural groups of interest (N=536), 19.6% (n=105) consented to participate in a follow-up interview.

Recruitment

Purposive selection of interview participants (selected from 105 national survey respondents) prioritized ethnocultural and social location diversity. Email invitations were preferentially sent to participants who self-reported multiple ethnocultural identities, to gain insights about intersectional influences on parents' vaccination perceptions and decision-making for their children. Of the 44 survey respondents invited to participate, 25 replied and consented to an interview. Seventeen participants completed 20-40-minute semi-structured interviews in English, using zoom video conferencing between February 27 and March 27, 2023. The online consent form and interview scheduling were managed using REDCap[24] electronic data capture tools hosted at the University of Alberta. Interviewees received a $50 gift card of their choice, as an expression of gratitude for their participation. For participant anonymity, pseudonyms were used and identifiable demographic data has been removed.

Semi-structured interviews

Interview guiding questions were informed by results from our previous study that quantitatively analyzed national cross-sectional survey data among parents of ethnocultural groups who have historically experienced vaccination inequities.[20] Qualitative interviews sought to explore silences and surprising findings of quantitative survey results, such as Racialized minority parents who were more than twice as likely to report low childhood vaccination acceptance (compared to parents who did not self-identify as a Racialized minority), parents' increased uncertainty regarding childhood influenza and COVID-19 vaccination, and reported experiences of discrimination and/or racism when accessing health services.[20] Participants were asked to describe their ethnocultural identities and social locations, including social and cultural experiences of vaccination and VPDs. Questions explored participants' perceptions and beliefs regarding childhood vaccination, experiences of access during the pandemic, barriers and facilitators of vaccination, and whether discrimination and/or racism was experienced when

accessing health services. Intersectionality theory remained a guiding focus throughout the interview process as parents contextualized responses within ethnocultural identities and social locations. For example, when participants described sociocultural differences in vaccination with respect to common beliefs, accessibility, and availability of vaccines, our follow-up questions explored those topics. Participants responded to questions with reflective descriptions and observations based on personal, familial, community, and/or cultural relevance.

Qualitative analysis

Interviews were transcribed by Microsoft Word transcription, reviewed for accuracy, and revised minimally for readability and grammatical errors.[25] Descriptive thematic analysis was conducted according to methods described by Braun and Clarke.[26] Researcher RH coded transcripts and developed a coding guide utilizing NVivo software (QSR International, Burlington, MA), and coauthors reviewed and validated identified themes. Inductive analysis explored emerging themes in the data, to determine whether participants' ethnocultural and social locations influenced perceptions and experiences with regards to childhood vaccination during the COVID-19 pandemic. Parents' experiences are reported descriptively in common terms and verbatim, with low inference.

Results

Ethnocultural identities and social locations of participants are summarized in Table 4.1; information was collected during the interview process. Of the 13 female and 4 male participants, most were married and/or common-law, had a university degree, were aged 30-49 years, and had 1-2 children aged 2-11 years. Four participants self-identified as Indigenous (Métis or First Nations), 2 participants self-identified as 2nd generation immigrants (Jamaica and China), and 11 participants spoke a minority language most often and immigrated directly from Mexico, Philippines, Hong Kong, India, South Africa, Nigeria, and Czech/Slovak. Sixteen participants vaccinated their children with routine vaccines during the pandemic, and 1 participant expressed non-acceptance of all vaccines for their children with no future intention. Nine participants experienced delays in routine vaccination due to the pandemic, with seven reporting no delays. Ten participants vaccinated their children with seasonal influenza and COVID-19 vaccines, although parents expressed hesitancy specific to these vaccines in comparison with routine vaccines. Eight participants received childhood vaccines from nurses in public health centres, and the remaining from a pediatrician or physicians office.

Table 4.1 Interview participant characteristics (N=17)

Participants	Ethnocultural identity	Language spoken most often	Immigration status	Province of residence	Age	Gender	Highest education	Employment	Relationship status	Age(s) of children
1	Filipino	Filipino	Newcomer 2014	Alberta	30-39	Woman	University degree	Full-time hybrid (home ⅖ days)	Married/ common-law	2.5 years
2	East Indian	Hindi	Newcomer 2015	British Columbia	30-39	Woman	University degree	Full-time from home	Married/ common-law	5 years
3	Métis	English	Indigenous	Manitoba	30-39	Woman	University degree	Full-time from home	Married/ common-law	10 years
4	Chinese	English/ Cantonese	1st gen born Canada	Ontario	40-49	Man	University degree	Full-time outside home	Not married/ common-law	6 years
5	Jamaican	English/ Patois	1st gen born in Canada	Ontario	40-49	Man	High School	Full-time outside home	Married/ common-law	6 years
6	East Indian	Hindi	Newcomer 2007	Ontario	30-39	Woman	University degree	Full-time outside home	Married/ common-law	11 years
7.	Czech/ Slovak	Slovak/ Czech	Newcomer 2002	Ontario	40-49	Man	University degree	Full-time outside home	Married/ common-law	9 years 11 years
8	Mexican	Spanish	Newcomer 2019	Ontario	30-39	Woman	University degree	Not working (at home parent)	Married/ common-law	3.5 years
9	Cree	English	Indigenous	Quebec	30-39	Woman	University degree	Full-time hybrid (home ⅗ days)	Married/ common-law	2 years 5 years
10	Mohawk	English/ Mohawk	Indigenous	Ontario	15-29	Woman	High school	Not working (at home parent)	Married/ common-law	7 years 11 years
11.	Métis	English	Indigenous	Manitoba	30-39	Man	University degree	Full-time outside home	Married/ common-law	1.5, 4, 6, & 8 years
12	South African	Afrikaans	Newcomer 2019	Alberta	30-39	Woman	University degree	Full-time from home	Married/ common-law	9 years 11 years

13	Filipino	Filipino	Newcomer 1998	Manitoba	50-59	Woman	University degree	Not working/disability (at home parent)	Married/ common-law	5 years
14	Mexican	Spanish	Newcomer 2020	Saskatchewan	30-39	Woman	University degree	Part-time from home (at home parent)	Married/ common-law	1.5 years Pregnant
15	Nigerian	Yoruba/Benin/ English	Newcomer 2020	Alberta	15-29	Woman	University degree	Not working (at home parent)	Married/ common-law	2.5 years
16	East Indian	Telugu	Newcomer 2016	Ontario	30-39	Woman	University degree	Full-time hybrid (home ⅗ days)	Married/ common-law	8 years 12 years
17	Hong Kong	Cantonese/ (English 2nd)	Newcomer 2018	British Columbia	40-49	Woman	University degree	Not working (at home parent)	Married/ common-law	10 years 12 years

Coded transcripts were organized into five themes that emerged from synthesizing data, through reflecting on findings from a previous study,[20] and existing literature on determinants of routine childhood vaccination.[27,28]

Theme 1: Accessible vaccination with uncertain processes.

Newcomers found Canadian routine childhood vaccination accessible, although unfamiliarity with vaccine schedules and processes created uncertainty. Eleven newcomer participants shared overwhelmingly positive experiences regarding the availability and accessibility of childhood vaccines in Canada, in comparison to a previous country of residence. For example, participant 1 who immigrated to Canada from the Philippines in 2014 commented, *"For me, coming from a third world country, we wish we had more access*." Other newcomer participants expressed gratitude for Canadian vaccination resources, acknowledging that childhood vaccines may not be as readily available in other areas of the world. *"We as Canadians, I feel sometimes we need to recognize how fortunate we are. That we have the means and accessibility to these [routine vaccines] because a lot of areas, they don't." [Participant 5] "It's a really great experience [routine vaccination] and I think other countries can learn from how Canada is doing it." [Participant 12]*

Participants perceived that the reason routine childhood vaccines were accessible and available in Canada was due to increased resources (i.e., health care providers and services), smaller population size, universal health services (i.e., free health services), and improved vaccination information sharing compared to a previous country of residence (i.e., India, Nigeria, South Africa, Mexico, Philippines). Newcomer participant 2 who immigrated from India to Canada in 2015 discussed many of these rationalizations:

"Because of the big population [in India] we sometimes struggle… when we go for vaccines, we need to keep long queues because the country has a big population. In Canada we have a small population [...]. They are taking fees [in India] and in Canada they are not taking fees. So that's a good point. It's a big advantage of Canada that we have lots of doctors here, lots of hospitals. It's a good system here, it's definitely a good country and we are happy to live here."

Unfamiliarity with Canadian vaccination processes created uncertainty for some newcomer parents regarding which childhood vaccines were recommended and available, and how to access services. *"Most of the newcomers don't know or they are not aware of how these things [vaccination] happen and how do they know what to do? …because every country has*

different diseases and different kinds of vaccines." [Participant 2] Some newcomers relied on vaccination information sharing from social groups and other parents to know when and which routine childhood vaccines are due for their child(ren). A newcomer participant who arrived in 2019 and had lived in two Canadian provinces since immigration, shared their uncertainty about accessing vaccination services in multiple provinces and in comparison, with their previous country of residence.

"I didn't know anything about the vaccines, how to access them. Who would give them to my son?… in Mexico, you would go to your pediatrician… in Alberta, we needed to go to the community clinic and then he would receive them at the appropriate age. But here in Toronto, it's different too, because here you have to go to the doctor's office. And the nurse is the one who vaccinates. So everything is different." [Participant 8]

Newcomers also discussed how social and cultural beliefs and perceptions about vaccination, and experiences with VPDs from a previous country of residence influenced their decision whether to vaccinate their children in Canada. For instance, a number of participants had not been exposed to the idea of seasonal influenza vaccination before immigrating to Canada.

"There was nothing like that [influenza vaccines] in Nigeria. Flu was common. It was a normal thing. There was no vaccination or prevention for flu back in Nigeria." [Participant 15]

"In India it is not mandatory and it's not common that people get the influenza vaccine. We saw it [influenza illness] after one year [being in Canada] and from then on we have been getting them [children] the flu vaccine every year." [Participant 16]

Influenza disease was also socially perceived as a common illness, and vaccination was not available in participants' previous country of residence. One participant who immigrated to Canada from India in 2006 noted, *"I've never actually had influenza vaccine in my life. Back at home, it was like, "Oh you have cold? You just have some chicken soup, rest, and you will be fine." [Participant 6]* Conversely, a newcomer who immigrated to Canada in 2019 perceived the availability of influenza vaccination in Canada as a new opportunity "*Our family never used to get vaccinated for the flu [in South Africa]. [...] So when we came here, we decided we'll give it a try. Just because the winters here are so much different than in South Africa." [Participant 12]*

Two participants, who immigrated to Canada from Mexico in 2019 and from India in 2016 shared personal experiences with VPDs and how these influenced perceptions about vaccination and decisions whether to vaccinate their children.

"Hepatitis A, I know it's not included here maybe because it's not a problem, but in Mexico, it's a problem there and I have met a neighbor kid who got a serious infection of hepatitis A… So I think those things influence my opinion about vaccines." [Participant 8]

"My generation, most of us fell sick with chicken pox and measles, there was no chicken pox and measles recommended vaccine from my childhood. I think they [children] have a better option. I don't want them to go through that same problem again." [Participant 16]

Theme 2: Ethnocultural diversity protects against racialized discrimination.

Most participants experienced ethnocultural acceptance and inclusion when accessing Canadian health services for themselves and/or their children. *"Yes, pretty inclusive [in Canada]. Even the nurses, they help us. They're not usually White; they're mostly different nationalities." [Participant 14]* Many participants described Canada's multicultural diversity as a strong protective factor against Racialized minority discrimination. For example:

"The communities that we have been staying in are mixed communities. We see people of Asian origin. We have other people too. But maybe it's because we are a completely mixed bunch. We haven't really had any kind of an issue." [Participant 16]

"We're close enough to some reservations so it's very common to see Native appearing individuals here and we don't seem to have too much of a bias against my culture or anything here either." [Participant 9]

"Because here in Canada, we're multicultural people, right? And we have to respect every aspect of every human being... So for me personally, I don't experience that [discrimination and/or racism]. [...] Yes, we have different kinds of diversity. We have people from India and Pakistan; many other countries we have here." [Participant 13]

Two Métis participants also spoke of receiving culturally relevant vaccination, such as services provided by an Indigenous organization and health professionals, reciprocity in providing gifts such as gift cards, children's toys, and food packages; noting that the clinic was also accessed by many newcomers living in the community.

"We took my nephew to an Indigenous organization nearby that was offering vaccine clinics. The majority of the staff there are Indigenous people and… there's a high population of

Indigenous people here…. We received gifts when we went to our vaccine clinic like gift cards and food packages for the kids… we had a positive experience." [Participant 3]
"The Metis Nation … they do a pretty good job of informing us [about vaccination], they have good information on websites, ads on billboards, on TV, they keep us pretty well informed." [Participant 11]

One newcomer who immigrated to Canada in 2019 discussed experiencing discrimination in their previous country of residence, feeling like a "weight had been lifted."
"We did very much feel discriminated against in South Africa [...] here we feel like a weight lifted. First off, we don't feel discriminated against. We feel like we're welcome and we belong and at the same time a weight has also been lifted in the sense that we don't have that pressure from family that our kids should only be friends with other kids that have the same skin color or the same background, it's very liberating. [...] There is definitely a lot of diversity and we see that especially in the kids' school. It's a great learning opportunity for them." [Participant 12]

The few participants (n=3) who had experienced discrimination when accessing health services expressed feeling misinterpreted, excluded, or refused care based upon the perceived assumptions (i.e., language barrier), discomfort of healthcare providers, or disapproval of health choices (i.e., vaccine refusal).
"She's [daughter] having a hard time understanding that they're going to put something in her mouth… she was uncomfortable and crying. Then one of the ladies said, she understands English. Right? So that made me a little uncomfortable. I feel like it's a little racist." [Participant 1]
"I do have one instance where I felt like I was stereotyped or discriminated against [...] I just felt maybe it was just how she felt, or if she felt that way because I'm black. It was also out of town … and the populace of other cultures is not as high [...] because if you're a visible minority, those are things that you are almost guaranteed you've come across in life." [Participant 5]

Theme 3: Normalization and socialization of vaccination fosters inclusivity.

Inclusive vaccination services were seen as more than just a 'convenient location,' and consisted of social processes (e.g., parents and children being vaccinated together) that normalized the behaviour of accepting vaccines. Participants discussed the importance of convenient services and locations for vaccine delivery; however, a concept of inclusivity remained the prominent theme. For example:

"The community centres, they should [provide vaccination] once in a while, like in libraries, or in schools they could have more vaccines for kids. Because I can have access to a car, but if I didn't have a car, it would be difficult for me to get to vaccine centers." [Participant 14]
"Social media works. Maybe on Facebook or Instagram or Google or on the blogs we can just mention for newcomers all the guidelines for child vaccines and why it's important because every country has different diseases and different kinds of vaccines." [Participant 2]
"Making it more kid friendly like the places where they receive vaccines … I think that makes the experience less traumatic for kids and even for parents." [Participant 8]

Participants discussed school-based vaccination as a facilitator of peer information sharing, noting that socialization and normalization of vaccination processes among adolescents promotes acceptance and a sense of contributing to the great good (e.g., herd immunity).
"I think the kid feels supported because they're not the only kid getting the vaccine. Their whole class is usually getting it… they don't feel alone and it's a group thing. I think it helps mentally." [Participant 12]
"But if the kids saw that every classmate, they are doing the same thing. […] It is more convenient for parents, because I already sent my kids to school, I don't need to bring them again." [Participant 17]

Although most participants were motivated and accepting of routine childhood vaccines, many parents discussed how the pandemic interfered with the receipt of childhood vaccines. *"It was because of the first of COVID. It was when they started to close and they didn't have enough masks, they had to limit the amount of people." [Participant 8]* Vaccines were often delayed, there were further challenges to accessing services (i.e., limited appointments, one child one parent restrictions), or parents had concerns about COVID-19 transmission during the appointments.
"I was just scared back then when I was just a new mom… If I do it by myself, I'm a little hesitant. During that time, just one parent is allowed and then a mask is required. When she's still in a carrier, it's physically demanding, plus you're also healing as a mom and then you have to worry about changing the mask." [Participant 1]

Theme 4: Challenges for newcomers without social supports.

Most newcomer participants expressed having developed strong and supportive family, community, and/or friend groups in Canada. However, all four newcomer participants who

arrived in Canada just prior to the COVID-19 pandemic (i.e., fall 2019/winter 2020) experienced further challenges navigating health services for their children during the pandemic without the support of family or established social or community groups.

"It was extremely difficult for us when he [son] was sick because we don't have a very big support network here. It's only my husband and I and having to be with him in the hospital, that meant my husband didn't go to work" [Participant 8]

"We don't have family in Canada [...] When Emma was a baby, it was my first kid. English is not my first language, so I was afraid. But the nurse has always been so good to me, if I ask anything in the vaccination appointment for my daughter. At first, I had postpartum anxiety, I was talking with the nurse and she was really nice about it." [Participant 14]

"I found out that here in Canada it's not as open as in Nigeria. Everyone here is busy [...] Since I didn't know anybody, it was so difficult after I gave birth to my son. Because I don't have experience taking care of babies and I just had to cope." [Participant 15]

Theme 5: Polarized perceptions towards different vaccines.

Participants discussed their decision-making whether to accept influenza and COVID-19 vaccines for their children, in comparison with routine vaccination. Polarized perceptions placed high importance on routine vaccines but increased hesitancy towards influenza and COVID-19 vaccines for children. *"I understand that the influenza and COVID are somewhat different [than routine vaccines] in that they don't offer as much of a strong protection … But I do feel that generally they have the same purpose, to minimize the bad effects of the viruses that are going around. So, I do see benefits to all three." [Participant 11]* Five participants commented how they perceived routine, seasonal influenza, and COVID-19 vaccination as similar in importance for protecting their children. *"Our thinking is the same as before, whatever we are taking for other vaccines. Same, we are treating the COVID vaccine. Now the COVID vaccine is added to the list." [Participant 2]*

The pandemic influenced parents' perceptions of routine childhood vaccines as being more important (compared with perceptions prior to the pandemic). *"[COVID-19] made me more approaching or more in favor of routine vaccines, because aside from COVID, you don't want to think about other illnesses coming in." [Participant 1]* However, participants also shared perceptions of increased hesitancy towards influenza and/or COVID-19 vaccines for their

children. "*The COVID-19 vaccines did change our perspective in kind of a negative way. Just specifically for those [COVID-19] ones, not for other routine vaccinations." [Participant 3]*

Irrespective of whether parents vaccinated their children against COVID-19, most participants shared hesitancy towards COVID-19 vaccines, questioning the safety and necessity of vaccines for children, commenting on its rapid development and unknown long-term side effects.

"For children, for the COVID-19 vaccine, I'm still kind of skeptical about it because I don't know what harm it would do … our daughter has never been [vaccinated]." [Participant 5]
"I trust in [routine vaccines], because they have had a longer history. But, also because some vaccines, for example measles vaccine, you have the vaccine and you don't get sick. With COVID you get the vaccine but there are so many variations, and you can get sick." [Participant 8]
"The COVID vaccine, there's still so much unknown about it…we are still very much on the fence for our daughters just because there've been a lot of adverse effects… and we don't know the long-term effects." [Participant 9]

Although participants were more accepting of influenza vaccines for their child compared to COVID-19, most parents chose not to vaccinate their children against influenza based on perceptions that the vaccine was not necessary or effective in the prevention of influenza disease.

"I personally was not a very big fan of getting influenza vaccine because it is just hit and miss… And its influenza, it's cold flu, it is usually better." "We don't always do the flu shots. It depends on how it lines up with their school schedules and their attitudes towards everything. Obviously, no kid really wants to get a vaccine." [Participant 6]

One parent who had not accepted any vaccination for their children expressed how the COVID-19 pandemic caused them to further question vaccination. *"I didn't have a lot of trust in the system to begin with, but I think it made me question even more, a lot of my friends questioned even more. You know, they didn't believe in the COVID vaccine for many reasons. They started questioning other ones." [Participant 10]*

Discussion

Using an intersectional lens, we identified key facilitators and challenges to accessing routine childhood vaccination for parents of diverse ethnocultural identities and social locations during the pandemic.

Vaccination as an opportunity for newcomers

Newcomer participants overwhelmingly perceived childhood vaccination as a privileged opportunity, expressing gratitude for Canadian services. Perspectives were contextualized within Canadian sociodemographics such as a small population, sufficient health resources, and universal health services (i.e., publicly funded); and in contrast to limited access to vaccines and experiences with VPD within a previous country of residence. Parents' motivations and determination to vaccinate their child(ren) was contextualized as a means to prevent adverse disease and illness, an opportunity some parents did not have themselves as a child. Research has shown that newcomers to Canada are more likely to accept childhood vaccination compared to their counterparts.[8,20] Supporting these findings, two newcomer parents in our study expressed surprise when observing some Canadian parents' complacency and hesitancy towards routine vaccines, attributing this 'way-of-being' due to 'having choice.' Funded, available, and accessible vaccination may be limited in other countries, therefore the opportunity to 'have choice' is absent. As a highly available and accessible mechanism for preventing disease, the opportunity to 'have choice,' and in the absence of VPD experiences, vaccination in Canada very well may be a victim of its own success.[29] This phrase refers to a social perceptual shift from a fear of the disease (due to successful VPD eradication), to a fear of the vaccine itself. [30]

Newcomers discussed uncertainty regarding how and where to access services, and unfamiliarity with which vaccines were required when. Participants contextualized uncertainty within international differences in vaccination processes, interprovincial service delivery (e.g., public health centre, pharmacy, school-based), and vaccine providers (e.g., nurses, family physicians, pharmacists, pediatricians). Newcomers expressed lack of awareness of the existence and/or benefits of specific vaccines available in Canada, and some desired vaccines available in a previous country of residence were not routinely funded in Canada (i.e., Hepatitis A).[31] Research has shown that newcomers often experience disproportionate barriers to access (i.e., language barriers, inconvenient transportation), and are underserved with respect to targeted vaccination information sharing.[8] These unique challenges require adaptability and resilience in the context of ethnocultural characteristics and social locations. In light of Canada's welcoming immigration policies, supporting routine childhood vaccination among newcomers are required to meet national coverage targets. Many newcomers arrive from diverse climates with unique VPDs. The development of intake questionnaires could pre-emptively address common questions and

considerations based upon geographical immigration patterns. Routine vaccination information sharing must be tailored to newcomers' contexts.

Childhood vaccination inclusivity

Participants in our study discussed how COVID-19 disease prevention measures created further challenges to accessing routine vaccines in the way of delayed and decreased appointment availability, one parent restrictions, fear of COVID-19 transmission, and physically demanding infection control requirements. These results are similar to other studies, which noted that even through additional challenges to accessing routine childhood vaccines, parents remained highly motivated to do so.[8,17] In the context of these difficulties, newcomer participants who arrived in Canada within the last 5 years (since 2018) experienced further challenges in navigating health services during the pandemic with limited social/family networks. Beyond overcoming logistical barriers to access, newcomers shared feelings of "being alone" and having to "just cope", and rely on healthcare professionals in the absence of family support. Importantly, newcomers spoke positively regarding feeling supported by physicians, public health nurses, and pediatricians as they transitioned to Canadian social norms and parenthood in general.

Vaccination accessibility is vitally important and requires a 'remove barriers first' approach to increase capacity and opportunity. However, participants in our study shared that vaccination inclusivity meant more than just convenient service delivery. Accessibility may get parents in the door, however services tailored to promote positive experiences for parents and children motivate future vaccination.[32] Participants noted that school-based group vaccination normalized and socialized vaccination, fostered peer information sharing, and incorporated a concept of doing good for the community (i.e., herd immunity). Similarly, MacDonald et al.[11] noted that for some Indigenous parents, colonial processes and policies placed unrealistic expectations on families, in order to receive childhood vaccines. For example, "one parent, one child, one appointment" policies during the COVID-19 pandemic inhibited siblings and additional parents from attending appointments or utilizing waiting areas, creating further barriers to access.[16] Conversely, Indigenous participants in our study shared experiences of culturally relevant childhood vaccination services and information sharing. Services supported cultural values of inclusion (e.g., multiple family members being vaccinated together), delivery within the Indigenous community, and reciprocity (e.g., sharing of gifts).

Ethnocultural diversity as a protective factor

Discrimination is complex and contextual, occurring interpersonally, structurally, overtly or covertly, and may be perceived or not perceived, making it a challenging phenomenon to measure.[33] Participants in our study described discrimination as being perceived as "less" or "treated unfairly" (e.g., individually or systematically), where "choice" is removed based upon being different from a social majority such as color of skin, where one was born, and religious or cultural characteristics. It is well known that measures of social location (i.e., income, education) are associated with pervasive health inequities among some ethnocultural groups.[35] However, less is known about the role of discrimination in existing health disparities among some ethnocultural groups in Canada, and its role in parents' decision-making when seeking health services for their children.[33,34]

In Canada, over 25% of the population have reported experiencing discrimination based on an ethnocultural identity,[34,35] with those having a lower income, identifying as female, Indigenous, and/or Black having higher odds of experiencing discrimination in comparison with their counterparts.[36,37] From an intersectional lens, self-reports of experiencing ethnocultural discrimination when accessing health services is associated with an increased lack of trust in healthcare providers[20] and a decrease in health seeking behaviors,[13,38] contributing to health inequalities.[33,34] The association between Racialized discrimination and mental health is however stronger than that of physical health, with ethnocultural groups who have not experienced discrimination self-reporting positive determinants of well-being such as self-efficacy, resiliency, and self-esteem.[34] Research on the quality of life of children and their families during the pandemic found that ethnocultural minorities in Canada generally experienced a decreased quality of life compared to their counterparts.[39] This decreased quality of life was attributed to experiences of discrimination, disproportionate impact of COVID-19 transmission prevention measures (e.g., stay at home orders, employment and school-closures), and the intersectionality of social locations such as income, education, and speaking a minority language.

Although recent research has shown increased anticipation of experiencing discrimination when accessing health services in Canada among ethnocultural minorities,[19] parents in our study reported experiencing a strong sense of inclusion and acceptance when accessing health services for themselves or their children. Importantly, parents attributed inclusivity to existing diverse multiculturalism within their communities and among health

professionals. A key example is a participant who contextualized previous experiences of discrimination and racism in South Africa. This participant reported an overwhelming sense of belonging and liberation from Racialized oppression, describing Canada's social make-up as diverse, providing a positive learning opportunity on inclusion. Furthermore, Indigenous parents in our study described culturally relevant childhood vaccination services (i.e., Indigenous vaccine providers, reciprocity of sharing gifts). Self-determination and resilience of Indigenous peoples in Canada, related to culturally sensitive vaccination processes, has been noted during the COVID-19 pandemic.[36,37] A strength-based approach focuses on protective factors such as ethnocultural diversity and culturally relevant health services which promotes inclusion, acceptance, resiliency, and self-determination for historically underserved ethnocultural groups. Imperatively, vaccination providers must exhibit cultural sensitivity, demonstrating curiosity and inclusion of cultural factors that may positively influence parents' routine vaccination decision-making for their children.

Polarized perceptions towards specific vaccines

Vaccine-hesitancy may be defined as a, "delay in acceptance or refusal of vaccination despite availability of vaccination services."[40] Individuals who are vaccine-hesitant may choose to accept some vaccines but not others, delay vaccination, or have concerns regarding the safety of vaccines despite having been vaccinated.[41] Importantly, vaccine hesitancy is contextual across time and types of vaccines and is influenced by factors such as confidence, complacency, constraints, calculation, and collective responsibility.[27] Sixteen participants in our study were highly accepting of routine vaccines for their children, having trust in Canadian public healthcare and the science behind vaccination as "tried and true." However, regarding COVID-19 vaccines, most participants were hesitant and lacked trust in the safety (i.e., unknown long-term side effects), effectiveness, and necessity of vaccination for their children, irrespective of whether parents accepted vaccines for their child(ren). Results are similar to recent Canadian studies that found that parents of ethnocultural groups had increased hesitancy towards COVID-19 vaccination for themselves[19] and their children.[8,42]

Historically, there has been low rates of childhood influenza vaccination in Canada[43,44] due to parental concerns with the effectiveness or necessity of the vaccine in comparison to routine childhood vaccines.[45] Parents in our study also shared similar attitudes and beliefs towards influenza vaccination for their children, frequently lumping COVID-19 and influenza

vaccination together as unreliably "hit or miss" due to multiple disease strains. In Canada, as of Dec 3 2023, 9.2% of children aged 6 months-4 years, and 47% of those aged 5-11 years had received at least one dose of a COVID-19 vaccine.[46] Childhood influenza vaccination also remained low during the COVID-19 pandemic with approximately 40% of children aged 6 months-4 years, and 29% of those aged 5-11 years having been vaccinated during the 2021-2022 influenza season.[42] In light of elevated incidence of pediatric hospitalization due to respiratory syncytial virus (RSV) and influenza disease in 2022-2023,[47] provincial, territorial, and federal vaccination governing bodies recommend pediatric vaccination for children, noting further recommendations for those at risk for adverse disease (i.e., immunocompromised, chronic respiratory disease).[48,49]

We found that parents' hesitancy towards COVID-19 and influenza vaccination for their children did not impact attitudes or behaviors towards accepting routine vaccines during the pandemic. Our study contextualized polarized perceptions in the sense that many parents reported that because of the COVID-19 pandemic, they perceived routine vaccines as being even more important. However, vaccination against COVID-19 and influenza diseases was seen as less important, untrustworthy, ineffective, and unnecessary for children. Furthermore, one parent in our study, whose children had not received routine childhood vaccines, noted that perceived uncertainty with COVID-19 vaccines and government imposed mandated vaccination deepened an existing lack of trust in all vaccines. Research has noted how the pandemic may have further influenced the polarization of parents' perceptions regarding routine, COVID-19, and influenza vaccination for their children.[8,20,50,51] Parents' COVID-19 and influenza vaccine decision-making for their children demonstrates a shift from fear of adverse health outcomes, to a lack of trust in vaccination necessity and efficiency, and a fear of long-term adverse effects from innovative vaccine science.[52] In the context of ethnocultural parents' uncertainty experienced during the pandemic, specific and reliable information that addresses common misconceptions related to COVID-19, influenza, and routine vaccines is critical for parents' decision-making for their children.[52]

Strengths and Limitations

A strength of this study was the ability to contextualize perceptions and experiences of childhood vaccination during the pandemic, among parents of various ethnocultural groups. An intersectional lens broadened visual perceptions into oppressive and inclusive vaccination

processes that influence parents' decision-making, and explored how previous social and cultural experiences of vaccination and VPDs shaped parents' perceptions. There are a number of limitations. First, participants were invited from a sub-sample of English-proficient survey respondents. It is not feasible to represent Canada's ethnocultural diversity with a small national sample of interviewees. Second, our sample excludes participants who lack regular access to the internet and those who do not have reading proficiency in English. When considering interdependent intersections of social locations among ethnocultural parents, the inability to include parents who are not proficient in English and those unable to access the internet due to poverty pose significant limitations. Further research inclusive of parents who speak only minority languages and those with socioeconomic constraints is needed.

Conclusion

Using an intersectional lens, we identified key facilitators and challenges to accessing routine childhood vaccination during the pandemic. An important facilitator of respectful and inclusive health services is Canada's multiculturalism, which is preventative against experiences of discrimination among some ethnocultural minority groups. Our findings further contextualized how previous social and cultural perceptions of vaccination and experiences with VPDs shaped parents' positive perceptions and acceptance of routine vaccines for their children. However, parents' polarized perceptions between routine, COVID-19, and influenza vaccines is a cause for concern in the prevention of adverse health outcomes from VPDs in children. Although overcoming logistical challenges to accessing routine vaccines is critical, the heart of inclusive services must encompass culturally relevant approaches, address international differences in vaccine schedules and delivery methods, and bridge communication gaps to ensure newcomers and those who primarily speak minority languages have access to trustworthy and straightforward information.

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CHAPTER FIVE

Introduction

In the concluding chapter, I (1) briefly summarize the overall purpose of my dissertation as a unified piece of work, and provide a synopses of each individual study's objective and methods; (2) discuss mixed methods as an intersectional strength-based approach in nursing and public health research; (3) provide an integrated discussion of my overall findings, and how each study's findings build upon each other to explore, compliment, and contribute towards addressing the overall purpose of this dissertation; (4) discuss key implications for public health policy and public health and nursing practice; and (5) provide recommendations for future research.

Dissertation Summary

The overarching purpose of this paper-based dissertation was to assess how the COVID-19 pandemic influenced Canadian parents' perceptions and intentions towards routine vaccination, and access to services for their children ≤17 years old, across diverse ethnocultural identities and social locations. The theoretical framework of intersectionality guided the development of each study, the analyses, and interpretation of results. Individual study objectives and methods included:

Objective one longitudinal study design

The first study assessed the proportion and direction of difference between parents' responses (N=650) at two time points during the pandemic. Longitudinal findings were foundational to understandings parents' shifting perceptions and intentions toward routine vaccines and access for their children ≤17 years. At the time of survey one (Dec 2020), the first COVID-19 vaccine was approved by Health Canada,[1] compared to survey two (Oct-Nov 2021) just before the first pediatric COVID-19 vaccines were approved and available for children 5-11 years old.[2] The first study also focused on parents' social locations (i.e., stratification by province, number and age groups of children).

Objective two cross-sectional study design

The second study assessed associations between parents' perceptions and acceptance of childhood vaccination between diverse ethnocultural identities and social locations. The larger sample size (N=2531) allowed for assessment of broad associations between parents of various ethnocultural identities, combined intersections of identities, social locations, and parents'

reported experiences of discrimination and/or racism when accessing health services. Importantly, a reference group of parents who did not self-identify with ethnocultural groups of interest (i.e., Indigenous, Racialized minorities, newcomers, those who primarily speak a minority language), supported assessment of intersectional factors between groups of parents.

Objective three qualitative descriptive design

The third study explored more deeply how intersections of ethnocultural identities and social locations influenced parents' perceptions and acceptance of childhood vaccination. Semi-structured interviews (N=17) were conducted with parents of diverse ethnocultural identities and social locations to contextualize perceptions and experiences when accessing childhood vaccination within and outside of Canada. Purposive selection enabled diverse perspectives from newcomer parents, and those who self-identified as Indigenous or from a Racialized minority group. Objectives two and three studies, combined, utilized a sequential mixed methods design.[3] The third study further explored objective two study results that were surprising, raised questions, and identified silences that would benefit from further qualitative descriptive analysis.[4] Studies two and three combined are methodologically triangulated to confirm and further explain results.[5]

Mixed Methods Integration

How can public health and nursing researchers comprehensively understand the prevalence of VPDs and vaccine coverage rates among underserved populations, without considering intersectional ethnocultural identities, social locations, and parents' perceptions and experiences of this epidemiological inquiry? To address this broad methodological question, I have included a discussion of intersectionality theory within the discipline of nursing, and how the dissertation's overall mixed methods design is integrated, before engaging in a discussion of integrated key findings.

Intersectionality theory and the discipline of nursing

Nurses have a unique role and opportunity within healthcare to support inclusivity and accessibility for historically underserved groups, and those who have experienced discrimination.[6] Philosophical foundations of nursing practice include equitable and safe care, and health promotion that honors autonomy, agency, and personhood.[7] Therefore, understanding how social and systemic discrimination influences health outcomes and access to services are critical.

Intersectionality theory grew from an outcry for social transformation.[8] Remaining true to its origins, the theory focuses on privilege and oppression and is committed to raising awareness of associated inequities for the purpose of social action for social justice.[8] Therefore, intersectionality is a unifying framework to promote social justice in public health and nursing practice.[8-10] Rogers and Kelly[9] discuss how principles of intersectionality contribute to the elimination of health disparities through the tenets of social justice. Some of these principles include the identification and elimination of social injustice, reconciling dimensions of difference as social deficits, analyses of institutional power relationships, and investigating interdependent and mutually constituted systems that create inequities.[9] Furthermore, within public health and nursing practice, cultural competence is grounded in ideals of social justice as a moral obligation to provide equitable care, also congruent with intersectionality theory.[11]

Intersectional public health and nursing research informs policy and delivery of care, and therefore is strength-based social justice action through a pursuit of accessible and inclusive services.[11] It addresses social inequalities created by exclusionary positivist philosophy, as interdependent and connected systems that cannot be segregated and explained by a single variable.[9] Qualitative methodologies were largely developed within the philosophy and discipline of nursing.[7] Furthermore, nursing research has highly utilized intersectional theory to inform qualitative study methods, analysis, and application,[12] in addition to Indigenous research methods, community-based research, participatory action research, and other strength-based approaches.[12-15]

Mixed methods design

With global advances in vaccine innovation and delivery initiatives to prevent infectious diseases in diverse populations, quantitative biomedical approaches have historically dominated epidemiology and public health research.[16] Often missing from deductive approaches and statistical incidence and prevalence of diseases in populations, are descriptive human experiences with regards to intersectional ethnocultural identities and social locations. In the context of COVID-19, epidemiological research diversified into interdisciplinary approaches (e.g., microbiology, immunology, psychology, economics, anthropology, sociology) required to answer complex questions about the intersectional impact of the pandemic on humanity. For instance, public health COVID-19 transmission prevention initiatives demonstrated a blending of social, economic, and environmental measures, adjoining epidemiological and innovative

vaccine science (e.g., social distancing, personal protective equipment mandates, societal activity and travel restrictions, mRNA vaccine innovation, and global vaccine delivery).

The blended intricacies of scientific and social epidemiology required an integrated mixed methods research design to explore the impact that the pandemic had on childhood vaccination among parents of diverse ethnocultural identities and social locations. In essence, parents' contextualized human experiences were critical to understanding how perceptions and intentions towards childhood vaccination formed the outcome of accessing and accepting vaccines. Mixed methods are "research [that] draws on potential strengths of both qualitative and quantitative methods, allowing researchers to explore diverse perspectives and uncover relationships that exist between intricate layers of our multifaceted research questions."[3] Providing "multiple ways of seeing and hearing, and multiple ways of making sense of the social world,"[17] mixed methods are an appealing approach for public health and nursing researchers seeking to contextualized social and environmental understandings of an epidemiological phenomenon, using both qualitative and quantitative research methods.[16-18] When using a mixed methods design, often qualitative and quantitative approaches are methodologically triangulated with the purpose of confirming and further contextualizing a researcher's understanding of a phenomenon. As the broad purpose of this dissertation was grounded in social epidemiological and public health research, I used methodological triangulation as a strength-based approach[16,19] to explore how parents' intersectional ethnocultural identities and social locations influenced their perceptions and experiences regarding routine vaccination and decision-making for their children.

I included three distinct methods within this dissertation, each as a stand-alone study. However, all three study objectives and methods are complementary and integrative within a broad sequential mixed methods design that addressed the overarching purpose: to assess how the COVID-19 pandemic influenced Canadian parents' perceptions and intentions towards routine vaccination and access to services for their children ≤17 years old, across diverse ethnocultural identities and social locations.

Integrated Discussion

I have presented common key findings of the three studies in Table 5.1. I then discuss the Integrated Discussion Points (IDPs) in the following sections.

Table 5.1 Summary of integrated discussion points across the three studies

Key findings			
Objective one study (N=650): Survey one: Dec 2020 Survey two: Oct-Nov 2021	**Objective two study (N=2531): Survey two: Oct-Nov 2021**	**Objective three study (N=17): Interviews: Feb-Mar 2023**	**Integrated discussion points (IDPs)**
1.1 Increase over time in parents' acceptance of routine childhood vaccines during the pandemic (82.9% to 86.5%, p=.021) Decrease in parents who reported no intent/receipt of routine childhood vaccines (12.5% to 8.3%, p=.021)	**2.1** Eighty-seven percent (87.9%) of parents reported that they would accept routine vaccination for their children during the pandemic, 8.1% had no intention and 4.0% remained undecided Racialized minority parents or those with two intersecting identities reported the lowest vaccine acceptance (16.0% and 16.1% respectively). Parents who self-identified as a Racialized minority were more than twice as likely to report low routine vaccination acceptance for their children, compared to the reference group (aOR=2.19, 95% CI: 1.18–4.05).	**3.1** Sixteen participants vaccinated their children with routine vaccines during the pandemic, and 1 participant expressed non-acceptance of all vaccines for their children with no future intention Theme 1: Accessible vaccination with uncertain processes. Theme 4: Challenges for newcomers without social supports.	**IDP.1 Vaccination during the COVID-19 pandemic** Increase overall in parents' acceptance of childhood vaccination during the pandemic Decrease in no intent/receipt of routine childhood vaccines Newcomers' facilitator and challenges to accessing childhood vaccination
1.2 25.1% of parents with a child aged 0-6 years and 20.5% of parents with a child aged 7-17 years reported in S2 that they perceived childhood vaccines as being more important because of the COVID-19 pandemic. Reasons for uncertainty S1: 19.8% reported that they were waiting for the pandemic to be over and 18.0% were worried about COVID-19 transmission at appointment. S2: parents were less concerned about COVID-19 transmission at appointment (9.1%), were waiting for the pandemic to be over	**2.2** 36.6% of Indigenous parents reported that the pandemic made them realize that routine vaccines were more important, compared to 16.7% of newcomers and 16.9% of the reference group. Parents who perceived that routine childhood vaccines were less important because of COVID-19 were 4 times more likely to have low acceptance (aOR=4.16, 95% CI: 1.98–8.73) The most common reason for parents' uncertainty in S2, was parents who chose not to vaccinate their children in general, and uncertainty regarding appointments were happening, or cancelled appointments.	**3.2** Theme 5: Polarized perceptions towards different vaccines The pandemic influenced parents' perceptions of routine childhood vaccines as being more important (compared with perceptions prior to the pandemic). Theme 1: Accessible vaccination with uncertain processes. Nine participants experienced delays in routine vaccination due to the pandemic, with seven reporting no delays.	**IDP.2 How parents' perceptions of childhood vaccines changed because of the pandemic** Reasons for routine vaccine delays and uncertainty during the pandemic

(19.3%), were not sure if appointments were happening (17.0%).			
1.3 Increases over time in parents' confidence in routine vaccines (72.8% to 80.2%, p<.001) Agreement that parents weigh the benefits and risks of vaccination to make the best decision possible (73.4% to 79.8%, p=.006) Routine vaccines are effective (81.7% to 85.2%, p=.007) Increasing disagreement over time that everyday stress would prevent parents from getting a routine vaccine (68.5% to 78.8%, p<.001)	**2.3** Low acceptance of routine vaccines was associated with parents' perceptions that vaccination was unsafe (aOR=2.95, 95% CI: 1.75–4.98) Low acceptance of routine vaccines was associated with parents' perceptions that vaccination was unnecessary (aOR=2.22, 95% CI: 1.48–3.31) Low acceptance of routine vaccines was associated with parents' perceptions that everyday stress (such as competing priorities or many demands on my time) would prevent vaccination (aOR=2.26, 95% CI: 1.45–3.52).	**3.3** Theme 1: Accessible vaccination with uncertain processes. Theme 5: Polarized perceptions towards different vaccines	**IDP.3 5C psychological antecedents of vaccination** Increases is parents' confidence, parental vaccination decision-making, and belief in the effectiveness of vaccines. Increased access to vaccines.
1.4 Ontario reported an increase over time in vaccine acceptance for their children during the pandemic (80.4% to 87.1%, p=.007) and a decrease in no intent/no receipt (15.4% to 7.5%, p=.007) Parents with 2 children reported increases over time in acceptance (82.6% to 87.4%, p=.024), and a decrease in no intent/no receipt (11.3% to 6.1%, p=.024), compared to parents with 1 child	**2.4** Younger parents were less likely to experience low acceptance (i.e., they had higher acceptance) compared to parents ≥50 years (15-29 years: aOR=0.35, 95% CI: 0.19–0.66 and 30-39 years: aOR=0.59, 95% CI: 0.37–0.94) Parents who only had preschool-aged children (0-6 years) were less likely to experience low acceptance compared to parents of only school-aged children (7-17 years) (aOR=0.53, 95% CI: 0.36, 0.79).	-	**IDP.4 Social locations and vaccination.** Ontario increases over time in childhood vaccine acceptance compared to other provinces, decreasing no intent/no receipt Parents with 2 children reported increasing routine vaccine acceptance compared to those with 1 child

1.5 Parents were increasingly undecided about vaccinating their children against influenza (12.6% to 20.3%, p=.002)	**2.5** Those who were neutral or did not intend to vaccinate their child against influenza during the pandemic, were over three times more likely to experience low vaccination acceptance compared with parents who intended to vaccinate their child against influenza (aOR=3.42, 95% CI: 2.18–5.38 and aOR=3.46, 95% CI: 2.24–5.32, respectively)	**3.5** Ten participants vaccinated their children against seasonal influenza and COVID-1, although parents expressed hesitancy specific to these vaccines in comparison with routine vaccines. Theme 5: Polarized perceptions towards different vaccines	**IDP.5 Polarized perceptions towards specific vaccines** Increasing uncertainty and acceptance of childhood influenza vaccination.
-	**2.6** Discrimination/racism when accessing health services was most often experienced by Indigenous (27.8%) and Racialized minority (20.2%) parents, compared to 4.8% of reference group. Of all respondents 9.9% reported experiences of racism when accessing services	**3.6** Theme 2: Ethnocultural diversity protects against racialized discrimination Three participants shared experiences of racism. Theme 3: Normalization and socialization of vaccination fosters inclusivity	**IDP.6 Inclusivity in vaccination services** Discrimination/racism when accessing health services Vaccination inclusivity included normalization and socialization processes; more than just a convenient 'location'

Table adapted from: Lewis KB, Graham ID, Boland L, Stacey D. Writing a compelling integrated discussion: a guide for integrated discussions in article-based theses and dissertations. *Int. J. Nurs. Educ. Scholarsh.* 2021;18(1). https://doi.org/10.1515/ijnes-2020-0057

IDP 1: Vaccination during the COVID-19 pandemic

Across all three of the studies, parents reported high acceptance of routine childhood vaccines during the COVID-19 pandemic. Longitudinal analysis (study one) (N=650) demonstrated an increase over time in parents' acceptance (82.9% to 86.5%, p=.021) and a decrease in parents who reported no intent/receipt of routine childhood vaccines (12.5% to 8.3%, p=.021). In the second study, 87.9% of parents (N=2531) reported that they would accept routine vaccines for their children during the COVID-19 pandemic, whereas 8.1% had no intention and 4.0% remained undecided. Of the interview participants in the third study (N=17), 16 parents accepted routine vaccines for their children during the pandemic.

The timing and context of when data collection occurred for each study during the pandemic is important. The first study results showed that compared to children's pre-pandemic vaccination status (retrospectively reported), parents of children aged 0-6 and 7-17 years reported an initial decrease in vaccine acceptance at the time of survey one (Dec 2020), however a slight increase in acceptance occurred for survey two (Oct-Nov 2021). In the second study (N=2531), in Oct-Nov 2021 parents' reported acceptance was higher than the pre-pandemic 7-

year-old child and 14-year-old adolescent national coverage levels.[20] These findings are critical in light of the decrease in childhood vaccine uptake that occurred during the first months of the pandemic (Mar-Sept 2020).[21-23] Most countries who reported the alarming decrease had returned to pre-pandemic levels, or higher, by Jan 2021.[23,24] This rebound may be due to effective public health communication, improved access to vaccines, and parents who were increasingly motivated to vaccinate their children.[25-27] Parents' increasing acceptance of routine vaccines (i.e., reported intent/receipt of vaccines), was attributed to growing awareness of the importance and effectiveness of childhood vaccines due to the spotlight on COVID-19 vaccination and its role in preventing adverse disease outcomes and enabling a return to normal socioeconomic activities.[28,29]

In the third study (Feb-Mar 2023), Racialized minority and newcomer parents discussed how social and cultural beliefs, and perceptions about vaccination and experiences with VPDs from a previous country of residence, positively influenced their decision whether to vaccinate their children in Canada. Perspectives were contextualized within Canadian sociodemographics such as a relatively small population, sufficient health resources, and universal health services (i.e., publicly funded); and in contrast to limited access to vaccines and experiences with VPD within a previous country of residence. Parents' motivations and determination to vaccinate their child(ren) was described as a means to prevent diseases, an opportunity some parents did not have themselves as a child.

In contrast, objective two (Oct-Nov 2021) survey respondents who self-identified as a Racialized minority, or those with two intersecting ethnocultural identities, reported the highest non-acceptance (i.e., parents who reported no intention to vaccinate) at 16.0% and 16.1%, respectively, compared to 10.9% of parents who did not self-identify with the ethnocultural identities of interest. Furthermore, parents who self-identified as a Racialized minority were more than twice as likely to report low vaccination acceptance for their children, compared to the reference group (aOR=2.19, 95% CI: 1.18–4.05). Through descriptive thematic analysis, the third study results provided contextual understandings of these significant findings. Although Racialized minority and newcomer interview participants overwhelmingly perceived childhood vaccination as accessible, available, and a privileged opportunity, parents expressed compounding uncertainties and challenges accessing vaccines. Challenges were attributed to

unfamiliarity with Canadian vaccination schedules and service provision, a lack of family and social supports, and constraints related to COVID-19 transmission prevention measures.

IDP 2: How parents' perceptions of childhood vaccines changed because of the pandemic

In the longitudinal analysis (study one), parents increasingly perceived over time that routine vaccines were more important because of the COVID-19 pandemic (22.9% to 27.1%, p =.166). In survey two (Oct-Nov 2021), during the second wave of the COVID-19 pandemic (i.e., when the Delta variant [B.1.617.2] was prominent and prior to the Omicron variant [B.1.1.529]), 25.1% of parents with a child aged 0-6 years and 20.5% of parents with a child aged 7-17 years reported that they perceived routine childhood vaccines as being more important. Of the overall sample of the second study (N=2531), 21.1% of parents reported that they perceived routine childhood vaccination as being more important because of the COVID-19 pandemic, and 77% reported no change in their perceptions. Assessing across various ethnocultural identities in the second study, I found that 36.6% of Indigenous parents reported that the pandemic made them realize that routine vaccines were more important, compared to 16.7% of newcomers and 16.9% of the reference group. Furthermore, parents in the second study who perceived that routine childhood vaccines were less important because of the COVID-19 pandemic, were four times more likely to have low acceptance (aOR=4.16, 95% CI: 1.98–8.73). Finally, in the third study (Feb-Mar 2023), 16 of 17 interview participants described the pandemic as either reaffirming or increasing their perceptions that childhood vaccines were important for their children.

These findings demonstrated that global attention on the benefits, risks, and effectiveness of COVID-19 vaccines in conjunction with parents' ongoing active engagement in COVID-19 vaccine decision-making for their children, likely translated into active-engagement in parents' routine childhood vaccine decision-making.[30,31] Parents' overall perceptions about the importance of childhood vaccination were positively influenced by the pandemic. It is equally important to understand how hesitancy about routine vaccines may have been perpetuated by the pandemic. Similar to a study from the United States,[32] in the second study there was a significant association between parents' low acceptance and beliefs that childhood vaccines were less important because of the pandemic. It is noteworthy, that only 1.9% of parents (N=2531) reported that they believed routine vaccines were less important. Two interview participants also expressed how the pandemic caused them to experience further mistrust, affirming their decision to not accept future vaccination.

IDP 3: 5C psychological antecedents of vaccination

The 5C psychological antecedents of vaccination model[33] was utilized in survey data collection as a validated measure of vaccine attitudes that determine the outcome of vaccine uptake. I found significant results in all 5C categories, except for collective responsibility. In the longitudinal analysis (objective one study), I found statistically significant increases over time in parents' confidence in routine vaccines (72.8% to 80.2%, p<.001), agreement that they weigh the benefits and risks of vaccination to make the best decision possible (73.4% to 79.8%, p=.006), and that routine vaccines are effective (81.7% to 85.2%, p=.007). Parents increasingly disagreed that everyday stress would prevent them from getting a routine vaccine over time (68.5% to 78.8%, p<.001). It is noteworthy that parents in Canada were less likely to encounter barriers to accessing routine childhood vaccines later in the pandemic due to the resumption of preschool-aged and school-based vaccination programs.[34,35] In the second study, low vaccine acceptance was associated with parents' perceptions that vaccination was unnecessary (aOR=2.22, 95% CI: 1.48–3.31) or unsafe (aOR=2.95, 95% CI: 1.75–4.98), and that everyday stress would prevent vaccination (aOR=2.26, 95% CI: 1.45–3.52).

Along with increased perceptions of the importance, safety, and effectiveness of routine vaccines, parents in my studies one and two were more motivated to actively overcome perceived barriers to accessing routine vaccines. Although most interview participants (objective three study) were motivated and accepting of childhood vaccines, parents experienced delays and constraints to accessing childhood vaccination due to COVID-19 transmission prevention measures early in the pandemic (i.e., limited appointments, one child one parent restrictions).[21,36,37] Similar to Canadian literature,[24,36,37] across all three studies, parents' reported concerns regarding possible COVID-19 transmission during the appointments and uncertainties about whether vaccination appointments were available to due COVID-19 related closures.[35]

Importantly, my third study further contextualized Racialized minority and newcomer participants' experiences with accessing childhood vaccination in Canada. Fourteen newcomer participants shared overwhelmingly positive experiences regarding the availability and accessibility of childhood vaccines in Canada, in comparison to a previous country of residence. Participants perceived that the reason routine childhood vaccines were accessible and available in Canada was due to increased resources (i.e., health care providers and services), smaller population size, universal health services (i.e., publicly funded health services), and improved

vaccination information sharing compared to a previous country of residence (i.e., India, Nigeria, South Africa, Mexico, Philippines). However, similar to existing literature,[38-40] I found that unfamiliarity with Canadian vaccination processes created uncertainty for some newcomer parents regarding which vaccines were recommended and available, and how to access services. Participants contextualized uncertainty within international differences in vaccination processes, interprovincial service delivery (e.g., public health centre, pharmacy, school-based), and vaccine providers (e.g., nurses, family physicians, pharmacists, pediatricians). Similarly, Bell et al.[25] noted that Racialized minority parents in England experienced increased barriers to accessing routine vaccines during the pandemic, subsequently influencing their low acceptance.

Four newcomer interview participants (objective three study) who arrived in Canada just prior to the COVID-19 pandemic (fall 2019/winter 2020) experienced further challenges navigating health services for their children during the pandemic without the support of family or established social or community groups. Participants discussed how COVID-19 disease transmission prevention measures created further challenges to accessing vaccines in the way of delayed and decreased appointment availability, one-parent per appointment restrictions, fear of COVID-19 transmission, and physically-demanding infection control requirements.[24,36,37] In the context of these difficulties, newcomer participants who arrived in Canada within the last 5 years (since 2018) experienced challenges in navigating health services with limited social/family networks. Beyond overcoming logistical barriers to access, newcomers shared feelings of "being alone" and having to "just cope" and rely on healthcare professionals in the absence of family support. Importantly, newcomers spoke positively regarding feeling supported by physicians, public health nurses, and pediatricians as they transitioned to Canadian social norms and parenthood in general.

Although intention does not necessarily translate to uptake, the comprehensive findings suggest that parents' confidence in the safety and effectiveness of routine vaccines, engagement in decision-making, and acceptance of childhood vaccination increased. Although parents were motivated to actively overcome perceived barriers to accessing vaccines during the pandemic, they experienced delays and service constraints. COVID-19 prevention measures created significant social and economic hardship for many parents.[32] Although mandates and public health measures aimed to protect the greater population, results demonstrated that some parents were disproportionately impacted, which subsequently influenced routine vaccination intentions

and decision-making.[25,32] Although newcomers overwhelmingly found Canadian childhood vaccination accessible and available in comparison to a previous country of residence, a lack of family and social support and unfamiliarity with vaccine schedules and processes created uncertainty and additional challenges to accessing services.[25,32,41]

IDP 4: Social location and vaccination

I found that social location (i.e., province of residence, number and ages of children) was associated with parents' childhood vaccine acceptance. In the first study, parents from Ontario reported an increase over time in vaccine acceptance for their children (80.4% to 87.1%, p=.007) and a decrease in no intent/no receipt (15.4% to 7.5%, p=.007). Preschool-aged and infant routine vaccines are primarily administered by family physicians and pediatricians in Ontario, therefore being directly impacted by the suspension of in-person appointments.[42,43] This conclusion was supported by Canadian studies that found continued delays in the recovery of routine vaccination rates and coverage as late as Nov-Dec 2020.[29,36,42,44] Parents from Ontario in this study also reported the lowest routine vaccine acceptance in Dec 2020, compared to other provinces, with the highest increase in acceptance during Oct-Nov2021. Contributing to the literature, the results demonstrated that vaccination delivery methods in Ontario were more negatively impacted by public health measures to prevent the spread of COVID-19 than other provinces.

In the first study, parents with two children reported an increase over time in routine vaccine acceptance for their children (82.6% to 87.4%, p=.024), and a decrease in no intent/no receipt (11.3% to 6.1%, p=.024), compared to parents with one child. Whereas, in the second study, younger parents were less likely to experience low routine vaccination acceptance (i.e., they had higher acceptance) compared to parents ≥50 years (15-29 years: aOR=0.35, 95% CI: 0.19–0.66 and 30-39 years: aOR=0.59, 95% CI: 0.37–0.94), and parents who only had preschool-aged children (0-6 years) were less likely to experience low routine vaccine acceptance compared to parents of only school-aged children (7-17 years) (aOR=0.53, 95% CI: 0.36, 0.79).

In summary, I found that routine childhood vaccination delivery methods in Ontario were more negatively impacted by public health measures to prevent the spread of COVID-19 than other provinces. Importantly, the World Health Organization's 2020 list of 13 global health threats for the next decade included delivering health services during crises and preventing

infectious disease outbreaks.[34] I also found that parents' social location with regards to number of children, and age demographics of children and parents, was associated with childhood vaccination, however research has demonstrated varying results.[46,47] Thus, further research regarding social location is required to better understand additional intersecting social factors.

IDP 5: Polarized perceptions towards specific vaccines

Across all three studies, parents reported polarized perceptions between routine and influenza vaccination for their children. In longitudinal analysis (objective one study), parents were increasingly undecided about vaccinating their children against influenza (12.6% to 20.3%, p=.002). In the second study, parents who were neutral or did not intend to vaccinate their child against influenza during the pandemic were over three times more likely to experience low routine vaccine acceptance compared with parents who intended to vaccinate their child against influenza (aOR=3.42, 95% CI: 2.18–5.38 and aOR=3.46, 95% CI: 2.24–5.32, respectively). Furthermore, parents were equally likely to accept or decline influenza vaccination for their child during the pandemic, with a large majority who remained undecided. Building upon the second study's results, interview participants (objective three study) discussed perceiving influenza disease as a common illness, and noted that vaccination was not available in their previous country of residence. Interview participants were more accepting of influenza vaccines for their child compared to COVID-19 vaccines, and most parents expressed influenza vaccine hesitancy based on perceptions that the vaccine was not necessary or effective in the prevention of influenza disease. Although parents' low routine vaccine acceptance was associated with low seasonal influenza vaccine acceptance in the second study, in study three, parents contextualized that their hesitancy towards influenza vaccination for their children did not impact attitudes or behaviors towards accepting routine vaccines during the pandemic.

Sokol and Grummon[48] found that the COVID-19 pandemic may exacerbate polarity between routine childhood and influenza vaccination, with a marked decrease in parents' influenza vaccination intentions for their children. Before the pandemic, childhood influenza vaccination was typically lower than that of routine vaccines,[49,50] with parents reporting concerns with its necessity and effectiveness compared to routine childhood vaccines.[51] In Canada, childhood influenza vaccination remained low during the COVID-19 pandemic with approximately 40% of children aged 6 months-4 years and 29% of those aged 5-11 years having been vaccinated during the 2021-2022 influenza season.[52] Considering the low prevalence of

influenza disease during the pandemic, it is possible that parents prioritized COVID-19 and routine vaccines over influenza vaccine for their children.[32,53] Others may have prioritized influenza vaccination for their child, seeking protection against a potential second respiratory illness during the pandemic.[54,55] However, in light of elevated incidence of pediatric hospitalization due to respiratory syncytial virus (RSV) and influenza disease in 2022-2023,[56] provincial, territorial, and federal vaccination governing bodies recommend influenza and RSV pediatric vaccination for children, noting further recommendations for those at risk for adverse disease (i.e., immunocompromised, chronic respiratory disease).[48,57]

In summary, I found that parents' polarized perceptions placed high importance on routine vaccines but increased hesitancy towards influenza vaccines for children. Furthermore, parents were equally likely to accept or decline influenza vaccination for their child during the pandemic, with a large majority who remained undecided.

IDP 6: Inclusivity in vaccination services

I assessed discrimination and/or racism when accessing health services in the second and third studies. Of the second study respondents (N=2531), 9.9% reported experiencing discrimination and/or racism and 3 of 17 interview participants in study three reported such experiences. In the second study, discrimination and/or racism when accessing health services was most often experienced by Indigenous (27.8%) and Racialized minority (20.2%) parents, compared to 4.8% of the reference group. In Canada, other studies have found that over 25% of the population have reported experiences of discrimination based on ethnocultural identities and social locations; racial discrimination, being most commonly reported.[58,59] A recent Canadian study identified how intersecting forms of discrimination constrained COVID-19 vaccination decision-making for Racialized minority and Indigenous peoples.[60] Importantly, an association exists between past experiences of discrimination and decreased health service seeking behaviors.[61,62]

In light of the second study results, and recent research that has shown increased anticipation of experiencing discrimination when accessing health services in Canada among ethnocultural minorities,[41] study three sought to further explore parents' experiences of discrimination and/or racism when accessing health services. I conducted purposive sampling of participants who self-identified as Indigenous or a Racialized minority to assist in capturing possible experiences of discrimination. Surprisingly, interview participants (study three) reported

experiencing a strong sense of ethnocultural inclusion and acceptance when accessing health services for themselves or their children. Parents attributed inclusivity to existing multiculturalism within their communities and among health professionals in Canada. A key example is a participant who contextualized experiences of discrimination and racism in South Africa. This participant reported an overwhelming sense of belonging and liberation from Racialized oppression, describing Canada's social make-up as ethnoculturally diverse, providing a positive learning opportunity about inclusion.

Finally, the study three participants discussed the importance of convenient services and locations for vaccine delivery; however, a concept of inclusivity remained the prominent theme. Participants discussed school-based vaccination as a facilitator of peer information sharing, noting that socialization and normalization of vaccination processes among adolescents promoted acceptance and a sense of contributing to the greater good (e.g., herd immunity). Furthermore, Indigenous parents described culturally relevant childhood vaccination services. Services supported cultural values of inclusion (e.g., multiple family members being vaccinated together), delivery by and within the Indigenous community, and reciprocity (e.g., sharing of gifts).[40] Self-determination and resilience of Indigenous peoples in Canada, related to culturally sensitive vaccination processes, has been noted during the COVID-19 pandemic.[61,63] A strength-based approach focuses on protective factors, such as ethnocultural diversity and culturally relevant health services, which promotes inclusion, acceptance, resiliency, and self-determination for historically underserved ethnocultural groups.

Implications for Public Health Policy and Nursing Practice

Eight key implications for public health policy and nursing practice are as follows:

1. Within the context of the pandemic, a unique opportunity exists for frontline health care providers to support parents, as a potentially captive audience, as they navigate childhood vaccine decision-making. This opportunity extends to government and health authority messaging to promote childhood vaccination as a means of preventing adverse health outcomes from VPDs.
2. Health care providers must develop trusting relationships with parents as they navigate mis- and dis-information. Trusting relationships with health care providers supports parents' confidence and acceptance of childhood vaccines when deciding whether to vaccinate.[30,31]

3. Reliable information that addresses misconceptions related to COVID-19, influenza, and routine vaccines is critical for parents' decision-making for their children. Targeted and multipronged communication strategies are required for specific vaccines.[64]
4. Approaches to childhood vaccination should focus on strength-based protective factors. These include vaccine provider multiculturalism, and culturally relevant services that promote inclusion and self-determination for historically underserved ethnocultural groups.
5. Promoting childhood vaccination among newcomer parents should include information tailored to newcomers' contexts, such as intake questionnaires that pre-emptively address known differences in routine vaccination by geographical immigration patterns.
6. During a global health crisis, childhood vaccination in Canada must be safeguarded through strategies that promote accessibility and inclusion across provinces and territories where vaccine delivery processes differ.[31,65]
7. Accessibility may get parents in the door, however, services tailored to promote positive experiences for parents and children (e.g., parent/child friendly and child focused) motivates future vaccination.[66] School-based vaccination, for example, normalizes and socializes vaccination, fosters peer information sharing, and incorporates a concept of doing good for the community (i.e., herd immunity).
8. Early COVID-19 vaccination in Canada was based on equitable allocation to populations who may experience differential access to health services (i.e., remote and isolated communities), Indigenous populations, and other identified at-risk groups.[61,67] This prioritization framework aimed to reduce health inequities and prevent further discrimination within some populations.[67] Similarly, public health officials should consider a childhood vaccination framework that prioritizes equitable access for some ethnocultural groups, where known social discriminations and inequities to accessing services exist.

Knowledge Translation

Knowledge translation of my dissertation provides information to public health vaccination decision-makers, front-line service providers (e.g., public health nurses, nurse practitioners, pediatricians, physicians), and epidemiological determinants of vaccination researchers. Key stakeholders were integrated in the *COVImm study (Vaccination in a Pandemic)* team, including the Executive Secretary for NACI, and public health knowledge users in Alberta (Secretariat for the Alberta Advisory Committee on Immunization), Québec (Comité

sur l'immunisation du Québec), and British Columbia (BC Centre for Disease Control [BCCDC]). Findings identify further determinants of childhood vaccination among parents of diverse ethnocultural identities and social locations.

Outputs and dissemination

Knowledge dissemination of study results and recommendations included three targeted publications (one for each objective). Two studies have been published in peer reviewed and open access journals,[68,69] with the third qualitative study in the preparation stages. Two posters for the quantitative studies (objectives one and two studies) were presented at the *Canadian Immunization Conference* in Ottawa, Apr 2023.[70,71] In addition, results from the first and second studies were presented to key immunization stakeholders at the *Canadian Immunization Research Network* Sept 2023.[72] The third qualitative study (objective three) has been accepted for a poster and oral presentation at the *BCCDC Western Canada Immunization Forum*[73] Mar 2024 in Vancouver BC, and at the *Canadian Public Health Conference (CPHA) Public Health*[74] Apr 2024 in Halifax, Nova Scotia. Childhood vaccination knowledge gained through this dissertation research has enabled me to complete two written reports, one for Alberta Health[75] and the second for the Maskwacis First Nations community,[76] related to childhood immunization coverage and barriers to access for underserved and vulnerable children in Alberta Canada. Additionally, I serve on the *Canadian Vaccination Evidence Resource and Exchange Centre's* (CANVax) expert review panel[77] as an external reviewing body on topics related to immunizations, and vaccination policy and program evaluation.

Future Directions

The integrated mixed methods of this dissertation assessed intersections of ethnocultural identities and social locations, and explored how these influenced parents' perceptions, acceptance, and access to childhood vaccines during the COVID-19 pandemic. Research has demonstrated challenges in assessing interdependent intersections of social determinants of health and their associations with childhood vaccine acceptance.[6,8] Quantitative epidemiological methodologies measure determinants of routine childhood vaccination within specified populations, and qualitative methodologies have the unique ability to contextualize associations among intersections of ethnocultural identities and social locations. "Mix[ed] methods combine the power of stories and the power of numbers. In public health, stories have the power to change policies, and statistics traditionally provide a strong rationale to make changes."[78] Future

childhood vaccination research should include intersectional approaches to disaggregated data in combination with descriptive contextual analysis. Within the realm of epidemiology, public health and nursing practice, mixed methods (e.g., methodological triangulation) facilitates an analysis and synthesis of multiple data sources that increases credibility, validates results, and contextualizes findings within the '*human experience*.'[79,80] A key benefit of mixed methods in public health and nursing research is that it addresses not only a research question of how did we get here, but also, what do we do next?[33,81]

As depicted through the COVID-19 pandemic, social community and the interconnectedness of humanity are vital considerations in public health initiatives. Routine childhood vaccination is one such example of a public health intervention that benefits the social community. Therefore, public health decision-makers must ensure the availability and equitable access to vaccines. Inclusive services should target diverse ethnocultural identities and social locations, where disproportionate barriers and low acceptance may prevail. This dissertation projects' findings demonstrate how Canada's multiculturalism is a facilitator of inclusive health services and is protective against racialized discrimination among some ethnocultural groups. Furthermore, these findings contextualize how previous social and cultural perceptions of vaccination and experiences with VPDs shaped parents' positive perceptions and acceptance of vaccines. However, polarized perceptions between routine, COVID-19, and influenza vaccines are a cause for concern regarding the potential adverse health outcomes from vaccine preventable respiratory viruses in children. Overcoming logistical challenges to accessing childhood vaccines is critical. However, inclusive services promote positive experiences for parents and children that motivate future vaccination. Culturally-relevant approaches and pre-emptively addressing differences in vaccine schedules and delivery methods is important for newcomer parents.

This dissertation project sought to understand parents' perceived importance of continuing routine vaccinations during the pandemic, intentions to vaccinate, access to services, and changes in their beliefs and attitudes about vaccination because of the pandemic. Ethnocultural identities and social locations of parent groups, identified necessary adaptations to public health messaging and service delivery. This dissertation supports vaccination policy to address the pandemics indirect consequences on childhood vaccination, and the creation of accessible and inclusive services.

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APPENDICES

Appendix 1

National Advisory Committee on Immunization (NACI) Equity Matrix

Table adapted from: Ismail SJ, Tunis MC, Zhao L, Quach C. Navigating inequities: a roadmap out of the pandemic. *BMJ Global Health*. 2021;6(1):e004087-. https://doi.org/10.1136/bmjgh-2020-004087

NACI equity matrix applied to COVID-19: identifying inequities, sources of inequities, and interventions to reduce inequities and improve access to vaccines

Factors that may contribute to health inequity	**Why inequity may exist** (differential access to healthcare, differential disease exposure/susceptibility/severity plus intersections with other factors*)	**Examples of interventions to reduce inequity and improve access**
Pre-existing condition (e.g., chronic disease, immunocompromise, pregnancy, disability)	► Differential disease severity has been shown to have large independent associations with chronic medical conditions (heart failure, diabetes, chronic kidney disease, dementia, liver disease) and obesity (body mass index, BMI≥40).[10] ► Differential disease severity has been shown to have moderate independent associations with obesity (BMI>30), and haematological malignancy.[10] ► No clear evidence of an independent association of differential disease severity in pregnancy currently exists[10]; however, the possibility has been suggested in some studies. ► People with disabilities may experience differential disease exposure due to challenges with infection prevention and control (IPC) measures† and residence in group home settings. *Multiple possible intersections such as: age, socioeconomic status (SES), place of residence, social capital, racialization*	► Include these populations in clinical trials to demonstrate efficacy and safety of interventions (following Research Ethics Board (REB) guidelines and First Nations Principles of Ownership, Control, Access and Possession (OCAP)[49] of data collection processes in their communities). ► Consider these populations as key groups for vaccination. ► Facilitate rides to immunisation clinics or home visits for those who are immobile to improve access to vaccines and testing for infection. ► Offer vaccination at healthcare visits for pre-existing conditions (e.g., medical specialist appointments). ► Enable IPC measures† to reduce exposure.
Place of residence (e.g., remote, overcrowding, homeless, institutionalisation)	► Differential exposures in institutions exist with evidence of a high number of outbreaks in long-term care facilities (experiencing the majority of outbreaks), hospitals, prisons, shelters.[50] ► Outbreaks involving large numbers of reported cases have occurred in rural, and remote communities.[50] ► Differential disease severity has been shown to have large independent associations with homelessness.[10] ► Homeless populations, and those living in shelters/group homes or in overcrowded neighbourhoods or homes (e.g., migrant workers), as well as rural, remote and Indigenous communities have differential exposure and	► Include these populations in clinical trials of interventions (following REB guidelines and OCAP principles[49]). ► Consider these populations as key groups for vaccination. ► Consider standing orders in institutions, and mobile clinics in hardly reached populations to improve access to immunisation. ► Enable IPC measures† to reduce exposure. ► Consider vaccinating all eligible individuals in remote areas facilitated by community members/ leaders/

	challenges with physical distancing and other IPC measures†, as well as potentially decreased access to healthcare. ► Indigenous communities have been disproportionately impacted in previous pandemics (e.g., 2009 H1N1 influenza).[4] *Multiple possible intersections such as: pre-existing condition, SES, education/ literacy level, social capital, racialization*	advocates for efficient, effective use of resources. ► Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Racialization (including ethnoracial and ethnocultural diversity, immigration or refugee status)	► Differential disease severity has been shown to have large independent associations with some Racialized populations.[10] Evidence of higher rates of COVID-19 and differential disease severity in ethno-culturally diverse neighbourhoods exists.[17-19] ► Racialized populations have differential access to healthcare and may experience stigmatisation and discrimination. Lower vaccination rates have been observed in immigrant children and seniors for other vaccine-preventable diseases (VPDs).[41] Visible minorities and Indigenous Canadians appear to be less willing than non-visible minorities to get an effective recommended SARS-CoV-2 vaccine.[42] ► Immigrant/refugee populations or migrant workers may have differential exposure due to international travel. ► Racialized populations are disproportionately represented in precarious jobs and workplace settings such as in the food or healthcare sectors, and often reside in multigenerational living spaces, leading to differential exposure and transmission within communities. *Multiple possible intersections such as: SES, place of residence, occupation, pre-existing conditions, social capital, education/literacy level*	► Include populations from diverse racial, ethnic and cultural backgrounds in clinical trials (following REB guidelines and OCAP principles[49]). ► Address Racialized barriers to accessing healthcare and support policies that target systemic racism and protect the rights of Racialized groups. ► Improve access to testing and vaccination (e.g., mobile clinics, publicly funded interventions) for Racialized populations without further stigmatisation or discrimination, including those without health insurance (e.g., migrant workers, asylum seekers). ► Engage trusted community leaders/partners/elders and liaise with relevant organisations (e.g., immigration and refugee departments) in planning for immunisation programmes and communication materials. ► Provide culturally appropriate educational and communication materials in a variety of languages, media platforms and venues. ► Have translators and supports (e.g., community members) available in clinics. ► Enable improved IPC measures† to reduce exposure.
Occupation	► Healthcare workers/personnel have differential exposure and transmission to clients at high risk of severe illness. However, some in this group may have more access to and training in the use of PPE and other IPC measures†, so exposure risk could be significantly reduced compared with other groups.[47,48] ► Essential services workers (e.g., emergency workers, grocery/transit staff, meat/ agriculture	► Include these populations in clinical trials (following REB guidelines and OCAP principles[49]). ► Consider these populations as key groups for vaccination. ► Offer alternate immunisation settings such as mobile, worksite, or after-hours immunisation clinics and testing.

	workers, teachers) and others who cannot work virtually as the economy reopens and have high social contact (with limited IPC measures†) have differential exposure. ► Outbreaks involving large numbers of reported cases have occurred in agricultural work settings, including those with congregate living for migrant workers.[50] ► Individuals who travel internationally for work may have differential exposure. *Multiple possible intersections such as: SES, racialization, social capital*	► Enable improved IPC measures† to reduce exposure.
Gender identity/sex	► Differential disease severity has been shown to have a large independent association with male sex,[10] that may be linked to immunological sex differences or gendered differences in behaviours such as differential access to healthcare before progression of disease. ► Gendered differences in caregiver roles, gender-based violence and socioeconomic instability may result in differential direct and indirect impacts of the pandemic. *Multiple possible intersections such as: occupation, pre-existing conditions, SES, social capital, risk behaviours*	►Consider gender/sex-inclusive vaccination policies. ► Address gendered barriers to accessing healthcare and vaccination programmes (e.g., through social influencers). ► Support sex and gender-based analyses. ► Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Religion/belief system	► Religious beliefs about immunisation may result in differential access to vaccines. ► Gatherings of faith-based communities may lead to differential exposure. Outbreaks involving large numbers of reported cases have occurred in mass gatherings,[50] and cases linked to religious facilities continue to emerge. *Multiple possible intersections such as: racialization*	► Engage faith-based leaders in the development of educational materials and planning for immunisation programmes. ► Offer alternate immunisation settings such as at places of worship. ► Enable improved IPC measures† to reduce exposure. ► Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Education/literacy level	► Those with lower education or literacy levels potentially have decreased access to healthcare. Lower levels of education (or parental education in the case of children) have been associated with lower vaccination rates in all age groups for various VPDs.[44,45] ► Those with lower education or literacy levels are less likely to be able to work from home, potentially leading to differential exposure. ► International students may have differential exposure if they travel internationally, and differential access to healthcare if not insured.	► Offer alternate immunisation and testing settings to improve access (e.g., school- based vaccination programmes). ► Provide educational materials at appropriate literacy levels. ► Have translators available in clinics. ► Enlist multilingual family/ community members to assist in communication.

	Multiple possible intersections such as: place of residence, occupation, pre-existing conditions, smoking, SES, racialization	
Socioeconomic status (SES) (including income, and coverage of healthcare and healthcare interventions)	► Differential disease severity has been shown to have large independent associations with low socioeconomic status.[10] ► Populations with lower income status and inability to pay for IPC resources, higher risk occupations with limited IPC measures†, job insecurity and inability to work from home have differential exposure. ► Lack of healthcare insurance or inability to pay for healthcare interventions may result in differential access. Vaccination rates tend to be lower in lower socioeconomic groups for various VPDs even if vaccines are publicly funded.[43,44] *Multiple possible intersections such as: place of residence, occupation, pre-existing conditions, social capital, education/literacy level, racialization*	► Include populations from a variety of SES backgrounds in clinical trials (following REB guidelines and OCAP principles[49]). ► Improve access to testing and vaccination (e.g., mobile clinics, publicly funded interventions) regardless of healthcare coverage. ► Enable improved IPC measures† to reduce exposure. ► Support programmes and policies aimed to assist and empower systemically marginalised populations and improve access to healthcare.
Social capital (social support/ networks, trust)	► Lack of support networks (e.g., to remind or enable individuals and caregivers to attend to vaccination and other IPC measures†), and lack of trust (e.g., in authorities making recommendations) may lead to differential access to healthcare interventions. ► Non-vaccination has been associated with single-parent families for other VPDs.[44] *Multiple possible intersections such as: SES, place of residence, occupation, age, pre-existing conditions, education/ literacy level*	► Empower trusted healthcare providers to recommend and provide vaccinations during patient visits. ► Improve trust in immunisation and other healthcare interventions through trusted leaders and social media influencers. ► Implement reminder/recall systems for immunisation. ► Offer childcare during immunisation visits.
Age	► All ages are susceptible to COVID-19, but the rate of diagnosed COVID-19 cases generally increased with age earlier in the pandemic. As national lockdown measures relaxed, a significant increase in the proportion of cases in younger adult age groups has been observed.[50] ► Differential disease severity has been shown to have a very large independent association with increasing age.[10] ► Children <10 years of age experience milder or asymptomatic infection but evidence of differential disease severity (i.e., multisystem inflammatory syndrome) is emerging.[51] *Multiple possible intersections such as: pre-existing conditions, social capital, SES*	► Include populations from a variety of age ranges in clinical trials (following REB guidelines and OCAP principles[49]). ► Consider the evidence of inequities related to age when sequencing groups for early vaccination. ► Consider promotion and education activities on platforms that access key age groups (e.g., established social media, print media, mail campaigns in older ages). ► Consider vaccine programmes to protect those in contact with the elderly if vaccine efficacy is impaired due to immune senescence.

Other factors (eg, substance use disorders, smoking)	► No large increased risk in hospitalisation in current or former smokers has been observed to date with limited data for associations with substance use disorders.[10] However, data continues to evolve. ► These populations may have differential access to healthcare. ► Indirect impacts of the pandemic could lead to increased substance use. *Multiple possible intersections such as: SES, social capital, place of residence, pre-existing conditions, education/literacy level*	► Include these populations in clinical trials (following REB guidelines and OCAP principles[49]). ► Improve access to testing and vaccination (e.g., mobile clinics, at substance use treatment centres) and offer publicly funded interventions. ► Enable improved IPC measures† to reduce exposure. ► Support programmes aimed to assist those with tobacco and substance use disorders.

This table may not include evidence which has evolved since it was initially developed.
*Multiple intersections between factors may exist; however, only a subset are highlighted in the table.
†Possible IPC measures include: handwashing, disinfecting surfaces, erecting physical barriers, maintaining physical distancing, using appropriate PPE. PPE, personal protective equipment.

Appendix 2

The 5C Psychological Antecedents of Vaccination Questions

Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Böhm R. Beyond confidence: development of a measure assessing the 5C psychological antecedents of vaccination. *PloS One*. 2018;13:e0208601. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6285469/

Instructions: How much you disagree or agree with the following statements. (1=strongly disagree, 2=moderately disagree, 3=slightly disagree, 4=neutral, 5=slightly agree, 6=moderately agree, 7=strongly agree). **Scoring:** mean scores of each sub-scale. The item with (R) is reverse-coded. **Short scale**: use bolded items (5 items). **Long scale:** include all 15 items.	
Confidence (α = .85)	
I am completely confident that vaccines are safe.	
	Vaccines are effective.
	Regarding vaccines, I am confident that public authorities decide in the best interest of the community.
Complacency (α = .76)	
Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.	
	My immune system is so strong, it also protects me against diseases.
	Vaccine-preventable diseases are not so severe that I should get vaccinated.
Constraints (α = .85)	
Everyday stress prevents me from getting vaccinated.	
	For me, it is inconvenient to receive vaccinations.
	Visiting the doctor's makes me feel uncomfortable; this keeps me from getting vaccinated.
Calculation (α = .78)	
When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.	
	For each and every vaccination, I closely consider whether it is useful for me.
	It is important for me to fully understand the topic of vaccination, before I get vaccinated.
Collective responsibility (α = .71)	
When everyone is vaccinated, I don't have to get vaccinated too. (R)	
	I get vaccinated because I can also protect people with a weaker immune system.
	Vaccination is a collective action to prevent the spread of diseases.

Appendix 3

CHERRIES Checklist for Objectives One and Two Studies

Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet e-surveys (CHERRIES). *J Med Internet Res.* 2004;6(3):e34–e34. https://doi.org/10.2196/jmir.6.3.e34

Item	Explanation	Response
Designs		
Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Respondents were randomly selected from the Leger Web panel, which has more than 200,000 panelists in Quebec and more than 400,000 panelists across Canada. The target population included parents of children younger than 7 years old (N=500); parents of children 7-17 years old (N=500); people < 60 years, not pregnant and with no chronic medical conditions; Adults > 60 years old (N=500); healthcare workers (N=500); Indigenous persons (N=300); Pregnant respondents (N=200); visible minority persons (N=500)(persons, other than Indigenous peoples, who are non-Caucasian in race or non-white in colour); newcomers (N=500)(arrived in Canada within the past 5 years); persons with chronic medical conditions, age <60 years (N=500); and persons whose first language is not English or French (N=500)
Institutional Review Board approval and informed consent process		
IRB approval	Mention whether the study has been approved by an IRB.	Health Research Ethics Board, University of Alberta
Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Participants were informed responses are confidential and stored in the Leger Opinion data base by unique number, length of survey (15-20 minutes), and information was provided regarding the purpose of the study and principal investigators. Data provided to the COVImm project is confidential, anonymous, and contains no identification information unless participant contact information provided in response to a survey question.
Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access. https://www.ualberta.ca/nursing/research/supports-and-services/hrdr.html#:~:text=Based%20withi	Data received from Leger is stored in the University of Alberta, Faculty of Nursing, Health Research Data Repository (HRDR) which is a secure and confidential virtual research environment. Researchers can securely access data, however information cannot be

	n%20the%20Faculty%20of,health%20research%20data%20and%20meta%2D	removed or copied from HRDR unless by request and permission granted.
Development and pre-testing		
Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	The survey was based on a previous national survey of Canadians' acceptance of routine childhood vaccines and a literature review of validated conceptual models and measures of vaccine up-take behaviours. The 5C psychological antecedents of vaccination model was chosen as the most comprehensive validated measure of vaccine behaviours. The 5Cs model is grounded in vaccine acceptance and hesitancy theoretical models and includes 5 category measures of vaccine uptake including confidence, complacency, constraints, calculation, and collective responsibility. The 5Cs model has been tested internationally in 4 different studies and includes a long (15-item) and short (5-item) scale. Cronbach's α was used as an indicator of reliability of the 5Cs scale, and correlation analysis for assessing the concurrent and construct validity as well as for the comparison to existing measures of vaccination behaviours. The survey was pre-tested, then validated on 20 members of the public, and revised as needed. Non-discriminatory and inclusive language was used throughout the survey vetted by Dr. Devon Greyson an expert in health and social equity.
Recruitment process and description of the sample having access to the questionnaire		
Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows.	Closed survey: Respondents (N=5028) were randomly selected from the Leger Opinion panel which consists of 400,000 members from every province and territory of Canada.
Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet.	An invitation email in English or French was sent to panelists with a custom web link to access the survey. The link remained active for a given period of time and included a unique identification number for each respondent. Respondents completed the survey at their leisure, in one sitting.
Advertising the survey	How/where was the survey announced or advertised?	No external advertising outside of the existing Leger Opinion Panel.
Survey administration		
Web/E-mail	State the type of e-survey (eg, posted on a Web site/sent through e-mail). If it is an e-	The email invitation contains a customized weblink to access the survey. The link is active

	mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	for a given period of time and is unique to each respondent (it includes an ID number). Answers are automatically recorded, and respondents can answer the questionnaire at their convenience.
Context	Describe the Web site in which the survey was posted.	Not applicable
Mandatory/ voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	A randomly selected and voluntary survey.
Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	Leger Opinion Panel members earn money, AirMiles or Aeroplan points for each survey completed, and are eligible to win one of 5 monthly prizes valued at $2,500 (Opinion Panel website)
Time/Date	In what timeframe were the data collected?	December 10-24, 2020
Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	The questionnaire was administered in a meaningful order; items were not randomized or alternated.
Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	Branching questions were conditionally displayed based upon responses to other items, and specific questions administered to target populations only.
Number of items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	One question item per page.
Number of screes (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Approximatley 75 pages for 75 questions (including 2 open-ended questions).
Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if “yes”, how? An alternative is to check for completeness after the questionnaire has been submitted. If this has been done, it should be reported. All items should provide a non-response option such as “not applicable” or “rather not say”, and selection of one response option should be enforced.	Respondents could only move forward in the questionnaire once an answer was provided for the displayed question. Incomplete surveys were discarded and not included in data collection. Batter questions monitored for and eliminated ‘straight liners.” Survey participants were monitored for inattentiveness and data excluded for respondents who gave no substantive comments to open-ended questions. The survey had to be completed in on sitting. Although no lime limits were required for this study, Leger kept track of how long respondents take to complete the questionnaire.
Review step	State whether respondents were able to review and change their answers.	Respondents could only move forward in the questionnaire once an answer was provided for the displayed question.
Response rates		

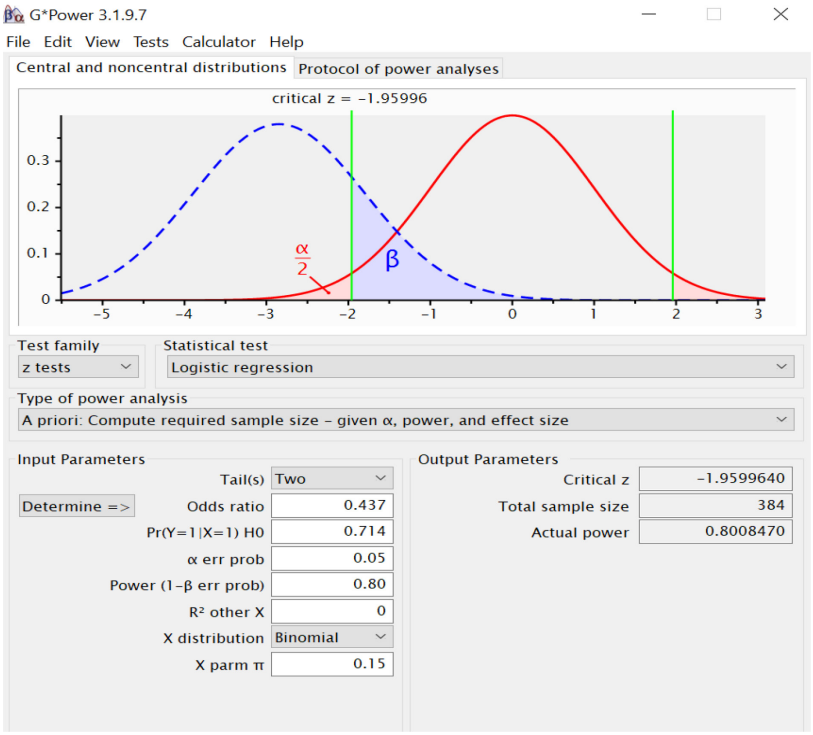
Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	Each respondent had a unique URL. Incomplete surveys were discarded and not included in data collection.
View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors.	Not applicable.
Participation rate	Count the unique number of people who filled in the first survey page, divided by visitors who visit the first page of the survey. This can also be called "recruitment" rate.	Not applicable
Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate. This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in.	Incidence rates could not be displayed as a single figure due to mixed population quota groups and the heterogenous nature of the target population.
Preventing multiple entries from the same individual		
Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis?	Unique URL's were required for each respondent. The email invitation contains a customized web link to access the survey. The link is active for a given period of time and is unique to each respondent (it includes an ID number).
IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed. Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis?	(see above).

	If the latter, which entries were kept for analysis?	
Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	Quality control mechanisms: • Telephone validation occurred for 15% of respondents to validate their identity and profile. • Online respondents agreed to phone validation prior to completing the survey in order to be included in completes. • The sample meet a fail rate of less than 10% (or validation continued until fail rate was less than 10%). • Those that fail validation were replaced. Validation included confirming identity and re-asking screener questions. • Embedded consistency questions cross referenced to the panel data base, to ensure the survey was completed by the correct person.
Registration	In "closed" surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis?	The survey was never displayed a second time once the user had completed the questionnaire.
Analysis		
Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early also analyzed?	Only completed questionnaires were included in data collection and analyzed. Questionnaires that were terminated early were discarded.
Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined.	Respondents answered the questionnaire at their own convenience, however the survey had to be completed in one sitting.
Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	LegerWeb's random sample was weighted according to gender, age, region, mother tongue, education and presence of minor children in the household (or any other sociodemographic element discussed with the research team) including those screened out for answering the survey in order to obtain a sample representative of the entire studied populations [using the latest census data from Statistics Canada].

Appendix 4

G*Power Version 3.1.9.7: Objective Two Study Sample Size Calculation

I used the G*Power version 3.1.9.7 to calculate a sample size[1] using a probability of complete vaccination within non-Indigenous populations of .714 (H0), an adjusted odds ratio of .437 (for incomplete versus complete vaccination), and a binomial distribution for the exposure variable. An estimated proportion of Indigenous populations being completely vaccinated was .67, therefore, a total sample size of 384 participants was required to achieve a power level of 80% and an alpha level of .05. As the reference study used adjusted odds ratios to account for the impact of other covariates, I set the value for R2 at 0, and X parm π at .2 as I expected that approximatley15% of participants will belong to the Indigenous population group in comparison with the other four population groups. Furthermore, logistic regression typically requires a large sample size with a general guideline of a minimum of 10 cases with the least frequent outcome for each exposure variable in the model.[2] In addition to power calculations to ensure an appropriate sample size, I calculated the least frequent outcomes with the number of exposure variables (for example, the least frequent outcome is .10 and eight exposure variables would require a minimum sample size of 800 (10*8/.10).



Notes:

1. **R^2 other X** = covariates (age, geographical location, gender/sex, marital status, income, employment etc.); set to 0 based on the reference study by Macdonald et al.[3] who reported adjusted odds ratios of rotavirus vaccination status among Alberta's sub-populations accounting for socio-demographic covariates.
2. **X distribution** = set to binomial as the predictor variable is two categories (Indigenous versus non-Indigenous).
3. **X parm π** = reflects predictor variable assignments. Set at 0.15 it is expected that approximately 15% (or less) of participants will be Indigenous in comparison with the other 4 population groups.

References

1. UCLA Institute for Digital Research & Education Statistical Consulting. G*Power version 3.1.9.7. Published 2021. Accessed Nov 9, 2021 https://stats.idre.ucla.edu/other/gpower/
2. Statistics Solutions. Assumptions of logistic regression. Published 2021. Accessed Feb 14, 2024 https://www.statisticssolutions.com/assumptions-of-logistic-regression/
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Appendix 5

Objective Three Study Qualitative Interview Guide

Title of Project: Acceptance and access to routine childhood vaccines among diverse Canadian populations during the COVID-19 pandemic (Pro00116703)

Context for interview guide:
The purpose of this study is to explore how various social intersections influence parents' perceptions and beliefs about routine childhood vaccines, and experiences when accessing vaccination during the pandemic for their children ≤11 years old. Intersectionality is the interconnection of social determinants, and as a theoretical approach, also acknowledges overlapping and interdependent systems of discrimination[1]. Intersectional social determinants may include ethnocultural identities (i.e., newcomers, Racialized minority, Indigenous, or those who primarily speak minority languages) and social locations (i.e., household income, education, age) that when combined, may perpetuate health inequities[2]. This study builds on national data collected (Oct-Nov 2021) and reports on objective two study regarding how the COVID-19 pandemic has influenced parents' perceptions of childhood vaccination, intentions to vaccinate their children, access to services, and uptake for their children ≤ 17 years old, across a diverse sample of underserved parents. This qualitative study will further explore parents' perceived barriers and enablers to accessing childhood vaccines during the pandemic, and how previous experiences of discrimination may influence health related decision-making for their children.

Selection of interviewees will include parents who meet the NACI equity matrix[3,4] criteria of 'Racialized' populations (i.e., ethnoracial and ethno-cultural diversity, immigration or refugee status) who also reported intersecting sociodemographic characteristics commonly associated with underserved population groups. Utilizing out COVImm survey data interview participant selection will include parents with the following characteristics:

1. parents who reported having only children aged 11 years or younger,
2. those who answered the survey in English, and
3. parents who reported one or more ethnocultural identity (i.e., Racialized minority, Indigenous, newcomers to Canada, minority language spoken most often at home, and those who reported past experienced of discrimination when accessing health services)

Interview guide
Preamble:
Thank you for participating in our national survey in Fall 2021, and also for agreeing to meet with me today. I am Robin Humble, a PhD student at the University of Alberta, working on this study as a part of my studies.

I come to you today from the traditional lands of the W̱SÁNEĆ people, on Vancouver Island, where I was born and raised, and now continue to live with my own family. My background is public health and women's health Nursing and epidemiology.

I am interviewing approximately 15 parents across Canada from diverse backgrounds and social groups in Canada. I am interested in your thoughts and experiences when accessing routine vaccines for your children during the pandemic. I am most interested in understanding how the

COVID-19 pandemic may have affected your thoughts about routine childhood vaccines, or intentions to have your child receive routine vaccines, and perhaps what made it easy or challenging to have them vaccinated.

This interview is intended to be conversational. I have some questions prepared and I would welcome any other insights that you would like to offer. I am grateful for your participation in this interview; however, it is completely voluntary. If you would like to end the discussion or withdraw from the study at any point, you absolutely may do so. You also do not have to answer any question that you would rather not answer, and no explanation is needed. The interview should take approximately 30 minutes. I am requesting your permission to audio record this interview, to ensure I have correctly captured your perspectives. Again, just an audio recording, no video. The recording will be deleted after transcripts of the interview have been created. Do you agree with the recording? Do you have any questions about the study or the interview process before we start?

Name (ID #)	**Province**	**Age**	**Sex**	**Income**	**# child**	**Intersections:**
Vaccination intent	**Racism**	**Education**		**Marital status**		**Pandemic change:**

Ice-Breaker Question

1. Would you share with me a little about yourself, such as where you come from, the work that you do, and/or something about your family?

Topic Focus 1: Sociodemographic characteristics

1. Would you feel comfortable sharing with me more about who you are and your background?
    a. *Prompts:* What languages do you speak at home? What culture or ethnic group do you identify as belonging to? Can you share with me what brought you to Canada if Canada has not always been your home?

2. Can you describe for me your household family and the community in which you live?
    a. **[Immediate family]** *Prompts:* How many people live in your household? How many adults and how many children and their ages?
    b. **[Community]** *Prompts:* Can you describe where you live? (e.g., Urban/rural, type of home)
    c. **[Access]** *Prompts*: Do you have access to a vehicle or public transportation? What community services do you and your family utilize? (Library, recreational centre)
    d. **[Health services]**: *Prompts:* How do you access health care for your children? (Family physician, walk-in clinic, hospital)
    e. **[Social network]**: *Prompts:* Can you describe your social network, such as individuals who you rely on or who you assist for day-to-day activities?

3. **[Survey]** *Prompts:* Other survey sociodemographic prompts specific to each respondent: relationship status (i.e., married/common-law, single parent home), employment, chronic illness of parent and/or child, citizenship, number of children, income, education, gender, etc.

Topic Focus 2: Perceptions of routine childhood vaccination

1**.** What do you think about routine childhood vaccines in general? *I am not talking about influenza/COVID-19 vaccination.*

a. *Prompts:* what are your perceptions, beliefs, thoughts, experiences about vaccine preventable diseases and vaccines?

2. How are routine childhood vaccines generally thought of in your social network or community?

a. *Prompts*: how do others in your community (their social norms or beliefs) influence your decision-making around vaccinating your children?

3. To what extent (or how has) the COVID-19 pandemic changed or impacted how you think about routine vaccines for your children?

[Yes] For example, are you more likely or less likely to get your children vaccinated? Would you encourage friends/family to get routine vaccines for their children? Have your feelings (perceptions) of the risk of vaccine preventable diseases changed?

[No] Please describe why you think the pandemic has not affected how you think about routine vaccines for your children.

Topic Focus 3: Routine childhood vaccine uptake during the pandemic

1. Did any of your children receive a routine vaccine since the start of the pandemic?
[As mentioned, when talking about "routine childhood vaccines" some examples may include vaccines recommended for your infant, preschool and/or school aged child. These may include measles, mumps, rubella, and/or meningococcal vaccines among others. We are not talking about influenza or COVID-19 vaccination for this interview]

[Yes] Please tell me what motivated you to have your child receive their routine vaccinations.

[Yes] Please tell me about your experience accessing childhood vaccines during the pandemic.

a. [Logistics] *Prompts:* when and location of immunization, on-time or delayed vaccination, what vaccine, how many needles, age of child.
b. [Pandemic] *Prompts:* Social distancing measures, wearing a mask, gloves gown, contact with child, differences from pre-pandemic experiences.
c. [Access] *Prompts:* difficulty versus ease of access, transportation to appointment, distance, appointment availability.

[No] Were any of your children due for a routine vaccine, and you chose to delay or not get it for them since the start of the pandemic?

[No] Please share, if you are comfortable, the reasons for delaying or choosing not to have your child vaccinated, whether it was for all vaccines or for one specific vaccine.

Topic Focus 4: Previous experiences influencing perceptions/intentions of routine childhood vaccination

1. Have you had other experiences in your life or in your family's lives that you believe influence how you think about (perceive) routine childhood vaccines?
    a. *Prompts:* experiences in another country, side effects, infectious disease illness, experiences with health care providers.

2. Could you share with me your definition of discrimination or stereotyping?

3. In the past when accessing health services for yourself or your children, have you experienced what you perceived as discrimination, racism? How about feeling stereotyped?
    [Yes] If comfortable, please share your experiences with me.
    [Yes] How has/have this/these experience(s) influenced your decision-making and/or how you think about (perceptions) getting health services for your children?

Topic Focus 5: Barriers/challenges to accessing routine childhood vaccines

1. What makes it difficult or challenging for you to receive routine vaccines for your child(ren)?

    a. **[Access & logistics]** *Prompts:* transportation, finances, time off work, other children requiring daycare, location of vaccination services, distance to clinic, vaccination information in a language that is easy to understand and in the language you understand most easily
    b. **[Social and personal reasons]** *Prompts:* An awareness that routine vaccines are needed for your children (i.e., understanding vaccine schedules, number of vaccines, fear of needles, children's health issues, concerns about safety of vaccines, concerns about culturally safe vaccination services).

Topic Focus 6: Facilitators to accessing childhood vaccines

1. As we have just discussed some of the challenges in accessing routine vaccines for your children, I invite you to share with me any suggestions or ideas that could make it easier for you and your family. **[OR]** What would make it easy for you to get your child(ren) vaccinated?

    a. **[Access & logistics]** *Prompts*: transportation, finances, time off work, other children requiring daycare, location of vaccination services, distance to clinic,
    b. **[Social and personal reasons]** *Prompts*: literacy, understanding vaccine schedules, number of vaccines, fear of needles, children's health issues, concerns about safety of vaccines, concerns about culturally safe vaccination services.

WRAP UP:

1. Do you have any additional comments about routine childhood vaccines, and your experiences in getting (accessing) these vaccines during the pandemic?
2. Is there anything else that you wanted to share with me, that I haven't addressed?

[Thank interview for participating and remind them that in gratitude for their time and contributions to the study, a gift card will be sent within 1 week.]

References

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Appendix 6

Consolidated Criteria for Reporting Qualitative Research (COREQ) for Objective Three Study

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349–57. https://doi.org/10.1093/intqhc/mzm042

Topic	**Item No.**	**Guide Questions/Descriptions**	**Reported on Page No.**	**Notes**
Domain 1: Research team and reflexivity				
Personal characteristics				
Interviewer/ facilitator	1	Which author/s conducted the interview or focus group?	*TBD	Intersectionality theory and reflexivity
Credentials	2	What were the researcher's credentials? e.g., PhD, MD	*TBD	Title page
Occupation	3	What was their occupation at the time of the study?	*TBD	Intersectionality theory and reflexivity
Gender	4	Was the researcher male or female?	*TBD	Intersectionality theory and reflexivity
Experience and training	5	What experience or training did the researcher have?	*TBD	Intersectionality theory and reflexivity
Relationship with participants				
Relationship established	6	Was a relationship established prior to study commencement?	*TBD	Methods Recruitment
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	*TBD	Recruitment Semi-structured interviews
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g., Bias, assumptions, reasons, and interests in the research topic	*TBD	Intersectionality theory and reflexivity

				Semi-structured interviews
Doman 2: Study design				
Theoretical framework				
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	*TBD	Intersectionality theory and reflexivity Methods
Participant selection				
Sampling	10	How were participants selected? e.g., purposive, convenience, consecutive, snowball	*TBD	Methods Recruitment
Method of approach	11	How were participants approached? e.g., face-to-face, telephone, mail, email	*TBD	Intersectionality theory and reflexivity Methods
Sample size	12	How many participants were in the study?	*TBD	Methods Recruitment
Non-participation	13	How many people refused to participate or drop out? Reasons?	*TBD	Methods Recruitment
Setting				
Setting of data collection	14	Where was the data collected? e.g., home, clinic, workplace	*TBD	Semi-structured interviews Results
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	*TBD	Recruitment Semi-structured interviews
Description of sample	16	What are the important characteristics of the sample? e.g., demographic data, date	*TBD	Results
Data collection				
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	*TBD	Semi-structured interviews Qualitative analysis

Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	*TBD	Recruitment Semi-structured interviews
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	*TBD	Recruitment
Field notes	20	Were field notes made during and/or after the interview or focus group?		Yes
Duration	21	What was the duration of the interviews or focus group?	*TBD	Recruitment
Data saturation	22	Was data saturation discussed?	*TBD	Qualitative analysis
Transcripts returned	23	Were transcripts returned to participants for comment and/or correction?	*TBD	N/A
Domain 3: analysis and findings				
Data analysis				
Number of data coders	24	How many data coders coded the data?	*TBD	Qualitative analysis
Description of the coding tree	25	Did authors provide a description of the coding tree?	*TBD	Qualitative analysis Results
Derivation of themes	26	Were themes identified in advance or derived from the data?	*TBD	Qualitative analysis
Software	27	What software, if applicable, was used to manage the data?	*TBD	Recruitment Qualitative analysis
Participant checking	28	Did participants provide feedback on the findings?	*TBD	N/A
Reporting				
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant #	*TBD	Results
Data and findings consistent	30	Was there consistency between the data presented and the findings?	*TBD	Results
Clarity of major themes	31	Were major themes clearly presented in the findings?	*TBD	Results
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	*TBD	Results

Appendix 7

Study One Survey Questions

Cross-sectional national survey questions for the impact of COVID-19 on parents' perceptions and intentions towards childhood routine vaccination

Variable	Question	Response options
Province	**In which province or territory do you live?**	British Columbia; Alberta; Saskatchewan; Manitoba; Ontario; Quebec; New Brunswick; Nova Scotia; Prince Edward Island; Newfoundland; Northwest Territories; Yukon; Nunavut
Age	**What is your age? (drop-down select age)**	Drop down answers for age of respondent
Highest level of education	**What is the highest level of education you have completed?**	Some high school or less; High school diploma or equivalent; Registered Apprenticeship or other trades certificate or diploma; College, CEGEP or other non-university trade, certificate, or diploma; University certificate or diploma below bachelor's level; Bachelor's degree; Post graduate degree above bachelor's level; Prefer not to answer
Employment status	**Which of the following categories best describes your current employment status?**	Working full-time (35 or more hours per week); Working part-time (less than 35 hours per week); Currently unemployed; Prefer not to answer
Household income	**To the best of your knowledge, what is the total combined income before tax of everyone living in your household?**	$19,999 or less; Between $20,000 and $39,999; Between $40,000 and $59,999; Between $60,000 and $79,999; Between $80,000 and $99,999; Between $100,000 and $249,000; $250,000 or more; Prefer not to answer
Gender	**What is your gender? (Select all that apply)**	Woman, Man, Gender non-conforming, Transgender, Two-spirit, Not listed please specify
Marital status	**What is your current marital status?**	Single, Married/Common law, Divorced/Separated, Widowed, Prefer not to answer, Not listed please specify
Number of children 0-17 years old in the household	**Are you the parent/primary guardian (e.g., birth parent, foster parent, stepparent, adoptive parent) who makes the health care decisions for one or more children 17 years old or younger? (If yes, then)**	Drop down answers for number and age of each child
Self-identified ethnicity	**What is your ethnic or cultural origin? (Select all that apply)**	White (e.g., Caucasian, European, etc.), Black (e.g., African, Haitian, Jamaican, etc.) Latin / Central American (e.g., Mexican, Colombian, Brazilian, Cuban, etc.), Arabic/West Asian/North African (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan, etc.), East Asian (e.g., Chinese, Filipino, Japanese, Korean, Vietnamese, etc.), South Asian (e.g., Indian, Sri Lankan, etc.), other please specify, prefer not to answer

Citizenship status	**What is your citizenship status in Canada?** Canadian citizen, landed immigrant (permanent resident), refugee (asylum seeker), non-permanent or temporary resident (e.g., work or study visa), Other please specify, prefer not to answer
Parents new to Canada in the past 5 years	**For respondents not born in Canada: When did you come to Canada?** Between 2016 and 2020; Between 2011 and 2015; Before 2011
Language spoken most often at home	**Which language do you speak most often at home? (drop-down list, select one)** English, French, Anishinini, Atikamekw, Dakota/Sioux, Dene, Innu, Inuktitut, Mi'kmaq, Michif, Nehiyawewin (Cree), Ojibwe, Siksiká (Blackfoot), Arabic, Cantonese, German, Gujarati, Farsi, Italian, Korean, Mandarin, Polish, Portuguese, Punjabi, Russian, Spanish, Tagalog, Tamil, Urdu, Vietnamese, Other please specify
The pandemics impact on parents' perceptions of childhood routine vaccines	**Has the pandemic changed the way you think about routine vaccines for your child?** The pandemic has not changed how I think about childhood routine vaccines; The pandemic has made me realize that childhood routine vaccines are more important; The pandemic has made me realize that childhood routine vaccines are less important; I don't know; Other, please specify
The pandemics impact on parents' perceptions of routine vaccines in general	**Has the pandemic changed the way you think about routine vaccines? We are not referring to the influenza or COVID-19 vaccines here.** The pandemic has not changed how I think about routine vaccines; The pandemic has made me realize that routine vaccines are more important; The pandemic has made me realize that routine vaccines are less important; I don't know; Other, please specify
Confidence in the safety of routine vaccines	**I am completely confident that routine vaccines are safe** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Necessity of routine vaccination	**Routine vaccination is unnecessary because vaccine-preventable diseases are not common anymore** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Vaccination as a collective action	**Vaccination is a collective action to prevent the spread of disease** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Active routine vaccination decision-making	**When I think about getting vaccinated, I weigh the benefits and risks to make the best decision possible** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Constraints preventing access to routine vaccines	**Everyday stress (such as competing priorities or many demands on my time) prevents me from getting vaccinated** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Routine vaccine effectiveness	**Vaccines are effective** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Mandated vaccination	**It should be mandatory for children to get the recommended childhood vaccines** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree

Parents' routine vaccination intention for their children during the COVID-19 pandemic	**If your child was due to receive a routine vaccine (e.g., MMR/ measles, whooping cough, rotavirus) during the pandemic (since March 2020) did you, or would you, have them get it?** Yes, my child was due for a routine vaccine and they received it, or I would have them get it if one was due; No, they did not receive it, or I would not have them get it if one was due; I don't know
Child(ren)'s retrospective influenza vaccination status	**Did your child or children get the seasonal flu vaccine last year (Survey 1: in Fall 2019 or Winter 2020) (Survey 2: in Fall 2020 or Winter 2021)?** Yes, No, My child is not eligible for the vaccine in the province/territory where I live, I don't remember
Parents' future influenza vaccine intention for their children	**Do you agree or disagree with the following: I received or plan to get the seasonal flu vaccine for my child this year (Survey 1: in Fall 2020 or Winter 2021) (Survey 2: in Fall 2021 or Winter 2022)?** Strongly disagree, disagree, neither agree nor disagree, agree
Parents' routine vaccination intention for themselves during the pandemic	**If you were due to receive a routine vaccine (e.g. tetanus, pneumonia) during the pandemic (since March 2020) did you, or would you, get it? We are not referring to the influenza vaccine here.** Yes, I was due for a vaccine and I received it, or I would get the vaccine if one was due; No, I did not receive it, or I would not get the vaccine if one was due; I don't know
Parents' retrospective influenza vaccine receipt for themselves	**Did you get the seasonal flu vaccine last year (Survey 1: in Fall 2019 or Winter 2020) (Survey 2: in Fall 2020 or Winter 2021)?** Yes, no, I don't remember
Parents' future influenza vaccine intention for themselves	**Do you agree or disagree with the following: I plan to receive the flu vaccine this year (Survey 1: in Fall 2020 or Winter 2021) (Survey2: in Fall 2021 or Winter 2022)?** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Parents' reasons for no intention/no receipt of childhood routine vaccines during the pandemic	**What is the main reason you did not or would not get the routine vaccine(s) for your child?** Worried about COVID-19 transmission at the appointment; Not sure if vaccination appointments still happening; Health centre/doctor cancelling my child's vaccination appointment; Waiting until the pandemic was over; Difficulty getting to the appointment (e.g. due to time, transportation, etc); I don't give my child vaccines; Other, please specify (additional option provided for parents of a child(ren) aged 7-17 years: Schools closed so my child could not get the vaccine)
Parents' reasons for no intention/no receipt of routine vaccines for themselves during the pandemic	**What is the main reason why you did not or would not get the vaccine?** Worried about COVID-19 transmission at the appointment; Not sure if vaccination appointments still happening; Health centre/doctor cancelling the vaccination appointment; Waiting until the pandemic is over; Difficulty getting to the appointment (e.g. due to time, transportation, etc.); I don't get vaccines; Other, please specify
Pre-pandemic routine vaccines received for	**Prior to the COVID-19 pandemic, did your child receive:** All recommended childhood vaccines; Some of the recommended childhood vaccines, but not all of them; No vaccines; I don't know

children 0-6 years old	
Pre-pandemic routine school-aged vaccines received for children 7-17 years old	**Prior to the COVID-19 pandemic, did your school-aged child receive:** All recommended childhood vaccines; Some of the recommended childhood vaccines, but not all of them; No vaccines; I don't know

Appendix 8

Study One Sociodemographic Stratification

Routine childhood vaccine acceptance during the pandemic stratified by sociodemographic characteristics

Variable[1]		**Category**	**Survey 1 N (%)**	**Survey 2 N (%)**	**McNemar p-value**
Age	15-39 years (n=277)	Intent/receipt	234 (84.5)	242 (87.4)	p =.071
		No intent/no receipt	33 (11.9)	19 (6.9)	
		I don't know	10 (3.6)	16 (5.8)	
	40-49 years (n=271)	Intent/receipt	225 (83.0)	237 (87.5)	p =.117
		No intent/no receipt	34 (12.5)	21 (7.7)	
		I don’t know	12 (4.4)	13 (4.8)	
	≥50 years (n=102)	Intent/receipt	80 (78.4)	83 (81.4)	p =.785
		No intent/no receipt	14 (13.7)	14 (13.7)	
		I don’t know	8 (7.8)	5 (4.9)	
Gender	Woman (n=360)	Intent/receipt	306 (85.0)	315 (87.5)	p =.060
		No intent/no receipt	39 (10.8)	23 (6.4)	
		I don’t know	15 (4.2)	22 (6.1)	
	Man/Other gender identification (n=290)	Intent/receipt	233 (80.3)	247 (85.2)	p =.050
		No intent/no receipt	42 (14.5)	31 (10.7)	
		I don’t know	15 (5.2)	12 (4.1)	

[1] Sociodemographic variables with adequate cell counts included for statistical analysis

Appendix 9

Study Two Survey questions

Variable	Question and response options
Self-identified ethnicity	**What is your ethnic or cultural origin?** (Select all that apply) White (e.g., Caucasian, European, etc.), Black (e.g., African, Haitian, Jamaican, etc.) Latin / Central American (e.g., Mexican, Colombian, Brazilian, Cuban, etc.), Arabic/West Asian/North African (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan, etc.), East Asian (e.g., Chinese, Filipino, Japanese, Korean, Vietnamese, etc.), South Asian (e.g., Indian, Sri Lankan, etc.), other please specify, prefer not to answer
Parents new to Canada	**For respondents not born in Canada: When did you come to Canada?** Between 2016 and 2020; Between 2011 and 2015; Before 2011
Citizenship status	**What is your citizenship status in Canada?** Canadian citizen, landed immigrant (permanent resident), refugee (asylum seeker), non-permanent or temporary resident (e.g., work or study visa), Other please specify, prefer not to answer
Language spoken most often at home	**Which language do you speak most often at home?** (drop-down list, select one) English, French, Anishinini, Atikamekw, Dakota/Sioux, Dene, Innu, Inuktitut, Mi'kmaq, Michif, Nehiyawewin (Cree), Ojibwe, Siksiká (Blackfoot), Arabic, Cantonese, German, Gujarati, Farsi, Italian, Korean, Mandarin, Polish, Portuguese, Punjabi, Russian, Spanish, Tagalog, Tamil, Urdu, Vietnamese, Other please specify
Province	**In which province or territory do you live?** British Columbia; Alberta; Saskatchewan; Manitoba; Ontario; Quebec; New Brunswick; Nova Scotia; Prince Edward Island; Newfoundland; Northwest Territories; Yukon; Nunavut
Age	**What is your age?** (drop-down select age) Drop down answers for age of respondent
Highest level of education	**What is the highest level of education you have completed?** Some high school or less; High school diploma or equivalent; Registered Apprenticeship or other trades certificate or diploma; College, CEGEP or other non-university trade, certificate, or diploma; University certificate or diploma below bachelor's level; Bachelor's degree; Post graduate degree above bachelor's level; Prefer not to answer
Employment status	**Which of the following categories best describes your current employment status?** Working full-time (35 or more hours per week); Working part-time (less than 35 hours per week); Currently unemployed; Prefer not to answer
Annual household income	**To the best of your knowledge, what is the total combined income before tax of everyone living in your household?** $19,999 or less; Between $20,000 and $39,999; Between $40,000 and $59,999; Between $60,000 and $79,999; Between $80,000 and $99,999; Between $100,000 and $249,000; $250,000 or more; Prefer not to answer
Gender	**What is your gender?** (Select all that apply) Woman, Man, Gender non-conforming, Transgender, Two-spirit, Not listed please specify
Marital status	**What is your current marital status?** Single, Married/Common law, Divorced/Separated, Widowed, Prefer not to answer, Not listed please specify
Number of children 0-17 years old in the household	**Are you the parent/primary guardian (e.g., birth parent, foster parent, stepparent, adoptive parent) who makes the health care decisions for one or more children 17 years old or younger?** (If yes, drop down answers for number and age of each child)
Parents' routine vaccination intention for their children	**If your child was due to receive a routine vaccine (e.g., MMR/ measles, whooping cough, rotavirus) during the pandemic (since March 2020) did you, or would you, have them get it?** Yes, my child was due for a routine vaccine and they received it, or I

during the COVID-19 pandemic	would have them get it if one was due; No, they did not receive it, or I would not have them get it if one was due; I don't know
Parents' influenza vaccine intention for their children	**Do you agree or disagree with the following: I received or plan to get the seasonal flu vaccine for my child this year (Fall 2021 or Winter 2022)?** Strongly disagree, disagree, neither agree nor disagree, agree
Parents' experience of discrimination and/or racism	**Have you experienced discrimination and/or racism when accessing health services for yourself or your child(ren)?** Yes; No; Don't know; prefer not to answer
The pandemics impact on parents' perceptions of childhood routine vaccines	**Has the pandemic changed the way you think about routine vaccines for your child?** The pandemic has not changed how I think about childhood routine vaccines; The pandemic has made me realize that childhood routine vaccines are more important; The pandemic has made me realize that childhood routine vaccines are less important; I don't know; Other, please specify
Confidence in the safety of routine vaccines	**I am completely confident that routine vaccines are safe** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Necessity of routine vaccination	**Routine vaccination is unnecessary because vaccine-preventable diseases are not common anymore** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Vaccination as a collective action	**Vaccination is a collective action to prevent the spread of disease** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Active routine vaccination decision-making	**When I think about getting vaccinated, I weigh the benefits and risks to make the best decision possible** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Constraints preventing access to routine vaccines	**Everyday stress (such as competing priorities or many demands on my time) prevents me from getting vaccinated** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Routine vaccine effectiveness	**Vaccines are effective** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Mandated routine vaccination	**It should be mandatory for children to get the recommended childhood vaccines** Strongly disagree, disagree, neither agree nor disagree, agree, strongly agree
Mandated COVID-19 vaccination	**COVID-19 vaccination in Canada should be:** Mandatory for everyone (with exceptions based on medical reasons); Mandatory for certain groups (e.g., health care workers); Mandatory for certain activities (e.g., travel, recreational/social activities); Voluntary for everyone; I don't know
COVID-19 disease status	**Have any of your children had COVID-19 disease?** Yes; No; Don't know; Prefer not to answer
Parents' reasons for no intention/no receipt of childhood routine vaccines during the pandemic	**What is the main reason you did not/would not get routine vaccines for your child?** Worried about COVID-19 transmission at the appointment; Not sure if vaccination appointments still happening; Health centre/doctor cancelling my child's vaccination appointment; Waiting until the pandemic was over; Difficulty getting to the appointment (e.g. due to time, transportation, etc); I don't give my child vaccines; Other, please specify (additional option provided for parents of a child(ren) aged 7-17 years: Schools closed so my child could not get the vaccine)

Appendix 10

Study Two Minority Languages Spoken Most Often

Ethnocultural characteristics of parents of children ≤17 years old (N=2531)

Characteristic	Category	Total n (%)
Language spoken most often at home	English	1487 (58.8)
	French	790 (31.2)
	Cantonese	38 (1.5)
	Urdu	27 (1.1)
	Spanish	21 (0.8)
	Tagalog	20 (0.8)
	Mandarin	19 (0.7)
	Punjabi	13 (0.5)
	Russian	13 (0.5)
	Arabic	12 (0.5)
	Hindi	12 (0.5)
	Gujarati	11 (0.4)
	Portuguese	7 (0.3)
	Tamil	7 (0.3)
	Indigenous languages[1]	6 (0.2)
	Malayalam	5 (0.2)
	Farsi and/or Dari	4 (0.2)
	Romanian	4 (0.2)
	Vietnamese	4 (0.2)
	German	3 (0.1)
	Afrikaans	2 (0.1)
	Bengali	2 (0.1)
	Berbere	2 (0.1)
	Estonian	2 (0.1)
	Italian	2 (0.1)
	Telugu	2 (0.1)
	Yoruba	2 (0.1)
	Other languages[2]	14 (0.6)
Self-identified ethnicity	European	1771 (70.0)
	East Asian	193 (7.6)
	South Asian	145 (5.7)
	Black	87 (3.4)
	Latin	37 (1.5)
	Arabic	55 (2.1)
	First Nations	113 (4.5)
	Métis	75 (3.0)
	Inuk	4 (0.2)
	Mixed ethnicity	37 (1.4)
	Prefer not to answer	14 (0.6)
Location of residence for Indigenous parents (n=195)	Reservation, settlement of community	33 (16.9)
	Urban area	114 (58.5)
	Rural area	43 (22.0)
	Prefer not to answer	5 (2.6)

[1] Indigenous languages include Dakota/Sioux, Innu, Anishinini, and Cree

[2] Other languages include (n=1) each of the following: Albanian, Bulgarian, Edo, Igbo, Indonesian, Japanese, Kannada, Korean, Latvian, Marathi, Polish, Serbian, Turkish, and Ukrainian