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Racial/ethnic disparities in pain among Canadian adults

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ABSTRACT

Background: Understanding pain disparities is critical for fostering health equity and guiding effective health policies. However, little is known about racial/ethnic disparities in pain among adults in Canada.

Aims: We provide a comprehensive analysis of racial/ethnic disparities in pain among Canadian adults, focusing on two dimensions of pain – frequent pain and interfering pain.

Methods: We use two-wave cross-sectional data collected in 2020 and 2022 from a representative sample of 4,637 adults aged 18 and older residing in Canada. We calculate the prevalence of pain among White, Black, East/Southeast Asian, South Asian, Indigenous, Multiracial, and "Other" groups and estimate relative differences adjusted for key covariates in a multivariable framework.

Results: The data reveal large and statistically significant pain disparities; specific patterns, however, vary across the two pain outcomes and by gender. Indigenous Canadians have relatively high prevalence of both frequent pain (38.4%) and interfering pain (27.8%), while East/Southeast Asian Canadians have the lowest prevalence of both (8.2% and 14.4%, respectively). Black Canadians have a relatively low prevalence of frequent pain (16.9%) but a very high prevalence of interfering pain (27.8%). Covariates are associated with pain levels but less so with the racial/ethnic patterns in pain.

Conclusions: Our analysis highlights substantial racial/ethnic disparities in pain prevalence among Canadian adults. Further research is essential to better understand the root causes of the observed disparities and ultimately improve the lives of Canadians living with pain.

RÉSUMÉ

Contexte: Il est essentiel de comprendre les disparités liées à la douleur pour favoriser l'équité en santé et l'élaboration de politiques de santé qui soient efficaces. Cependant, on sait peu de choses sur les disparités raciales ou ethniques en matière de douleur chez les adultes au Canada.

Objectifs: Nous présentons une analyse approfondie des disparités raciales ou ethniques en matière de douleur chez les adultes canadiens, en nous concentrant sur deux dimensions de la douleur : la douleur fréquente et la douleur gênante.

Méthodes: Nous utilisons des données transversales recueillies en deux vagues, soit en 2020 et 2022, provenant d'un échantillon représentatif de 4 637 adultes âgés de 18 ans et plus résidant au Canada. Nous calculons la prévalence de la douleur parmi les groupes Blancs, Noirs, Asiatiques de l'Est et du Sud-Est, Asiatiques du Sud, Autochtones, personnes multiraciales et « Autres », et estimons les différences relatives ajustées en fonction de covariables clés dans un cadre multivariable.

Résultats: Les données révèlent des disparités importantes et statistiquement significatives en matière de douleur. Toutefois, les disparités varient selon des schémas distincts, en fonction du type de douleur et du sexe. Les Canadiens autochtones présentent une prévalence relativement élevée (38,4 %) de la douleur fréquente et de douleur gênante (27,8 %), tandis que les Canadiens originaires de l'Asie de l'Est et du Sud-Est ont la prévalence la plus faible pour les deux types de douleur (8,2 % et 14,4 %, respectivement). Les Canadiens noirs ont une prévalence relativement faible de douleur fréquente (16,9 %) mais une prévalence très élevée de douleur gênante (27,8 %). Les covariables sont associées aux niveaux de douleur, mais moins aux schémas raciaux ou ethniques de la douleur.

Conclusions: Notre analyse met en évidence des disparités raciales ou ethniques considérables dans la prévalence de la douleur chez les adultes canadiens. Des recherches supplémentaires sont essentielles pour mieux comprendre les causes profondes des disparités et, à terme, améliorer la vie des Canadiens vivant avec la douleur.

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Racial/ethnic disparities in pain among Canadian adults

Pain is a complex and debilitating condition that significantly impacts individuals' quality of life and contributes to overall health inequities.[1] The Canadian Pain Task Force, established by the Government of Canada to improve the lives of Canadians living with pain, has repeatedly emphasized the need to address these inequities by improving the monitoring of pain outcomes in understudied populations, including racialized groups.[2,3] Prominent pain scholars also called for additional research on disadvantaged groups, including racialized groups.[4,5] This is an urgent challenge as Canada's population becomes increasingly diverse, with systemic inequities in pain determinants and pain management contributing to worse outcomes for disadvantaged groups.[6]

Our operationalizations of race and ethnicity follow up-to-date Statistics Canada definitions and recommendations. Race and ethnicity are social constructs reflecting both self-identified cultural heritage and shared experiences of systemic discrimination.[7] The definition of race aligns with socially ascribed physical characteristics (e.g., skin color), while ethnicity refers to shared language, cultural traits, or geopolitical origins. These constructs, though distinct in theory, are both shaped by structural and historical contexts including systemic discrimination, and frequently overlap in practice,[8,9] including in the study of pain.[10–14] In the present study, we use the term "race/ethnicity" to reflect these categories as self-identified by participants. Indigenous Canadians, defined as people who self-identify as First Nations, Métis, or Inuit,[15] are included in the analysis as well. Additionally, we refer to "racialized groups" as a broader term comprising non-White respondents, following Statistics Canada's recommendation for this term over "visible minority."[16]

There is considerable literature on race/ethnic disparities in pain, but most has focused on the United States.[7,13,14,17–35] This body of work has shown tremendous and persistent race/ethnic disparities in pain, with racialized adults, especially Native American and Black adults, having a high pain prevalence. In contrast, there is a conspicuous gap in the literature regarding racial/ethnic disparities in pain among Canadian adults. Widely cited population-level studies on pain prevalence in Canada over the prior two decades have not provided estimates by race/ethnicity.[36–39] Scholars who examined pain experiences among racialized adults have expressed concern over the lack of national prevalence estimates and race/ethnic comparisons.[40–43] The absence of this research isn't because of the absence of disparities as such; large racial/ethnic disparities in Canada have been documented for numerous other health outcomes.[44–48]

The modest number of studies that empirically compared pain prevalence across race and ethnicity among Canadian adults provide a limited and sometimes inconsistent picture. For instance, non-White Canadians were found to have a higher prevalence of chronic pain than White Canadians (15% vs 14%) in one study,[49] but a lower prevalence (13% vs 19%) in another study.[50] Asian Canadians had the lowest pain prevalence.[44] Interestingly, pain prevalence among Black Canadians similar or slightly lower than among White Canadians,[44,50,51] unlike for other health outcomes.[47,52] Finally, Indigenous Canadians were repeatedly found to have a high prevalence of pain compared to White or Asian Canadians.[43,44,50,51]

However, some of these studies only examined women,[51] or focused only on older adults;[44] some were not peer-reviewed.[50] Additionally, all of these studies used data from at least a decade ago. Given the substantial changes in the racial composition of the Canadian population[53] and the evolving landscape of pain and pain treatment,[36,54] an updated examination is necessary.

The present study contributes to the understanding of racial/ethnic disparities in pain in Canada by analyzing across seven race/ethnic groups, including Indigenous Canadians. In recognition of the multidimensional nature of pain, we examine two pain definitions: frequency-based pain and more impactful pain that interferes with activities, in line with the Canadian Pain Task Force recommendation.[3] Further, we follow best practices for inclusive pain scholarship[55,56] and conduct both full-sample and gender-stratified analyses. Finally, we not only present the observed disparities but also examine the net of important covariates known to be associated with pain. We include demographic characteristics such as age, immigrant status, marital status,[6,57,58] education, and household income as measures of socioeconomic status,[49,59,60] and experienced discrimination, which is a strong predictor of pain[44,61,62] and more frequently experienced by racialized Canadians.[63,64]

Methods

Data sources

We used data from the NEST Omnibus survey, a two-wave repeated cross-sectional general-population online survey conducted in Canada in 2020 and in 2022.[65,66]

The survey assessed a wide range of social, political, and health topics among Canadian adults during the COVID-19 pandemic. Participants were chosen from the well-established Leger panels – large, ongoing online panels utilizing national probability sampling within gender-age-region quotas. A single e-mail invited participants to take the survey in each year, yielding a modest acceptance rate (17% in 2020 and 13% in 2022). The survey was available in English and French. Poststratification sampling weights calculated using the raking procedure by Leger were used in all analyses. The survey received approval from the University of Western Ontario Ethics Board (Project ID 116046 for the 2020 wave and ID 120648 for the 2022 wave). Survey participants provided informed consent prior to participating in the survey. Datasets and documentation are publicly available at https://borealisdata.ca.

Sample definition. The analytic sample includes respondents age 18 and older residing in Canada. Of the 4,637 respondents who completed the survey, 4,612 (99.5%) provided information on pain frequency and 4,589 (99.0%) provided information on pain interference; these are the sample sizes for the respective analyses.

Variables

The dependent variables are two dimensions of pain: frequent pain and interfering pain. Pain frequency was assessed with the question, "In the past 30 days, how often have you experienced pain?" We dichotomized the response options as "never or almost never," "rarely," and "sometimes," versus "often" and "almost always or always."

Respondents who reported any pain were also asked, "How much did the pain interfere with your general activity like work or household chores?" The response options were given on a numerical scale from 1 = "did not interfere" to 11 = "completely interfered." Those who reported no pain in the frequency questions were assigned a score of 0 for interference. We then dichotomized the interference scale as 0 to 7 = no interfering pain versus 8 to 11 = interfering pain. This threshold was selected based on empirical and conceptual considerations. Empirically, the selection resulted in a better model fit relative to lower cut points – such as 7 to 11 – as assessed by AUC, AIC, BIC, and the percentage of correctly classified cases. Conceptually, a rating of 8 or higher represented a high degree of interference, aligning with a meaningful definition of "interfering pain." An even higher threshold (9 to 11) was suboptimal due to the small sample sizes for respondents with interfering pain, especially in gender-stratified models, for most visible-minority categories. Thus, the selected threshold offers the optimal balance of statistical performance and conceptual clarity. Additional details on the threshold selection are available in Supplemental Table S4.

The key independent variable is race/ethnicity. The information was collected with the question: "Do you identify as any of the following? White, South Asian, Chinese, Black, Filipino, Latin American, Arab, Southeast Asian, West Asian, Korean, Japanese, Indigenous, Other [please specify]." Due to the small sample sizes for several ethnic or national-origin groups, and following Statistics Canada precedent,[67] we classified the responses into seven racial/ethnic categories: White, Black, East/Southeast Asian (including Chinese, Japanese, Korean, and the Southeast Asian identification), South Asian, Indigenous (the survey did not ask respondents to further self-identify as First Nations, Metis, or Inuit), multiracial (for respondents who indicated two or more race/ethnic identities), and other groups (Latin, Arab, West Asian, or other).

Covariates. Age was categorized as 18–24, 25–34, 35–44, 45–54, 55–64, and 65 and older. Gender was coded as men, women, and other gender. This last category included respondents who self-identified as nonbinary, two-spirit, or other. Immigrant status is captured with the question "Were you born in Canada?" Respondents who answered "No" were classified as immigrants, while those who answered "Yes" were classified as Canada-born. Survey language was English or French. Marital status was coded as previously married, never married, and married or partnered as the reference. The province/region of residence comprised Ontario, Quebec, the West (British Columbia), the Prairies, and the Atlantic provinces. Two socioeconomic status measures were included: education (categorized as high school or less, some higher education but no degree, associate or college degree, bachelor's degree, and master's or more advanced degree) and household income (categorized as $0–30,000, $30,001–60,000, $60,001–-110,000, and $110,001 or above). Lastly, "experienced discrimination" was assessed with the question, "In the past 12 months, have you personally experienced discrimination by others?" with answer options Yes or No.

Missingness. Variables had no or low missingness; only 4% of respondents had one or more missing covariates. Imputation was thus not necessary, and we show results from complete-case analyses.

Statistical analysis

All analyses are conducted with pooled 2020 and 2022 waves. First, we summarized the distribution of covariates in the full sample and for each race/ethnic group

(Table 1). The table also shows a comparison of the distribution of covariates by race/ethnicity using design-adjusted *F*-tests (chi-square equivalents appropriate for data with survey weights).

Second, we estimated the weighted prevalence of both pain outcomes in the full sample and for each race/ethnic groups, including separately for men and women. We also tested whether the pain prevalence differed significantly by race/ethnicity using design-adjusted F-tests (Table 2).

Third, we examined pain differences across racial/ethnic groups in a multivariable framework. We estimated modified Poisson models to obtain prevalence ratios of frequent pain (Table 3) and interfering pain (Table 4). We followed an approach well-established in population-health studies, where covariates are added in a theoretically informed sequence to assess their impact on the primary outcome systematically. In the first model, we included demographic variables – age, gender, survey year, marital status, and immigration status – as these are fundamental characteristics known to influence health outcomes, including pain. The second model added survey-related and geographic factors, namely survey language and province or region of residence, to account for potential contextual influences on reporting patterns. The third model incorporated socioeconomic status (SES) variables, specifically education and household income, given their central role as determinants of health disparities and potential mediators of pain experiences. In the final model, we added experienced discrimination, which is a well-documented factor in shaping racial/ethnic disparities in pain perception and broader health outcomes. This sequential modeling strategy allowed us to observe how the inclusion of these different domains influenced the estimated disparities in pain.

The models were estimated for the full sample and separately for men and women. The modified Poisson model (also referred to as robust or quasi-Poisson) is an increasingly used model alternative to the logistic for binary outcomes; its major advantage is that the exponentiated coefficients are interpreted as prevalence ratios, which are more intuitive and easier to communicate than odds ratios from logistic models.[68] Tables 3 and 4 show only prevalence ratios associated with race/ethnicity

Table 1. Distribution of covariates by race/ethnicity (weighted proportions).

	Total	White	Black	East/SE Asian	South Asian	Indigenous	Multi-racial	Other
Sample size (*N*)	4,637	3,525	97	364	182	113	104	252
Age								
18–24	10.7	7.7	21.5	24.3	18.2	16.4	29.8	17.8
25–34	17.1	14.4	24.3	27.8	34.3	27.6	23.2	21.9
35–44	15.6	14.5	30.6	17.0	20.6	8.7	19.5	23.7
45–54	16.5	16.8	11.2	17.3	16.4	16.2	14.7	15.0
55–64	17.5	19.3	6.6	10.2	7.1	19.0	9.8	13.4
65+	22.5	27.3	5.8	3.4	3.4	12.0	3.1	8.3
Gender								
Men	48.5	48.2	55.5	49.4	58.0	43.8	36.2	49.9
Women	51.2	51.6	44.0	49.9	42.0	55.8	61.7	49.6
Other genders	0.3	0.2	0.5	0.6	0.0	0.4	2.2	0.5
Province/region								
Ontario	38.6	35.9	53.3	44.9	65.3	36.3	47.3	43.8
Quebec	23.3	27.2	14.6	3.6	2.7	9.7	13.4	18.0
British Columbia	13.7	11.8	1.6	33.8	13.5	18.2	20.0	16.3
Prairies	17.6	17.0	22.8	17.2	17.7	31.8	13.1	19.9
Atlantic	6.8	8.0	7.6	0.6	0.7	4.1	6.3	2.0
Marital status								
Married/partnered	58.8	61.8	46.6	45.6	58.7	45.8	36.7	52.1
Previously married	12.7	14.1	8.9	3.2	7.3	16.9	9.4	8.1
Never married	28.5	24.1	44.6	51.2	34.0	37.2	53.9	39.8
Immigrant (vs Canada-born)	16.9	8.9	46.2	48.5	66.2	2.2	33.6	51.6
French survey (vs English)	22.2	26.5	16.8	1.8	0.0	8.9	8.7	13.7
Educational attainment								
High school or less	26.6	29.4	24.4	13.6	9.8	28.7	13.2	17.5
Some higher education	17.0	16.6	18.9	15.8	15.3	26.3	23.7	17.6
Associate/college degree	22.7	24.3	18.6	12.2	7.9	28.8	24.0	19.7
Bachelor's degree	22.6	19.9	26.5	44.1	36.6	10.6	23.5	29.9
Master's degree or higher	11.2	9.9	11.5	14.3	30.4	5.6	15.6	15.4
Household income								
$30,000 or less	19.4	19.5	20.5	12.8	21.5	26.5	20.1	21.7
$30,001–$60,000	24.9	26.0	32.8	22.6	16.7	18.7	19.5	19.8
$60,001–$110,000	32.7	32.0	26.9	30.3	41.6	38.4	37.4	37.1
$110,001 or more	23.0	22.5	19.9	34.4	20.1	16.4	23.0	21.5
Experienced discrimination	17.5	13.8	37.6	28.1	32.5	41.5	26.0	25.3

All covariates' distribution differed across racial/ethnic groups at $p < 0.001$ except gender, where $p = 0.002$, from chi-square-equivalent *F*-tests for data with sampling weights. SE = Southeast.

Table 2. Weighted prevalence of frequent and interfering pain by race/ethnicity and gender.

Frequent pain	All		Men		Women	
All	28.2	(26.8, 29.7)	25.3	(23.4, 27.4)	30.8	(28.8, 32.9)
By race/ethnicity						
White	31.0	(29.4, 32.7)	28.4	(26.1, 30.9)	33.3	(31.0, 35.7)
Black	16.9	(10.4, 26.2)	15.5	(7.6, 28.8)	18.8	(9.5, 33.9)
East/Southeast Asian	8.2	(5.8, 11.6)	6.5	(3.7, 11.3)	9.3	(5.8, 14.7)
South Asian	20.8	(15.1, 28.1)	13.6	(8.2, 21.7)	31.0	(20.7, 43.7)
Indigenous	38.4	(29.2, 48.6)	32.0	(19.8, 47.3)	43.2	(30.5, 56.9)
Multiracial	17.4	(11.3, 25.8)	17.0	(8.0, 32.5)	15.1	(8.2, 32.5)
Other	20.6	(15.8, 26.5)	17.6	(11.5, 25.9)	23.7	(16.6, 32.7)
Test of differences	$P < .001$		$P < .001$		$P < .001$	
Interfering pain						
All	20.6	(19.3, 21.9)	18.1	(17.5, 18.8)	22.9	(21.7, 24.1)
By race/ethnicity						
White	20.4	(19.3, 21.9)	18.3	(16.3, 20.4)	22.5	(20.4, 24.7)
Black	27.8	(19.2, 22.0)	24.1	(13.6, 39.0)	32.9	(20.0, 49.0)
East/Southeast Asian	14.4	(11.0, 18.7)	12.2	(8.0, 17.9)	16.3	(11.2, 23.0)
South Asian	32.6	(25.7, 40.4)	26.8	(18.9, 36.5)	40.8	(29.5, 53.1)
Indigenous	27.8	(19.8, 37.6)	13.0	(6.2, 25.1)	39.0	(26.8, 52.8)
Multiracial	17.7	(11.3, 26.4)	15.4	(6.8, 31.2)	18.0	(10.1, 29.9)
Other	16.6	(12.3, 22.1)	16.7	(10.8, 24.8)	16.8	(10.8, 25.0)
Test of differences	$P = .001$		$P = .099$		$P = .001$	

The table shows weighted prevalence and 95% confidence intervals.

Frequent pain is defined as pain experienced often, almost always, or always, versus never or some days, over the previous 30 days.

Interfering pain is defined as pain that interfered with general activities.

Tests of differences are *F*-tests (chi-square equivalents for data with survey weights) for differences in prevalence across race/ethnic groups.

Table 3. Frequent pain by race/ethnicity, net of nested covariate sets, for all and by gender.

	Model 1		Model 2		Model 3		Model 4	
All								
Black	0.67	[0.42,1.06]	0.74	[0.46,1.17]	0.76	[0.48,1.22]	0.71	[0.44,1.14]
East/SE Asian	0.31***	[0.22,0.45]	0.34***	[0.23,0.49]	0.38***	[0.26,0.55]	0.36***	[0.25,0.53]
South Asian	0.83	[0.60,1.14]	0.95	[0.68,1.33]	1.02	[0.73,1.44]	0.95	[0.68,1.34]
Indigenous	1.31*	[1.01,1.70]	1.22	[0.94,1.58]	1.12	[0.86,1.47]	1.03	[0.79,1.35]
Multiracial	0.64*	[0.42,0.96]	0.66*	[0.44,0.99]	0.67	[0.44,1.02]	0.65*	[0.43,0.98]
Other	0.76*	[0.58,0.99]	0.84	[0.64,1.11]	0.88	[0.66,1.17]	0.84	[0.63,1.11]
Men								
Black	0.70	[0.36,1.36]	0.73	[0.38,1.40]	0.74	[0.38,1.43]	0.69	[0.35,1.35]
East/SE Asian	0.29***	[0.16,0.51]	0.29***	[0.16,0.53]	0.34***	[0.19,0.63]	0.34***	[0.18,0.61]
South Asian	0.58*	[0.35,0.96]	0.64	[0.37,1.09]	0.65	[0.37,1.13]	0.62	[0.36,1.09]
Indigenous	1.21	[0.77,1.88]	1.10	[0.71,1.71]	1.08	[0.69,1.69]	1.05	[0.68,1.62]
Multiracial	0.80	[0.39,1.62]	0.85	[0.41,1.75]	0.89	[0.43,1.85]	0.85	[0.40,1.81]
Other	0.72	[0.47,1.09]	0.79	[0.52,1.21]	0.82	[0.52,1.28]	0.79	[0.51,1.24]
Women								
Black	0.67	[0.35,1.27]	0.76	[0.40,1.45]	0.82	[0.43,1.56]	0.74	[0.38,1.44]
East/SE Asian	0.32***	[0.20,0.51]	0.36***	[0.22,0.59]	0.39***	[0.23,0.64]	0.37***	[0.22,0.61]
South Asian	1.13	[0.76,1.68]	1.29	[0.86,1.94]	1.49*	[1.00,2.20]	1.32	[0.89,1.95]
Indigenous	1.38*	[1.00,1.90]	1.28	[0.92,1.77]	1.14	[0.82,1.59]	1.00	[0.71,1.42]
Multiracial	0.52*	[0.29,0.93]	0.54*	[0.30,0.96]	0.52*	[0.29,0.95]	0.51*	[0.29,0.90]
Other	0.81	[0.57,1.14]	0.89	[0.62,1.28]	0.93	[0.64,1.36]	0.87	[0.60,1.27]

***$P < 0.001$; **$P < 0.01$; *$P < 0.05$.

SE = Southeast. Multiracial includes respondents who self-identified using multiple race/ethnic categories. Other race/ethnic category includes West Asian, Filipino, Arab, Latin American, and a residual "other" category.

The table shows prevalence ratios and 95% CIs from survey-adjusted modified Poisson models with robust standard errors of frequent pain, as a function of race/ethnicity (White as the reference). Only the prevalence ratios associated with race/ethnicity are shown here; the complete results are provided in Supplemental Tables S1a), S1b), and S1c).

Model 1 adjusts for age, survey year, and gender (only in full-sample model).

Model 2 adds province/region, immigration status, and marital status.

Model 3 adds education and household income.

Model 4 is fully adjusted; it also adds experienced discrimination.

for parsimony; the full results are in Supplemental Tables S1a), S1b), S1c) for frequent pain, and Supplemental Tables S2a), S2b), and S2c) for interfering pain.

Finally, we visualized the race/ethnic patterns in absolute perspective. We estimated average predicted probabilities of each pain outcome in each race/ethnic group net of age,

Table 4. Interfering pain by race/ethnicity, net of nested covariate sets, for all and by gender.

	Model 1		Model 2		Model 3		Model 4	
All								
Black	1.57*	[1.10,2.25]	1.71**	[1.19,2.46]	1.73**	[1.21,2.49]	1.58*	[1.09,2.30]
East/SE Asian	0.80	[0.61,1.06]	0.81	[0.60,1.09]	0.95	[0.70,1.29]	0.91	[0.68,1.23]
South Asian	1.88***	[1.48,2.40]	2.03***	[1.54,2.67]	2.10***	[1.60,2.77]	1.93***	[1.47,2.53]
Indigenous	1.41*	[1.02,1.94]	1.32	[0.95,1.82]	1.19	[0.87,1.64]	1.07	[0.77,1.49]
Multiracial	0.95	[0.61,1.47]	0.95	[0.61,1.48]	0.98	[0.62,1.54]	0.94	[0.60,1.49]
Other	0.89	[0.66,1.21]	0.96	[0.70,1.32]	0.95	[0.68,1.32]	0.89	[0.65,1.24]
Men								
Black	1.40	[0.81,2.41]	1.39	[0.79,2.47]	1.45	[0.82,2.56]	1.33	[0.74,2.39]
East/SE Asian	0.71	[0.46,1.10]	0.61*	[0.38,0.96]	0.76	[0.48,1.21]	0.74	[0.47,1.17]
South Asian	1.59*	[1.12,2.27]	1.48	[0.98,2.25]	1.54	[1.00,2.37]	1.45	[0.94,2.25]
Indigenous	0.73	[0.35,1.50]	0.67	[0.33,1.38]	0.69	[0.34,1.39]	0.66	[0.33,1.34]
Multiracial	0.92	[0.42,2.03]	0.90	[0.41,1.97]	1.03	[0.47,2.26]	0.97	[0.43,2.18]
Other	0.95	[0.62,1.47]	0.92	[0.59,1.43]	1.08	[0.69,1.67]	1.03	[0.67,1.60]
Women								
Black	1.77*	[1.12,2.81]	2.05**	[1.29,3.25]	2.13**	[1.33,3.41]	1.92**	[1.19,3.11]
East/SE Asian	0.84	[0.58,1.22]	0.97	[0.65,1.44]	1.11	[0.74,1.68]	1.04	[0.70,1.55]
South Asian	2.23***	[1.61,3.09]	2.63***	[1.84,3.75]	2.89***	[2.09,4.01]	2.54***	[1.84,3.52]
Indigenous	1.84***	[1.31,2.60]	1.73**	[1.23,2.44]	1.50*	[1.07,2.10]	1.31	[0.92,1.86]
Multiracial	0.93	[0.53,1.63]	0.98	[0.56,1.73]	0.93	[0.51,1.68]	0.90	[0.50,1.64]
Other	0.85	[0.56,1.31]	0.99	[0.64,1.54]	0.85	[0.52,1.39]	0.79	[0.49,1.27]

***$P < 0.001$; **$P < 0.01$; *$P < 0.05$.

SE = Southeast.

The table shows prevalence ratios and 95% CIs from survey-adjusted modified Poisson models with robust standard errors of interfering pain, as a function of race/ethnicity (White as the reference). Only the prevalence ratios associated with race/ethnicity are shown here; the complete results are provided in Supplemental Tables S2a), S2b), and S2c).

Model 1 adjusts for age, survey year, and gender (only in full-sample model).

Model 2 adds province/region, immigration status, and marital status.

Model 3 adds education and household income.

Model 4 is fully adjusted; it also adds experienced discrimination.

gender, and survey year as in Model 1. Figure 1 shows the probabilities of frequent and interfering pain for the full sample and for men and women separately.

We also conducted sensitivity analyses to test the robustness of our conclusions to different specification of the interfering pain construct. Specifically, we re-estimated models like those shown in Table 4 but for a higher threshold for pain interference: 9 to 11 on the 0–11 scale. Results are shown in Supplemental Table S4. For readers interested in the joint distribution of the two dimensions of pain, Supplemental Table S5 shows the crosstab of the original 12-point pain interference (from 0 for no pain to 11 as the highest level of interference) and the 5-point pain frequency measures; Supplemental Table S6 shows a crosstab of the dichotomized measures. We also calculated the phi coefficient (phi = 0.47), finding a moderately strong association. These crosstabs and phi value indicate that the two measures are related as would be expected, but each captures a unique dimension of the pain experience.

Analyses were done with Stata 18.0. The authors acknowledge the use of ChatGPT-4o (OpenAI) for editorial assistance in enhancing clarity and readability. All content reflects the authors' own analyses and interpretation, and the authors take full responsibility for the accuracy and integrity of the manuscript.

Results

The distribution of all covariates in the full sample and by race/ethnicity, as well as sample sizes for each group, are shown in Table 1. Roughly 43% of the sample is younger than 45; just over half (51.2%) are women. Chi-square-equivalent *F*-tests showed that all covariates differ significantly across race/ethnic groups. For instance, the proportion of immigrants is 2.2% among Indigenous Canadians but 66.2% among South Asian Canadians. Among Indigenous Canadians, 5.6% have a master's degree, compared to over 30.4% of South Asian Canadians. And while 13.8% of White Canadians report experiencing discrimination, the proportion is 37.6% among Black Canadians and 41.5% among Indigenous Canadians.

As the next step, we estimated the weighted prevalence of frequent and interfering pain in the full sample, by race/ethnicity, and by gender (Table 2). The average prevalence of frequent pain is 28.2%, but it varies significantly by race/ethnicity ($p < .001$): the lowest prevalence is among East/Southeast Asian Canadians (8.2%), followed by Black Canadians (16.9%) and multiracial (17.4%), while White Canadians and Indigenous Canadians have a much higher prevalence (31.0% and 38.4%, respectively).

Interfering pain prevalence is 20.6% overall. Again, this varies significantly by race/ethnicity ($p = .001$),

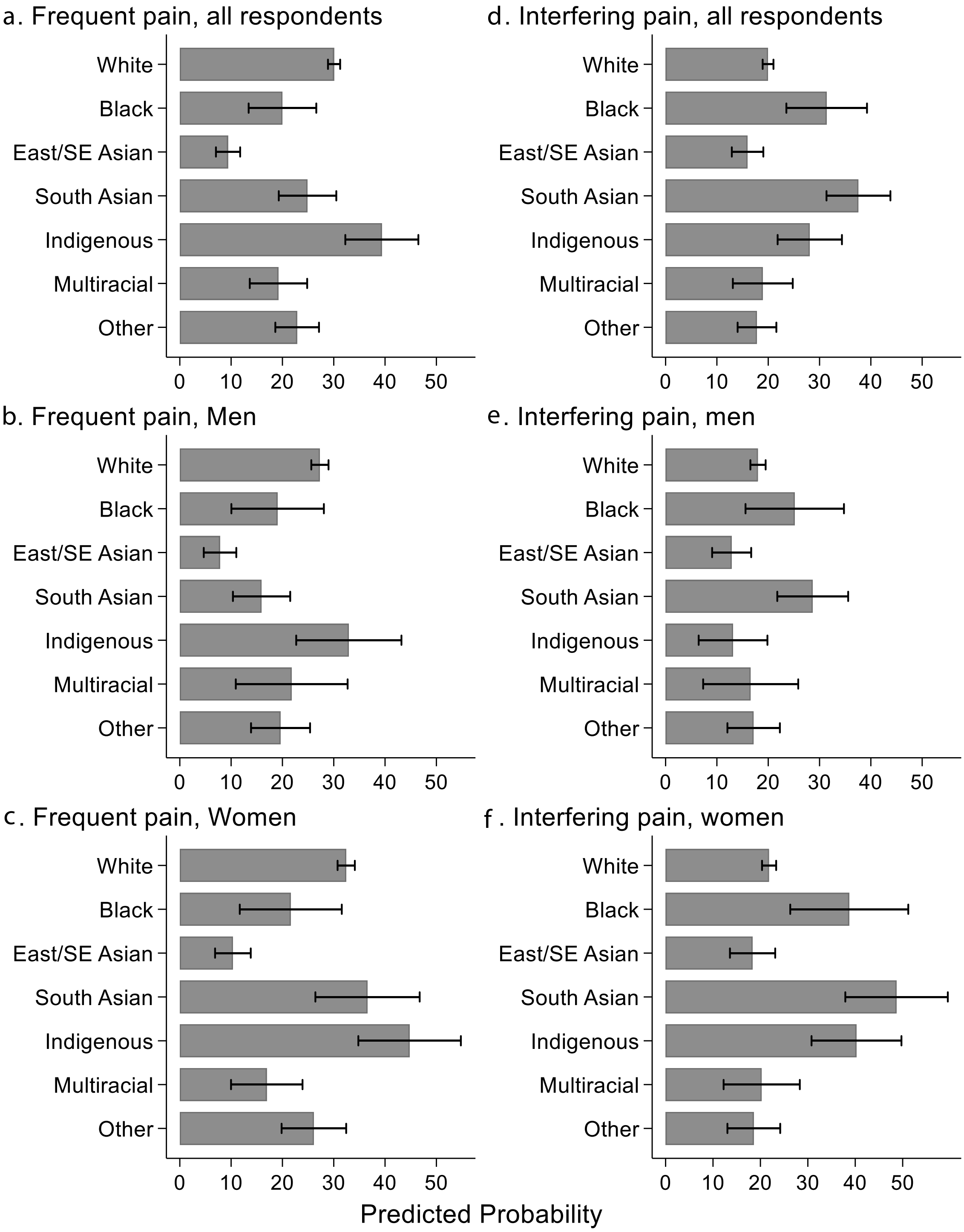

Figure 1. Average predicted frequent and interfering pain. Average predicted probabilities calculated from robust (modified) Poisson models of frequent pain and interfering pain for the full sample, for men and for women, in models controlling for age, gender in full-sample models, and survey year – these are the Model 1 results in Tables 3 and 4. The 84% confidence intervals allow comparison across groups.[81–84]

although not in the same way as the frequent pain. Interfering pain is lowest among East/Southeast Asian, "Other," Multiracial, and White Canadians (14.4%, 16.6%, 17.7%, and 20.4%, respectively); the highest prevalence occurs among South Asian Canadians (32.6%), as well as Black and Indigenous Canadians (27.8% for both groups).

When stratified by gender, the data show women have about 5 percentage points higher prevalence of both frequent and interfering pain than men in the total sample. Race/ethnic disparities in each pain outcomes often track for both genders. For frequent pain, East Asian Canadian men and women have lowest pain prevalence; Indigenous men and women have highest prevalence, and white men and women have second-highest prevalence. For interfering pain, East Asian Canadians of both genders have the lowest prevalence while South Asian and Black Canadian men and women have among the highest prevalence. However, there are some exceptions. For frequent pain, South Asian men have relatively low pain, but South Asian women have the highest prevalence by far (43.2%); for interfering pain, Indigenous men have the second-lowest prevalence (13.3%) but Indigenous women have the second-highest prevalence (39.0%).

Table 3 summarizes adjusted prevalence ratios for frequent pain by race/ethnicity net of four covariate sets, for the total sample and separately for men and women. Only the prevalence ratios associated with race/ethnicity are shown for parsimony; Supplemental Tables S1a), S1b), and S1c) show the full results with all covariates. We highlight several findings. 1) East/Southeast Asian Canadians stand out as having the lowest prevalence. Compared to White Canadians, they have 69% lower prevalence of pain (95% CI 0.22, 0.45). Multiracial and "Other" Canadians also have significantly lower prevalence, compared with Whites. Perhaps counter to expectations, Black Canadians also have a tendency toward lower pain frequency than White Canadians, although the differences are not statistically significant. The group with the highest point estimates for frequent pain are Indigenous Canadians, who have 31% higher prevalence than White Canadians (95% CI 1.01, 1.70). 2) Men and women have generally similar tendencies to those described for the full sample, except South Asian Canadians, where it appears that pain frequency tends to be low among men but not so much among women. 3) The inclusion of covariates across Models 2–4 does not change the racial/ethnic disparities substantially: for the most part, the point estimates and their confidence intervals change little as we add demographic and socioeconomic characteristics, as well as experienced discrimination.

Key findings for pain interference are shown in Table 4; Supplemental Tables S2a), S2b), and S2c) display the full results. Again, we highlight key patterns. 1) The results for pain interference differ from those for pain frequency. 2) Black Canadians have significantly higher prevalence of pain interference than White Canadians (prevalence ratio PR = 1.57, 95% CI 1.10, 2.25). Further, South Asian and Indigenous Canadians, especially among women, have a significantly higher prevalence compared with White Canadians. In sensitivity analyses using a higher pain threshold presented in Supplemental Table S4, generally similar patterns obtain. 3) The inclusion of covariates again does not change the racial/ethnic disparity patterns substantially.

The supplemental Tables S1a-S2c shows that although the inclusion of covariates does not "explain" the race/ethnic patterns in either pain measure, the covariates themselves are significantly associated with the outcomes. Older adults, women and people who identify using other gender such as nonbinary or two-spirit, and people born in Canada have a significantly higher prevalence than younger adults, men, and immigrants, respectively. Lower education and especially lower household income, as well, are associated with a significantly higher prevalence of both frequent and interfering pain. There is no significant difference in frequent pain between the two survey waves; interfering pain is significantly higher in 2022 compared with 2020 (PR = 1.14, 95% CI 1.01, 1.29); however, the difference is not significant net of socioeconomic characteristics included in Model 3. Finally, the experience of discrimination has a powerful association with pain: net of all the sociodemographic covariates, people who report experiencing discrimination have a 42% higher prevalence of frequent pain (95%CI 1.26, 1.61) and 49% higher prevalence of interfering pain (95% CI 1.29, 1.72), compared to those who do not experience discrimination.

Finally, we visualize the prevalence of frequent pain and interfering pain net of basic covariates (Figure 1). The figure highlights that East/Southeast Asian Canadian men and women have the lowest prevalence of frequent and interfering pain. Black Canadians have moderate frequent pain, lower than that of White Canadians, but a high prevalence of interfering pain. Indigenous Canadian men and women have the highest frequent pain, but for interfering pain this excess pain is less pronounced. The gender-stratified results emphasize several additional patterns. Overall, women's pain is higher than men's pain. Generally, the race/ethnic patterns track for both genders but among Indigenous Canadians and South Asian Canadians, women's pain is far higher than men's.

Discussion

This is the first comprehensive population-level analysis of racial/ethnic disparities in frequent and interfering pain among Canadian adults. Our analysis reveals four key findings: (1) substantial racial/ethnic disparities in pain, with the highest prevalence among Indigenous, South Asian and White Canadians; (2) complex disparity patterns that differ by pain dimension (frequent vs. interfering pain) and sometimes by gender; (3) notable gender differences in pain prevalence within some racial/ethnic groups, particularly among Indigenous and South Asian Canadians; and (4) socioeconomic factors and discrimination, while significantly associated with pain, do not explain the observed racial/ethnic disparities.

The results below describe patterns in two operationalizations of pain. Frequent pain, which captures pain experienced often to always over the 30 days prior to the survey response and may include mild, moderate, and severe or limiting pain, was reported by 28% of Canadians overall, which is within the range of similarly defined pain reported by previous studies in Canada.[36–39,60] Interfering pain, which captures the more burdensome pain that interferes with everyday activities, was reported by 21% of Canadians overall. In some cases, race/ethnic disparities were similar for both measures but there were important exceptions.

First, we find substantively large race/ethnic disparities in both pain outcomes. Frequent pain ranges from about 8% among East/Southeast Asian Canadians to 31% among White and 38% among Indigenous Canadians. Interfering pain ranges from about 14% among East/Southeast Asian Canadians up to 28% among Black and Indigenous Canadians, and almost 33% among South Asian Canadians. These sizable racial/ethnic disparities in pain are, unfortunately, not unexpected. They echo the large literature that described racial/ethnic disparities in other health outcomes and mortality in Canada.[45,47,69] Our findings also add to the literature on racial/ethnic disparities in pain in other populations.[7,13,14,17–35] Finally, they substantially expand the limited scholarship on racial/ethnic disparities in pain in Canada, which have previously been described in smaller studies, or included only select subpopulations, or only compared White and non-White adults.[44,49,51]

Second, and most importantly: the specific disparity patterns are complex. They differ between the two pain dimensions and sometimes also by gender. Moreover, it is not the case that all racialized groups have more pain than white Canadians, underscoring that analyses must be more detailed than White versus non-White[49] or White versus Black[70] comparisons as in many prior studies. For instance, the prevalence of frequent pain is particularly high among Indigenous and White Canadians, and relatively low among Black Canadians – who, however, have a high prevalence of interfering pain. There's also a sizable difference between East/Southeast Asian Canadians who have the lowest pain prevalence and South Asian Canadians with much higher levels.

As just mentioned, East/Southeast Asian Canadians have the lowest prevalence of both frequent and interfering pain of all groups. This pattern corroborates prior reports of low pain among adults of East or Southeast Asian descent, both in Canada and in the United States.[25,27,44,50,51] However, we found that only frequent pain was statistically significantly different relative to White Canadians; the apparent "advantage" was much more muted for interfering pain. We caution that less pain does not imply no pain, and East/Southeast Asian Canadians need to be included in all research and treated with the same urgency as all persons presenting with pain.[71]

Indigenous Canadians have the highest prevalence of frequent pain, and among the highest prevalence of interfering pain. This tendency corroborates prior findings pertaining to pain and other health outcomes both in Canada[41,42,44] and in the United States.[25,72,73] Our analysis adds two important nuances. First, after taking into account the Indigenous Canadians' more disadvantaged social position (lower education and income) and high level of experienced discrimination, their pain experiences are not significantly different from those of White Canadians. That is, the high pain among Indigenous Canadians may be uniquely linked to the legacy of colonialism, including ongoing economic disadvantage and discrimination. The second important point pertains to gender: Indigenous women report very high pain levels; especially for interfering pain, while Indigenous men have a more moderate prevalence, statistically on par with White Canadian men. These nuances underscore the need to move beyond descriptions of aggregate disparities to uncover the dynamics that contribute to pain inequities, paving the way for more targeted and effective interventions.

Black Canadians present an apparently paradoxical pattern: they report a relatively low prevalence of frequent pain but among the highest prevalence of interfering pain. That is, Black Canadians are less likely to state they experience pain frequently, but when they do experience pain, it tends to be severe and limiting their daily activities. This intriguing pattern has been described for Black U.S. adults[25] and another recent study also described high prevalence of severe and limiting pain among middle-aged Black adults.[74] Black Canadians may be more likely to have underlying conditions that cause flareups of particularly severe pain, such as sickle cell disease.[75] Although its prevalence is low, similar episodic conditions could contribute to the observed pain patterns. There could also be some reporting differences, whereas Black Canadians may underreport ongoing moderate pain, which could result in underestimates of our frequent pain measure. It may also be that due to continued racism in health care, Black people's pain is particularly underdiagnosed and undertreated,[11,70,76,77] resulting in a high prevalence of high-impact interfering pain.

The third important finding is that for most groups (White, Black, East/Southeast Asian, multiracial, and "other"), the race/ethnic patterns disparities to be similar in both genders. However, there are some exceptions. We already noted that among Indigenous Canadians, women report substantially more pain, especially interfering pain, than men. This is also the case for South Asian Canadians. The reasons for this gender pattern are not obvious, but a recent qualitative study examining pain in this subpopulation[40] offers some hints. South Asian Canadian women might have a particular difficulty accessing culturally sensitive health care or may carry a particularly heavy burden associated with their gender social roles.[78,79] These gendered roles may shape pain experiences through multiple mechanisms, including differences in caregiving responsibilities, stress exposure, and societal expectations surrounding pain perception, reporting, and expression.[80–82]

Fourth, beyond simply describing the disparities, this study aimed to explore possible reasons for the observed patterns. Historical inequities and continued racial prejudice and discrimination, as well as ongoing impacts of colonization on Indigenous Canadians, are considered as the root causes of racial/ethnic disparities. We thus included information about demographic and socioeconomic characteristics know to be associated with pain, including age, immigrant status, education, and household income. We also included discrimination, which is experienced unevenly by adults from different racial/ethnic groups[52,83–85] and is also a predictor of pain.[41,61,62,86] However, although these factors were significantly associated with both pain outcomes, they generally had only a muted effect on the racial/ethnic *disparities*. We urge further research on the reasons for this unexpected finding, as it suggests that our measures were suboptimal for the context or that other critical underlying factors driving the observed pain disparities were not included in our analysis. This is particularly the case for experienced discrimination, which did not specifically address discrimination due to race/ethnicity and thus may be a poor covariate to explain race/ethnic disparities.

This study has several strengths. It provides a comprehensive analysis of pain disparities across multiple racial/ethnic groups. The inclusion of both frequent and interfering pain as distinct dimensions offers a nuanced understanding of pain burden. Additionally, by accounting for socioeconomic status and discrimination, the study allows for a deeper exploration of potential explanatory factors contributing to these disparities.

However, reliability and generalizability of our findings are limited by several weaknesses in the data and pertaining to our variables. The data were collected in 2020 and in 2022 during the COVID-19 pandemic. Although the pandemic undoubtedly had a profound impact on Canadians' health including pain, it's not obvious how it would impact the observed race/ethnic pain disparities. Prior research has demonstrated that the pandemic exacerbated preexisting health disparities and increased the barriers to health care, all of which could increase pain disparities. Interestingly, two studies in the United States[34,87] and one with international focus[88] found that pain did not increase during the pandemic; however, it will be critical to continue monitoring pain in the Canadian population postpandemic.

Several other data limitations present the potential for bias in our results. The survey was not designed to be representative of the population with respect to race or ethnicity and it had a low response rate. As such, our prevalence estimates may not have the precision of a fully nationally representative survey. In addition, it was administered online, and it was offered only in English and French. These factors might have excluded individuals without reliable access to the internet or an e-mail account, and those with poor command of official languages. These limitations could cause underrepresentation of certain populations, such as new immigrants, those experiencing socioeconomic disadvantages, or those residing in remote areas with limited internet access.

We also acknowledge that defining and analyzing broad social groups such as "East/Southeast Asian Canadians" obscures important complexities and diversity within these groups.[4] This is especially relevant the "other" group, which is tremendously heterogeneous and includes people with West Asian, Central or South American and many other places of descent or origin, as well as multiracial adults, who also comprise an extremely heterogeneous group. We could not resolve this limitation analytically due to the small sample sizes. Finally, our pain measures were asked using a 30-day time frame, which prevents us from directly comparing our results with those for chronic pain, typically assessed with respect to prior three months. Future work should include a larger data or with oversamples of race/ethnic respondents, formulate pain questions identically to those in leading national surveys, and provide a more inclusive sampling methods, such as offering surveys in multiple languages and utilizing alternative distribution strategies to reach digitally underserved populations.

Conclusion

Despite these limitations, our findings substantially expand the literature on pain disparities in the Canadian population. The data revealed large differences in pain for adults from different population groups. Indigenous, Black, and South Asian Canadians' high pain prevalence indicates an urgent need for further research. By recognizing and addressing these disparities, health care professionals and policymakers can work toward more effective and equitable pain management, as well as improved well-being for people across all racial and ethnic backgrounds.

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