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ORIGINAL PAPER

COVID-19 Pandemic and Im/migrants' Elevated Health Concerns in Canada: Vaccine Hesitancy, Anticipated Stigma, and Risk Perception of Accessing Care

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Abstract
Vaccine hesitancy has taken a toll on COVID-19 immunization globally. This study aims to characterize three COVID-19-related health concerns (i.e., vaccine hesitancy, anticipated stigma, and risk perception) in Canada and how they differ based on im/migration status and other social determinants. Data were obtained from a nationwide probability sample of the Canadian Perspective Survey Series 3 (June 15 to 21, 2020). Multivariable binary logistic regression analysis was performed to investigate the association between each COVID-19 concern and nativity status, while controlling for socio-demographics. Of 3522 participants aged ≥ 25 years, the estimated overall prevalence of vaccine hesitancy was 16.9%, with im/migrants being greater than non-immigrants (21.5% vs. 15.5%, $p < 0.001$). After controlling for all covariates, im/migrants had around two-fold greater odds of all three health concerns, including risk perception of accessing care (aOR 2.44, 95% CI 1.89–3.15), anticipated stigma of being targeted (aOR 2.24, 95% CI 1.81, 2.78) and COVID-19 vaccine hesitancy (aOR 1.99, 95% CI 1.57–2.52), compared to their Canadian-born peers. Among vaccine-hesitant individuals (n = 596), im/migrants reported higher concerns, than non-immigrants, on vaccine safety (71.3% vs. 49.5%), side effects (66.4% vs 47.3%) and mistrust in vaccinations (12.5% vs 6.6%) as possible reasons of vaccine refusal. For migrant justice, health authorities should ensure equitable access to COVID-19 vaccines and other health-enhancing resources for im/migrants to mitigate their heightened fear, stigma, and mistrust of new vaccines amidst turbulent times.

Keywords COVID-19 immunization · Vaccine equity · COVID-19 stigma · Social determinants of health

Background

Although the novel coronavirus disease 2019 (COVID-19) can infect anyone, migrant and impoverished populations carry a disproportionate burden of the disease [1–3], which has heightened awareness of existing health gaps between the privileged social groups and those vulnerable populations. Similar to previous outbreaks of influenza and severe acute respiratory syndrome [4], what the COVID-19 pandemic brings to the forefront is that both exposures to health hazards and access to health-enhancing resources are fundamentally different based on nativity, class, race and many other social positions [5], also known as social determinants of health [6]. A burgeoning body of evidence has demonstrated overrepresentation of immigrants, low-income, and other socially marginalized populations among cases of and deaths from COVID-19 across the globe [3, 7]. While COVID-19 vaccine distribution is the most cost-effective strategy for reducing mortality and achieving population immunity, the benefits of COVID-19 vaccines are not equitably shared by all sectors of society [8–10].

Immigrants, refugees, and migrant (im/migrant) populations include more than nine million foreign-born people living in Canada, representing hundreds of cultures and languages, and account for 80% of Canada's population increase [11]. Despite their contributions to social and economic progress, these diverse communities are at higher risk of exposure to COVID-19 pathogens [5], as statistics have shown that migrants were heavily represented in essential industries requiring extensive interaction with the public, living in overcrowded multi-generational housing, and

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frontline healthcare occupations including personal support worker and nurse aide [12]. These vulnerable conditions all speak to populations at risk prioritized for initial vaccine roll-out as defined by the National Advisory Committee on Immunization in Canada [13]. However, the challenge of low vaccine access is persistent for im/migrant and refugee populations, who often experience discrimination and suboptimal treatments when accessing local health services even under normal circumstances before the pandemic [14]. While "universality" is a cornerstone of the Canada Health Act, health care inequity still disproportionately affects im/migrant populations [15–17]. Compared to Canadian-born residents, im/migrants are more likely to lack a regular doctor [18], experience difficulties in accessing immediate care [19] and encounter barriers in obtaining selected diagnostic tests [20], all of which lead to greater unmet healthcare needs [21]. In addition, the inadequacy of culturally sensitive health care [22], the lack of interpretation services [15], limited health insurance eligibility [17] and the arbitrary 3-month wait period for insurance coverage [23] further exacerbate im/migrants' mistrust in the Canadian health care system. These pre-existing access problems, together with recently widespread misinformation around the pandemic [24] (i.e., the COVID-19 "infodemic"), could give rise to the vaccine hesitancy—one of the top 10 global health threats in 2019 as declared by the World Health Organization (WHO) [25]—as well as stigma and fear accompanying COVID-19—"the greatest enemy" named by the United Nations [26].

It is worth noting that the framing of "vaccine hesitancy" in this study is not to shift responsibility on individuals, but rather as an indicator of public (mis)trust in health services that is rooted in a social, economic, political, and historical context [27], where systemic racism and neglect, as well as the legacy of unethical medical establishment that exploited marginalized communities are embedded in the Western society [8, 28]. Following this line of inquiry, research has identified broader social and political determinants, including socioeconomic insecurity [29], experience of racial discrimination [30], exposure to vaccine misinformation [31, 32], system failures of vaccine accessibility [33], mistrust in the government and medical organizations [34], inappropriate crisis governance [35] as strong predictors of vaccine hesitancy in the general population. Meanwhile, the study acknowledges that the use of "vaccine hesitancy" may inadvertently stigmatizes marginalized populations if not articulated with cautions [36], while there are other more neutral terminologies such as vaccine acceptance, vaccine risk perception, vaccination intent and vaccine confidence that may not capture the full scope of such multi-faceted phenomenon—see further discussion [33]. Yet, in line with the critiques against the individualistic "victim-blaming" discourse [8, 37, 38], this study, on the one hand, retains the term "vaccine hesitancy" to counteract its pervasive dialogue [33], and on the other hand, reinterprets this concept as the crisis of trust in vaccines and the authorities delivering them—a product stemming from maldistribution of power and health-enhancing resources across social groups that entails "self-scrutiny by our scientific and governmental bodies regarding their own credibility as well as investment" in resource-deprived populations [37]. By taking a structural equity lens, this study situates COVID-19-related health concerns including vaccine hesitancy beyond personal choices and posits that healthcare 'choices' are delimited by supra-individual forces as well as broader structural constraints, especially for oppressed minority groups.

Study Aims

The arrival of COVID-19 in Canada presents an unprecedented public health challenge, with over 2.3 million confirmed cases, 30 thousand deaths to date [39], and the adjusted case fatality rate estimated to be 3.36% nationwide as of December 15, 2020 [40], which is substantially greater than seasonal influenza death rate of approximately 0.1% [41]. In fact, Canada is among top countries for a fast growth of COVID-19 vaccination coverage, with 83% of the eligible population (aged 12 and over) having received at least one dose and about 76% being fully vaccinated as of August 8, 2021 [42]. However, with the success of COVID-19 vaccine rollout in Canada and around the world, there has been widespread concern regarding vaccine uptake, accessibility, and equity [43, 44]. While a growing body of research has documented disparities in COVID-19 vaccine hesitancy in relation to race/ethnicity [45, 46] and socioeconomic status [29], little has adopted an im/migrant equity lens to examine the pandemic fear, stigma, and vaccine hesitancy simultaneously. In addition, more contagious COVID-19 variants (e.g., the Delta variant, the Omicron variant) have jeopardized current vaccination achievements by putting unvaccinated or non-fully vaccinated adults at higher risk of hospitalization and intensive care use [47, 48], rendering the booster vaccine (supplemental doses) a heated debate for the pandemic control while balancing vaccine equity globally [49].

This study aims to characterize three major COVID-19-related health concerns in Canada with a focus on identifying nativity disparities in vaccine hesitancy, anticipated stigma of being targeted, and perceived health risks of accessing care. Recognizing that im/migrant communities may be more susceptible to COVID-19 infection and underserved by host countries' health systems [25], the present study hypothesizes that migrants are more likely to have heightened COVID-19-related health concerns than their Canadian-born peers, despite a universal health-care system in Canada. Identifying the unique needs regarding vaccine

beliefs, perceptions and practices of migrant populations and the sociodemographic subgroups that remain at-risk of COVID vaccine refusal are essential for informing appropriate evidence-based pandemic response across Canada. This study serves as a timely frame of reference for public health decision-makers to identify barriers to vaccination, optimise policy efforts to improve vaccine campaigns, allocate critical care interventions for recovery, and mitigate the pandemic's long-term societal harms. Therefore, the current study seeks to explore the relationship between three major health concerns and their determinants among Canadian adults by examining the following research questions:

(1) Do im/migrants have a higher prevalence and adjusted odds of COVID-19-related concerns, including vaccine hesitancy, anticipated stigma of being targeted, and risk perceptions of accessing care, than Canadian-born residents?
(2) Which demographic, economic, or social factors could potentially attenuate the association between COVID-19 related health concerns and im/migration status?
(3) What other social determinants of health—representing socially vulnerable communities—are significantly associated with COVID-19-related concerns after accounting for im/migration status?

Methods

Data Source, Research Context and Study Population

The data was drawn from the third circle of the Canadian Perspective Survey Series—Resuming Economic and Social Activities During COVID-19 (CPSS3-COVID), an online nationwide survey, conducted from June 15 to 21, 2020 [50]. The purpose of the cross-sectional CPSS survey series is to evaluate the health and socioeconomic consequences of the COVID-19 pandemic in Canada, starting from March 2020 [24]. The third survey, in particular, aims to examine whether Canadians will adhere to health and safety practices when the economy reopens and restrictions are loosened. The CPSS-3 was conducted three months after a provincial state of emergency declared in Ontario (Canada) on March 17, 2020, as a result of high COVID-19 transmission rates in the first wave of the COVID-19 outbreak. Beginning in late May 2020, the Public Health Agency of Canada (PHAC) has advised Canadians to wear a face mask in public areas. Since June 2020, various provinces in Canada, including Alberta, Ontario, and Québec, have entered Stage Two of the re-opening plan, allowing the re-opening of more business and an increase in social activities. On October 9, 2020, Health Canada approved the first COVID-19 vaccination, marking a significant step forward in Canada's fight against COVID-19 [51]. As such, the CPSS-3 data was collected four months before the first COVID-19 vaccine authorized for use in Canada.

The sampling frame of CPSS is a probabilistic panel (i.e., four rotation groups) from the Labour Force Survey (LFS) created by a stratified multi-stage sampling. Participants answering the LFS for the last time in April, May, June and July of 2019 was selected at random to participate in the CPSS and received emailed survey invitations with a link for online self-completion. Details of the survey methodology and data collection are available elsewhere [50]. The CPSS sampling frame represents 98% of the national populations and excludes persons living on First Nations reserves, the institutionalized population, and households in remote areas. The collection response rate of the CPSS-3 was 58.1% and may reflect a tight schedule for data collection and COVID-19-related fatigue during the pandemic. Those who did not report their health concerns about vaccine uptake, anticipated stigma of being targeted, perceived health risks (e.g., don't know, refusal, missing) and those aged less than 25 years were excluded from this study (n = 687), yielding a final sample size of 3522. The age group of 15 to 24 was excluded from the study sample because many of them did not finish their schooling and lack financial independence.

Ethical Considerations and Data Accessibility

The analyses were solely based on the public-use microdata files (PUMF) available to both Canadian and international researchers via Statistics Canada's Data Liberation Initiative. The public-use data are completely de-identified and publicly available with necessary suppression methods to protect confidentiality; thus, according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans—TCPS 2 (2018), this study based on Statistics Canada PUMF was considered non-human subject research and did not require institutional ethics review.

Dependent Variables

COVID-19 vaccine hesitancy was measured by a single item asking respondents: *When a COVID-19 vaccine becomes available, how likely is it that you will choose to get it?*. The 4-point response was then reversely grouped into two levels to operationalize vaccine hesitancy (Hesitant = somewhat *unlikely* and/or very *unlikely* to get the vaccine; Not hesitant = somewhat likely and/or very likely to get the vaccine). *Reasons for vaccine hesitancy* Among those who indicated vaccine hesitancy, a follow-up question was asked: *What are the reasons you would not get the COVID-19 vaccine?* with a multiple-response set (9 options), such as *Already had or*

think I have had COVID-19; Do not consider it necessary to get the vaccine; Not confident vaccine is safe; Do not believe in vaccination; Concern about risks and side effects; Have a pre-existing medical condition and Other reasons.

COVID-19 anticipated stigma was measured by a single item with a binary response (yes/no) asking respondents: *Once your federal, provincial, territorial or municipal governments relax the measures put in place to fight COVID-19, do you fear being the target of unwanted behaviours because you may be judged for putting others at risk?*. This variable operationalizes "concerns that one will experience future discrimination and bias" [52, 53] and reflects "anticipation of an adverse social judgment" in the future [54] that links labeled persons to negative stereotypes in the context of the COVID-19 pandemic [55, 56]. *Reasons for anticipated stigma* Among those who answered affirmatively, a follow-up question was asked: "For which reasons do you fear being the target?" with a multiple-response set (6 options), such as *I do not wear a mask all the time; Job associated with risk of COVID-19*; *Health conditions cause me to cough or sneeze*; *I have other health conditions*; *I am elderly* and *Other reasons*. Due to confidentiality restriction, the PUMF file collapsed two response categories by combining *My racial identity* and *I live in a collective dwelling* with *other reasons*. Similarly, two related options, *I work in a hospital, other healthcare facility, seniors' residence, nursing home or other long-term care residence* and *My place of employment or my job, other than those listed above, is associated with risk of COVID-19*, were merged as *Job associated with risk of COVID-19*.

Risk perception of accessing care was measured by a single item asking respondents: *How concerned are you about the health risks of going to the doctor or hospital as the COVID-19 safety measures are relaxed?*. The 3-point response was dichotomized: Yes = very concerned/somewhat concerned; No = not at all concerned. Risk perception has been found as a predictor of preventive health behaviors as well as medical care avoidance during the COVID-19 outbreak [57, 58].

Independent Variable

Im/migration Status

The primary relationships of investigative interest were the differences between foreign-born im/migrants to Canada and Canadian-born residents in relation to three major health concerns during the COVID-19 pandemic. This is a derived variable provided by Statistics Canada based on two questions regarding country of birth (*In what country were you born?* and im/migration status (*Are you now, or have you ever been, a landed immigrant in Canada?*). Two categories of participants were compared: (1) im/migrants to Canada, including landed immigrants with permanent residence permission as well as foreign-born temporary residents with precarious migration status (i.e., temporary workers with work permit, international students with study permit, or are claiming refugee status); and (2) Canadian-born residents were treated as the reference group as it reflects a social location of privilege that shapes health care experience in a White settler society with history of colonization [17]. Unfortunately, this study based on the PUMF data was unable to tease out temporary residents as a separate category that was more vulnerable. Nevertheless, this variable of im/migration status was regarded more than an individual attribute but as an embodied social position of power structures that "rank people into social hierarchies and (re)distribute social determinants of health" [59].

Other Potential Confounders

Demographics (age, sex), socioeconomic status (highest level of education, perceived income adequacy, employment status) and enabling factors (types of dwelling, marriage, municipality, living with spouse, household size) that could potentially attenuate the relationship between three major COVID-19-related health concerns and im/migration status were examined in the analysis. Perceived income adequacy during the pandemic was measured by asking respondents: *Overall, since the beginning of the COVID-19 restrictions, is your household income enough to meet your household's needs for transportation, housing, food, clothing and other necessary expenses*?. The response was coded as (1) more than enough; (2) enough; (3) not enough; (4) prefer not to say. Employment status was a variable to investigate the pandemic's impact on labour participation (defined as those who had worked at least one hour for pay, including self-employment) in the past 7 days prior to the survey (i.e., June 7 to June 13, 2020), with a specific focus to detect precarious employment/job precarity caused by the COVID-19 pandemic [24]. Consistent with prior literature [24], the response was categorized into five groups: (1) employed and at work for at least part of the week; (2) employed but absent for the entire week due to COVID-19 (e.g., business closure, layoff, or personal circumstances including COVID-19 diagnosis); (3) employed but absent for the entire week due to other reasons not related to COVID-19 (e.g., vacation, work schedule, seasonal business, maternity or parental leave, illness other than COVID-19); (4) not employed; (5) not stated. To measure the direct disruption from the COVID-19 pandemic, respondents who had a casual job with no work available at reference week were not considered as absent from work. In addition to aforementioned confounders, three COVID-19-related health concerns were also served as covariates for each other in the model.

Statistical Analysis

First, descriptive analyses were conducted to describe the sample characteristics and three COVID-19-related concerns in the general Canadian population. Second, cross-tabulation analyses were generated by Chi-square tests (χ^2) using weighted percentages to compare group differences based on im/migration status and vaccine hesitancy, respectively. Third, adjusted odds ratios (aOR) and 95% confidence interval (95% CI) were derived from binary logistic regression to examine associations between im/migration status and three major health concerns while adjusting for the covariates, with separate models predicting each health concern. Statistical analyses and data management were performed using the SPSS software package, Version 26 (IBM Corp., Armonk, N.Y., USA). A p-value < 0.05 (two-tailed) was considered statistically significant. Model performance was assessed by the Nagelkerke R^2 statistic (a measure of the proportion of explained variation in the logistic model). The weights provided by CPSS were normalized to produce population-representative estimates corrected for the altered sample size.

Results

Sample Description and Bivariate Analysis

As shown in Table 1, the overall sample (n = 3522) mainly consisted of Canadians aged 25 years above, in a relationship (70.7%), have enough perceived household income (62.4%), graduated from college (70.4%), living with a spouse (72.6%), living in a single-detached house (61.5%) and urban area (83.7%). Information on the comparative distribution of these factors among Canadian-born residents (n = 2924, 83%) and migrants (n = 598, 17%) were provided. Chi-square statistics indicated that most demographic and socioeconomic factors significantly, other than sex and cohabitants, differed based on im/migration status (p < 0.05). The population-weighted prevalence of vaccine hesitancy was 16.9% and thus vaccine acceptance rate was 83.1%. Notably, migrants had significantly higher proportions of three major health concerns relative to Canadian-born residents: vaccine hesitancy (21.5% vs. 15.5%), anticipated stigma of being targeted (27.3% vs. 14%) and perceived health risks when accessing care (89% vs. 76.3%). Chi-square statistics also revealed that most covariates were associated with vaccine hesitancy (p < 0.05), except for sex, marriage, and municipality.

Figures 1 and 2 further illustrate the possible reasons underlying two health concerns (i.e., anticipated stigma of being targeted and vaccine hesitancy) stratified by im/migrant status respectively. Among individuals who reported anticipated stigma of being targeted as risky individuals (see Fig. 1, n = 605), there were disproportionately higher proportions of im/migrants attributing the anticipated stigma to other reasons (including racial identity) than their Canadian-born peers (63.8% vs 21.7%, p < 0.001). Interestingly, Canadian-born residents had a higher percentage attributing the anticipated stigma to non-compliance with mask wearing than im/migrants (57.9% vs 33.6%, p<0.001), whereas reasons such as job-related risk of COVID-19 infection and stigma around the elderly did not differ significantly between these two groups. Among vaccine-hesitant individuals (see Fig. 2, n = 596), im/migrants had a significantly higher percentage reporting concerns on vaccine safety (71.3% vs. 49.5%, p < 0.001), side effects (66.4% vs 47.3%, p < 0.001) and mistrust in vaccinations (12.5% vs 6.6%, p < 0.05) as reasons of vaccine refusal, compared to Canadian-born residents.

Multivariable Logistic Regression

Table 2 contains the multivariable-adjusted logistic regression analysis of the im/migration status and other confounders on three health concerns. Overall, as expected, im/migration status was positively associated with all three COVID-19-related health concerns (*Research question 1*). These positive correlations between im/migrants and health perceptions were very robust that could not be attenuated by a serious of significant confounders including age, sex, education, employment, perceived income, marriage, type of dwelling and other living conditions (*Research question 2*). In general, the Nagelkerke R^2 statistics indicate that the established model could explain 17% variance for vaccine hesitancy and close to 9% variance for the other two health concerns. Im/migrants had close to two-and-a-half greater odds of perceived health risks of accessing care when compared with Canadian-born residents (aOR 2.44, 95% CI 1.89–3.15). Im/migrants also doubled the odds of reporting anticipated stigma of being targeted as risky individuals (aOR 2.24, 95% CI 1.81, 2.78). Likewise, the odds of vaccine hesitancy were almost two times greater for im/migrants in Canada than their Canadian-born counterparts (aOR 1.99, 95% CI 1.57–2.52).

Besides nativity-based disparities in health concerns, there were significant socio-demographic inequalities in the burden of COVID-19 health concerns (*Research question 3*). Female respondents had greater odds of reporting anticipated stigma of being targeted (aOR 1.23, 95% CI 1.03–1.49) and vaccine hesitancy (aOR 1.26, 95% CI 1.04–1.53) than their male peers. Social class also played a crucial role in shaping COVID-19 health concerns. For example, compared to those who had a bachelor's degree, respondents with lower educational attainments (i.e., high school graduate and/or

Table 1 Population-weighted proportion of sample characteristics by im/migration status and vaccine hesitancy in the CPSS-3 (June 15–21, 2020), persons aged ≥ 25 (N = 3522)

	Total sample	By im/migration status (%)			By vaccine hesitancy (%)	
		Can.-born	Im/migrants	χ^2	Hesitant	χ^2
	N = 3522	N = 2924	N = 598	p-value	N = 475	p-value
Vaccine hesitancy				< 0.001		–
No	83.1	84.5	78.5		–	
Yes	16.9	15.5	21.5		–	
Anticipated stigma of being targeted				< 0.001		0.616
No	82.8	86.0	72.7		17.1	
Yes	17.2	14.0	27.3		16.2	
Risk perceptions of accessing care				< 0.001		< 0.001
No	20.7	23.7	11.0		25.3	
Yes	79.3	76.3	89.0		14.8	
Covariates: demographic and socio-economic factors						
Age				< 0.001		< 0.001
25 to 34	20.2	20.5	19.1		21.8	
35 to 44	18.3	17.1	22.0		20.8	
45 to 54	17.4	16.8	19.6		21.7	
55 to 64	19.1	21.3	11.8		16.0	
≥ 65	25.1	24.3	27.5		7.5	
Sex				0.48		0.04
Male	49.3	49.6	48.2		15.6	
Female	50.7	50.4	51.8		18.2	
Education				< 0.001		< 0.001
≤ High school graduate	29.6	30.0	27.9		16.6	
College	36.4	40.3	23.8		21.7	
≥ Bachelor's degree	34.0	29.7	48.2		12.1	
Perceived income adequacy				< 0.001		< 0.001
More than enough	17.7	19.5	11.7		9.8	
Enough	62.4	62.0	64.0		16.8	
Not enough	15.1	14.0	19.0		25.6	
Prefer not to say	3.6	3.3	4.6		15.0	
Missing	NA	NA	NA		NA	
Employment status				0.047		< 0.001
Employed & at work	50.1	50.6	48.4		16.3	
Absent; COVID-19 related	2.7	3.6	3.5		8.5	
Absent; not COVID-19 related	3.6	3.0	1.4		21.3	
Not employed	41.1	40.4	43.5		16.8	
Not stated	2.6	2.4	3.1		33.3	
Type of dwelling				< 0.001		< 0.001
Single detached house	61.5	67.2	42.8		15.7	
Low-rise apartment	12.2	10.8	16.8		18.1	
High-rise apartment	9.6	6.9	18.1		13.4	
Others	16.7	15.0	22.3		22.6	
Marriage				< 0.001		0.386
Married/common-law	70.7	69.1	76.0		16.6	
Widowed/separated	12.7	13.0	12.0		16.3	
Single	16.5	17.9	12.1		18.9	
Municipality				< 0.001		0.09
Rural	16.3	20.1	4.0		19.4	

Table 1 (continued)

	Total sample	By im/migration status (%)			By vaccine hesitancy (%)	
		Can.-born	Im/migrants	χ^2	Hesitant	χ^2
	N = 3522	N = 2924	N = 598	p-value	N = 475	p-value
Urban	83.7	79.9	96.0		16.5	
Living with spouse				0.078		0.001
Yes	72.6	71.9	75.0		15.7	
No	27.4	28.1	25.0		20.2	
Household size				< 0.001		0.009
1 person	16.6	17.8	12.8		18.8	
2 persons	59.2	60.1	56.2		15.3	
≥ 3 persons	24.1	22.0	31.0		19.5	

NA not available (due to small cell size [n < 50], the estimates were not shown for quality control); *Can.-born* Canadian-born residents

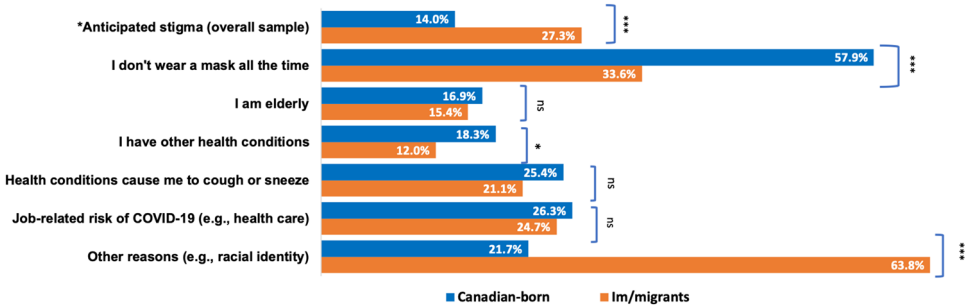

Fig. 1 Weighted prevalence of anticipated stigma (fear of being targeted) and its reasons by im/migration status in the CPSS-3 (June 15–21, 2020), persons aged ≥ 25. *Notes* *Anticipated stigma was based on the overall sample (n = 3522, Canadian-born = 2924, Im/migrants = 598), while other items (underlying reasons) were among individuals reported anticipated stigma (n = 605, Canadian-born = 379, Im/migrants = 226). Comparisons by im/migration status were based on the chi-square test (*p < 0.05; **p < 0.01; ***p < 0.001; *ns* not significant)

below) had a higher likelihood of reporting perceived health risks of accessing care (aOR 1.36, 95% CI 1.08–1.71) and vaccine hesitancy (aOR 1.67, 95% CI 1.27–2.18). Similarly, when compared with affluent respondents (i.e., perceived income more than enough), impoverished individuals whose income cannot meet their financial needs during the COVID-19 pandemic had a consistent pattern with greater odds of all three health concerns: perceived health risks when accessing health services (aOR 1.62, 95% CI 1.19–2.22), anticipated stigma of being targeted (aOR 2.02, 95% CI 1.46–2.80) and vaccine hesitancy (aOR 2.82, 95% CI 1.96–4.06). The odds of vaccine hesitancy were also greater for those who were unemployed (aOR 1.55, 95% CI 1.23–1.95), those who lived alone (aOR 1.85, 95% CI 1.27–2.69) and live without a spouse (aOR 1.99, 95% CI 1.35–2.95). On the contrary, the odds of vaccine hesitancy were lower for middle-aged adults (aOR 0.51, 95% CI 0.37–0.70), older persons (aOR 0.51, 95% CI 0.37–0.70), those who were absent from work due to other reasons not related to the COVID-19 pandemic (aOR 0.40, 95% CI 0.19–0.85), those who were widow/separated (aOR 0.39, 95% CI 0.24–0.63), and those who were single/never married (aOR 0.37, 95% CI 0.24–0.58). Interestingly, participants who reported risk perception of accessing health services reported lower odds of vaccine hesitancy (aOR 0.39, 95% CI 0.31–0.48), possibly due to their higher willingness to get immunisation protection against the risk of contracting COVID-19 virus.

Discussion

The current investigation examined the relationship between im/migration status and three COVID-19-related health concerns (i.e., perceived health risks when accessing care, anticipated stigma and vaccine hesitancy) among persons aged 25 years and older in Canada. The findings reveal that COVID-19-related health concerns are more prevalent among marginalized people who are migrants to Canada, those with lower educational attainment, and

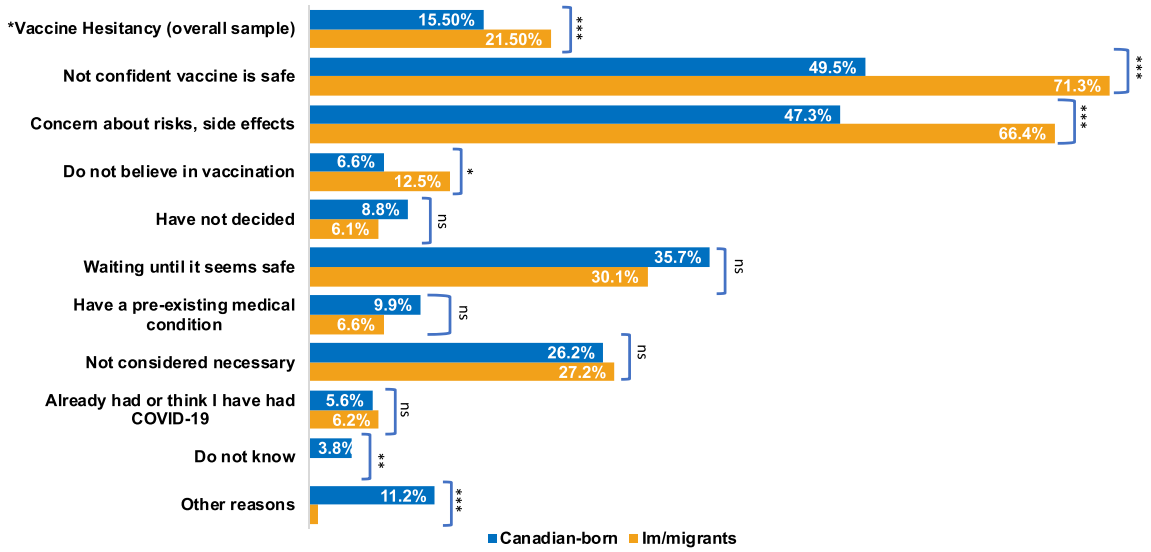

Fig. 2 Weighted prevalence of vaccine hesitancy and its reasons by im/migration status in the CPSS-3 (June 15–21, 2020), persons aged ≥ 25. *Notes* *Vaccine hesitancy was based on the overall sample (n = 3522, Canadian-born = 2924, Im/migrants = 598), while other items (underlying reasons) were among vaccine-hesitant individuals (n = 596, Canadian-born = 379, Im/migrants = 226). Comparisons by im/migration status were based on the chi-square test (*p < 0.05; **p < 0.01; ***p < 0.001; *ns* not significant)

those with unmet financial needs in comparison to participants who are Canadian-born, more educated and/or more affluent. In this nationally representative sample of general populations, four fifth of Canadians (83.1%) aged 25 and older intended to receive a future COVID-19 vaccine by June 2020 (before a vaccine was approved). This estimate was higher than the COVID-19 vaccine acceptance rate (76%) among Canadians aged 12 and above from a latter survey conducted by Statistics Canada in September 2020 [60], partly due to a younger cohort was included in its sample. Through a health equity lens focusing on im/migrant communities, this study documents that one in of every five im/migrants expressed concerns about vaccination as soon as a COVID-19 vaccine becomes available and they were two times more likely be affected by the burden of vaccine hesitancy, risk perception of accessing health care and fear of being targeted than their native-born Canadians.

Main Findings and Implications for Health Practice

The results of this research indicate that minority groups had higher levels of COVID-19 vaccine hesitancy in Canada as they do in the United Kingdom [46] and Ireland [45], despite a universal health system. These findings also echoed a recent provincial study in British Colombia, which found that females, those with less than high school education, racialized and indigenous groups had lower intentions to receive a COVID-19 vaccine [29]. Barriers to accessing health care, including lower vaccine uptake for infectious disease prevention, have been frequently documented among migrants [15, 25] racialized populations [61, 62] and socioeconomically disadvantaged groups [63], who are fundamentally deprived of health-promoting resources and at more risk of COVID-19 infection and adverse clinical outcomes [64]. In addition, this research demonstrates that health risk perceptions about seeing a doctor were more prominent in the im/migrant community, regardless of a publicly funded health care system in Canada. This is another worrying situation for im/migrants that could lead to underutilization of needed health services (e.g., delay of diagnostic tests and specialized care) in the host country during turbulence times [15, 65]. Thus, building COVID-19 vaccine confidence among these underserved populations primarily relies on the public health systems to become more accessible and sensitive on a structural basis, rather than placing the personal responsibility on these equity-seeking groups to become less hesitant [8]. For instance, decision-makers could ensure equitable immunisation coverage by establishing pop-up COVID-19 vaccine clinics via community- and faith-based organizations where no appointments are required for free vaccines [66]. Local health authorities should listen to voices of im/migrant and refugee communities, such as the Migrant Rights Network, to prioritize resources to address their unmet needs for health and social care [17]. Proactive health communication—highlighting vaccine efficacy and safety via health care professionals to leverage pro-vaccine norms and counter-narrative to tackle misinformation—would also be effective in building public trust in new vaccines [67].

Table 2 Binary logistic regression analyses predicting the multivariable-adjusted odds ratios of (a) perceived health risks of accessing care, (b) anticipated stigma, and (c) vaccine hesitancy, respectively, in the CPSS-3 (June 15–21, 2020), persons aged ≥ 25 (n = 3522)

Explanatory variables	Model A: Risk perceptions of accessing care				Model B: Anticipated stigma (Fear of being targeted)				Model C: Vaccine hesitancy			
	aOR	95% CI		Sig	aOR	95% CI		Sig	aOR	95% CI		Sig
	Nagelkerke $R^2 = 8.7\%$				Nagelkerke $R^2 = 8.9\%$				Nagelkerke $R^2 = 17.1\%$			
Im/migrants (Ref. Canadian-born)	**2.44**	**1.89**	**3.15**	**< 0.001**	**2.24**	**1.81**	**2.78**	**< 0.001**	**1.99**	**1.57**	**2.52**	**< 0.001**
Age (Ref. 25–34)												
35 to 44	1.12	0.84	1.50	0.446	1.06	0.80	1.41	0.676	0.85	0.63	1.14	0.276
45 to 54	0.91	0.68	1.22	0.518	1.22	0.91	1.63	0.187	0.89	0.66	1.20	0.447
55 to 64	1.07	0.80	1.44	0.649	**0.65**	**0.47**	**0.90**	**0.009**	**0.51**	**0.37**	**0.70**	**< 0.001**
≥ 65	0.79	0.57	1.09	0.147	**0.63**	**0.44**	**0.89**	**0.009**	**0.16**	**0.11**	**0.23**	**< 0.001**
Female (Ref. Male)	1.00	0.84	1.19	0.965	**1.23**	**1.03**	**1.49**	**0.027**	**1.26**	**1.04**	**1.53**	**0.021**
Education (Ref. ≥ BA degree)												
≤ High school grad	**1.36**	**1.08**	**1.71**	**0.010**	1.15	0.90	1.46	0.264	**1.67**	**1.27**	**2.18**	**< 0.001**
College diploma	**1.33**	**1.08**	**1.64**	**0.009**	0.97	0.77	1.22	0.807	**2.17**	**1.70**	**2.77**	**< 0.001**
Perceived income (Ref. > Enough)												
Enough	**1.46**	**1.17**	**1.83**	**0.001**	1.23	0.95	1.61	0.120	**1.70**	**1.25**	**2.32**	**0.001**
Not enough	**1.62**	**1.19**	**2.22**	**0.002**	**2.02**	**1.46**	**2.80**	**< 0.001**	**2.82**	**1.96**	**4.06**	**< 0.001**
Prefer not to say	0.83	0.52	1.33	0.439	0.94	0.51	1.72	0.838	1.06	0.57	1.96	0.860
Missing	NA	NA	NA	0.223	NA	NA	NA	0.896	NA	NA	NA	**0.001**
Employment (Ref. Employed)												
Absent; COVID-19 related	1.41	0.84	2.35	0.194	0.90	0.57	1.44	0.669	1.37	0.86	2.19	0.190
Absent; not COVID-19 related	1.23	0.71	2.16	0.463	0.97	0.57	1.66	0.910	**0.40**	**0.19**	**0.85**	**0.017**
Not employed	1.12	0.90	1.40	0.318	**0.69**	**0.55**	**0.88**	**0.002**	**1.55**	**1.23**	**1.95**	**< 0.001**
Not stated	**2.74**	**1.38**	**5.45**	**0.004**	**0.29**	**0.11**	**0.72**	**0.008**	**5.43**	**3.19**	**9.22**	**< 0.001**
Dwelling (Ref. House)												
Low-rise apartment	**1.59**	**1.15**	**2.18**	**0.005**	1.09	0.81	1.46	0.578	0.93	0.67	1.27	0.635
High-rise apartment	**1.40**	**0.99**	**1.99**	**0.060**	0.72	0.51	1.03	0.071	0.69	0.47	1.02	0.066
Others	1.08	0.85	1.38	0.526	1.05	0.81	1.35	0.716	**1.34**	**1.04**	**1.73**	**0.025**
Marriage (Ref. Married)												
Widowed/Separated	0.71	0.46	1.08	0.110	1.04	0.65	1.69	0.862	**0.39**	**0.24**	**0.63**	**< 0.001**
Single/never married	0.82	0.55	1.24	0.350	1.32	0.86	2.03	0.197	**0.37**	**0.24**	**0.58**	**< 0.001**
Rural residency (Ref. Urban)	**0.70**	**0.56**	**0.87**	**0.002**	**0.73**	**0.54**	**0.98**	**0.037**	1.12	0.86	1.47	0.388
Household size (Ref. 2 persons)												
1 person	**0.68**	**0.48**	**0.95**	**0.023**	0.70	0.49	1.01	0.058	**1.85**	**1.27**	**2.69**	**0.001**
≥ 3 persons	0.91	0.73	1.14	0.410	0.86	0.68	1.08	0.182	1.01	0.80	1.29	0.919
Living without spouse (Ref. No)	1.37	0.96	1.97	0.087	0.97	0.66	1.42	0.855	**1.99**	**1.35**	**2.95**	**0.001**
Risk perception of accessing care (Ref. No)	–	–	–	–	1.00	0.79	1.27	0.998	**0.39**	**0.31**	**0.48**	**< 0.001**
Anticipated stigma (Ref. No)	1.01	0.80	1.28	0.942	–	–	–	–	0.78	0.60	1.01	0.056
Vaccine Hesitancy (Ref. No)	**0.40**	**0.32**	**0.50**	**< 0.001**	**0.77**	**0.60**	**1.00**	**0.046**	–	–	–	–

Notes Boldface indicates statistical significance ($p < 0.05$). All predictors are adjusted for all other covariates in the model

aOR adjusted odds ratios, *95% CI* 95% confidence intervals for the adjusted odds ratios, *NA* not available (due to small cell size [n < 50], the estimates were not shown for quality control). *Sig.* Significance (p-value), *Ref.* reference group, *BA* Bachelor's degree and above

This study is particularly relevant to the current context of widespread xenophobia and anti-immigrant sentiment escalated by the COVID-19 pandemic [68–70]. Our finding is novel and extend previous literature by revealing that more than one-quarter of the im/migrants in Canada were fear of being targeted as risky "others" when the government relaxes public health measures against COVID-19. More importantly, one-third of such anticipated stigma among im/migrants was due to "other reasons (e.g., racial identity)", rather than non-compliance with public health

measures (e.g., no face masking) or underlying medical conditions during the COVID-19 crisis. The proportion of "other reasons" were substantially higher among im/migrant compared to Canadian-born residents, while "racial identity" was merged with "other reasons" by Statistics Canada. As such, one may speculate that the over-representation in "other reasons" for anticipated stigma among im/migrants may be primarily attributable to the racialized status and resultant exposure to racial discrimination, both of which are closely intertwined with im/migrant communities [17, 71]. To a broader scale, there is an urgent need to grapple with root causes of the longstanding im/migration-based inequities by pursuing structural interventions on xenophobic migration policy, occupational injustice, structural racism, and white supremacy [72].

In addition, the excess fear may be partly ignited by the framing of "foreign virus" that mistakenly blames the pandemic on foreign "others" [56, 73]. Although the CFSS survey was unable to untangle certain fear sources, migrants' double burden of anticipated stigma is concerning because daily stress and self-stigma have been associated with diminished well-being and increased mental health problems [74, 75], which can exacerbate health and mental health disparities already present in the im/migrant and refugee populations [76, 77]. To intervene more upstream determinants and social forces, COVID-19 pandemic responses need to simultaneously confront xenophobia, stigmatization, and vaccine hesitancy as well as to reduce socioecomic inequities [52], such as sufficient access to anti-stigma public health messaging, employment sick leave benefits, paid leave for COVID-19 vaccination and vaccine injury compensation program. These social welfare policies and interventions could enhance vulnerable individuals' capacity to cope with day-to-day life challenges during a public health emergency [78]. Through these equity-oriented empowerment initiatives, vulnerable populations could be informed to address their justified questions about vaccine safety and have adequate resources to act on trustworthy health information.

Strengths and Limitations

This is the first population-based study, to our knowledge, to compare health concerns, including COVID-19 vaccine hesitancy, among im/migrants and non-immigrants during the COVID-19 pandemic in Canada. However, several methodological flaws and biases limited the generalisability. First, when factoring in the nonparticipation, the cumulative response rate to the CPSS-3 survey was round 14% [50], possibly due to its online survey methods that exclude offline populations and respondent fatigue from previous CPSS survey series during COVID-19. Thus, this CPSS-3 survey is subject to high non-response bias and there is an over-representation of Canadian-born residents and two-person households in the sample [50]. Given im/migrants were not proportionately surveyed, the observed gaps between im/migrants and non-immigrants in COVID-19 health concerns may be underestimated at the national level. Second, this study relied on self-reported survey data and therefore is susceptible to recall bias. The statistical models will always have the risk of 'residual confounding', resulting from unobserved characteristics that are not included in the analyses. For example, due to PUMF data restriction, the study could not tease out certain non-permanent residents, foreign-born groups, such as those on a student or work visa or asylum seekers, who were more vulnerable than the landed immigrant populations.

Moreover, the CPSS survey did not capture the race/ethnicity identifier or country of origin; and thus omitted a racial equity lens that could distinguish racialized im/migrants apart from White im/migrants whose cultural beliefs, exposure to societal stressor, and health care utilization patterns significantly differed. Therefore, future research could focus on examining the within-group heterogeneity by intra-group membership instead of aggregating im/migrants as a homogeneous category. Since CPSS only includes participants speaking English or French, im/migrants facing language barriers with greater health concerns were less likely to be surveyed, which may have biased the sample. Lastly, the CPSS did not collect the information about more complex reasons, such as negative experiences and discrimination from previous healthcare encounters, vaccine availability by location and timing, which may help to explain disparities in health concerns. As the ongoing pandemic continues to evolve, future studies should adjust for important social determinants of health, including im/migrant and socioeconomic status that stratify access to health-enhancing resources, to predict vaccination rate and vaccine uptake disparities.

Conclusion

Overall, this nationwide study has demonstrated disparities by nativity, income and education in the prevalence of COVID-19-related health concerns and reasons for vaccination refusal under universal health coverage in Canada. In major im/migrant-receiving countries around the world, it is vital for the COVID-19 vaccination plans to proactively include migrant and displaced populations-regardless of their legal status—to address their heightened fear, stigma and vaccine hesitancy amidst turbulent times. Accountability should be held upon the governance and medical institutions to ensure equitable access to COVID-19 vaccines and other health-enhancing resources for im/migrant populations. With new COVID-19 virus variants spreading

(e.g., the Omicron variant and other variants of concern) and COVID-19 vaccine distributing globally, health equity should be placed at the center of all policy responses designed to mitigate the disproportionate impact of the pandemic on underserved communities.

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Data Availability The public use microdata file of the Canadian Perspectives Survey Series is available to Canadian researchers via Statistics Canada's Data Liberation Initiative and to international researchers by request at dli-idd@statcan.gc.ca from Statistics Canada. More information could be found: https://hdl.handle.net/11272.1/AB2/HHC2HD. The public-use data are completely de-identified and publicly available with necessary suppression methods to protect confidentiality; thus, according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans—TCPS 2 (2018), this study relied solely on Statistics Canada's publicly available data could be deemed as non-human subjects research and does not require institutional ethics review. TCPS Article 2.2 allows exemption of research based exclusively on publicly available data from research ethics board review. This exemption is based on the presence of a legally designated custodian who protects privacy.

Declarations

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