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Social determinants of self-reported health for Canada's indigenous peoples: a public health approach

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ABSTRACT

Objective: In Canada, indigenous peoples suffer from a multitude of health disparities. To better understand these disparities, this study aims to examine the social determinants of self-reported health for indigenous peoples in Canada.
Study design: This study uses data from Statistics Canada's Aboriginal Peoples Survey 2012.
Methods: Multinomial logistic regression models were used to examine how selected social determinants of health are associated with self-reported health among off-reserve First Nations and Métis peoples in Canada.
Results: Our analysis shows that being older, female, and living in urban settings were significantly associated with negative ratings of self-reported health status among the indigenous respondents. Additionally, we found that higher income and levels of education were strongly and significantly associated with positive ratings of self-reported health status. Compared with indigenous peoples with an education level of grade 8 or lower, respondents with higher education were 10 times (5.35–22.48) more likely to report 'excellent' and 'very good' health. Respondents who earned more than $40,000 annually were three times (2.17–4.72) more likely to report 'excellent' and 'very good' health compared with those who earned less than $20,000 annually. When interacted with income, we also found that volunteering in the community is associated with better self-reported health.
Conclusions: There are known protective determinants (income and education) and risk determinants (location of residence, gender, and age) which are associated with self-reported health status among off-reserve First Nations and Métis peoples. For indigenous-specific determinants, volunteering in the community appears to be associated with self-perceived health status. Thus, addressing these determinants will be necessary to

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achieve better health outcomes for indigenous peoples in Canada. Next steps include developing indigenous-specific social determinants of health indicators that adequately measure culture, connection, and community.

Introduction

Owing to the ongoing and long-lasting effects of colonialism, indigenous peoples, namely the First Nations, Inuit, and Métis peoples living within the boundaries of present-day Canada,[1,2] suffer from a multitude of health disparities when compared with their non-indigenous counterparts.[3–10] One framework developed to effectively meet the health needs of individuals and populations, including indigenous peoples, is the social determinants of health.[11] These determinants include factors such as education, employment, gender, and income,[12] and serve to broaden the conceptualization of health beyond the physical realm emphasized by the biomedical health approach. Importantly, this broadening conceptualizes health in a way that is complementary to the indigenous worldview of health, which situates the human body and health within the overlap between the physical, spiritual, mental, and emotional realms of being.[12,13] The social determinants of health framework are increasingly being integrated into practice at both the frontline and policy levels.

There are documented health and socio-economic disparities between indigenous and non-indigenous peoples, including lower life expectancies, higher rates of chronic health conditions, higher rates of incarceration, and an increased likelihood of experiencing poverty.[14–16] Another notable disparity is the income gap. In 2010, the median after-tax income for indigenous peoples was $20,060, while non-indigenous peoples earned $27,622.[17] This gap is thought to be reflective of the differences in educational attainment and employment opportunities for indigenous peoples. In terms of educational attainment, the rate of indigenous peoples who have not attained a secondary school diploma (32%) is double the rate for the non-indigenous population (15%).[18] A similar trend is observed when considering employment: in 2006, the mean employment rate for indigenous peoples was 57% compared with 62% for non-indigenous peoples. This employment disparity has worsened over time.[19] These disparities bring to light the diverse ways socio-economic determinants affect health through their interplay with factors such as housing and living conditions, food security, and engagement in healthy behaviors.[20–22] The present study will focus on understanding how the health of indigenous peoples in Canada, specifically off-reserve First Nations and Métis peoples, are affected by the social determinants of health.

To better understand how the health of indigenous peoples is affected by the social determinants, we use self-reported health as a measure of the population's health status. This commonly used proxy is thought to be a valid estimate of health status for indigenous populations due to the variable's ability to incorporate the physical, mental, spiritual, and emotional dimensions of health.[23] Self-reported health has been found to be predictive of psychological and physiological functioning,[3,24,25] morbidity and mortality,[26–31] health behaviors,[3] and use of health services,[32–34] in addition to being highly correlated with physician assessments of patient health.[35,36] Owing to the self-reported health variable's role in predicting biological and behavioral aspects of health, an improved understanding of the social determinants of self-reported health for indigenous peoples could better inform culturally specific health programming and service delivery.

This study also includes volunteering in the community as a proxy for connection to community as an indigenous-specific determinant of health. To explain, health in an indigenous cultural context is not specific to an individual but is understood as an individual in relation to their community.[37] Owen refers to "'self in a community', with its history, culture, and social relations".[38] This proxy for community integration is appropriate because previous research has found its positive interaction with self-reported health, positive health outcomes, and reduced mortality risk among both indigenous and non-indigenous populations.[37,39–42] The link between connection to community and connection to indigenous culture can also be made in this context. Not only is community central to the indigenous worldview but also connection to culture depends on multiple factors, including connection to elders and opportunities for cultural expression, both of which may be promoted with better community integration.[43]

The present study aims to examine the role of the social determinants on self-reported health for off-reserve First Nations and Métis peoples using data from Statistics Canada's Aboriginal Peoples Survey (APS) 2012.[44] On-reserve First Nations respondents were not captured in the APS, and the social determinants of Inuit self-reported health have been reported elsewhere and so were not included in this study.[45] Health disparities between indigenous and non-indigenous peoples in Canada have been previously well reported.[3–10] However, there has been little research into factors affecting self-reported health in off-reserve indigenous peoples in Canada. This study aims to address this research gap.

Methods

The Aboriginal Peoples Survey 2012

This study used data from the APS 2012, a Canada-wide voluntary survey conducted by Statistics Canada that collects data from First Nations peoples living off-reserve, Métis, and Inuit peoples.[44] The APS is conducted every 5 years with indigenous peoples aged 6 years and older included in the

survey. Income information is collected for respondents 15 years and older. The APS collects data on education, employment, income, health, housing, and participation in extracurricular and cultural activities. Analysis of these data can contribute to efforts aimed at improving the health and well-being of indigenous people in Canada.[39] While the survey uses the term aboriginal, we will be using the preferred term indigenous throughout this article.

Sampling strategy

The APS is a cross-sectional survey that selects its sample from respondents who answered 'yes' to the indigenous self-identifying questions in Statistics Canada's 2011 Canadian National Household Survey (NHS) questionnaire. The NHS identified approximately 1.4 million people who self-reported indigenous identity in 2011, which represents 4.3% of all Canadians.[45] Almost half of respondents with Registered Indian Status live on reserve (49.3%), making them ineligible to participate in the APS.[46] Of the 50,000 individuals invited to participate in the APS 2012, approximately 38,150 individuals completed the APS questionnaire, with a response rate of 76%. Excluding approximately 9740 non-indigenous respondents, a total of 28,410 indigenous respondents were included in the data set.

The target population was stratified according to domains of estimation, which correspond to geographical regions for which estimates were within an acceptable level of precision for a particular indigenous group (i.e. First Nations, Métis, or Inuit) and particular targeted demographic characteristics. The domains of estimation stratification allowed for allocation of participant weights. A weight is associated with each selected person to indicate the number of persons that he or she represents within the total population. Survey weights, provided by Statistics Canada, were used to account for oversampling.[44] With weighting applied, there are 681,275 participants based on the 28,410 survey responses.

Ethical considerations

All data were retrieved from a public use microdata file compiled by Statistics Canada and accessed through the University of Saskatchewan library portal. Statistics Canada followed proper research ethics protocols.

Dependent variable of interest

Our outcome of interest, self-reported health status, was derived from one question in which respondents ranked their general health as 'poor', 'fair', 'good', 'very good', or 'excellent'. Other response options, including 'do not know', 'refuse to answer', and 'not stated,' were omitted from the analysis. In the multinomial regression, self-reported health status was categorized into the following three groups: (1) 'poor' and 'fair' (weighted $n = 150,506$); (2) 'good' (weighted $n = 201,150$); and (3) 'very good' and 'excellent' (weighted $n = 329,618$).

Independent variables of interest

Potential determinants of self-reported health among indigenous peoples were identified a priori based on a scan of the relevant literature [3,18] and selected from the APS 2012. These variables include age (19–24 years, 25–34 years, 35–44 years, 45–54 years, or 55 years and older); sex (male or female); location of residence (a 'census metropolitan area [CMA]') with a population of 100,000 or more, an 'other population center' with a population of 1000 to 99,000, and an 'other rural center' which has a population below 1000 and a population density below 400 persons per square kilometer); education (having completed grade 8 or equivalent, some secondary education, secondary school diploma or equivalent, some postsecondary education, postsecondary certificate or diploma below bachelor's degree, bachelor's degree or university certificate/diploma/degree above bachelor's level); income (less than $20,000 per year, $20,000 to $40,000 per year, more than $40,000 per year); and volunteering in the community (yes or no) as a proxy measure of connection to community and by extension culture.

Statistical analysis

In all analyses, participant responses were weighted according to their assigned survey weight in the public use microdata file. Any participants with missing values in any variable of interest were excluded. Analyses were conducted in Stata, version 14. To test assumptions, collinearity between independent variables was tested using the variance inflation factor (VIF). As the VIF for each independent variable was below 2.5, the assumption of linearity was satisfied and multinomial logistic regression was used. Independent variables were included in the multivariate model based on their univariate association with self-reported health at a significant level of $P < 0.05$. The interaction term between volunteering in the community and other independent variables was checked before its inclusion in the multivariate analysis.

Results

Sample characteristics

In total, there were 681,275 weighted valid responses. With weighting applied, a greater proportion of participants (48.83%) were in the 'excellent' and 'very good' self-reported health group compared with both the 'good' self-reported health group (29.53%) and the 'fair' and 'poor' self-reported health group (22.09%). The majority of the sample lived in urban centers (CMA = 52.35%) and made less than $20,000 annually (38.77%). All univariate analyses, with the exception of volunteering in the community, were significant ($P < 0.001$). In light of this finding, we included an interaction term between volunteering in the community and income in the multivariate analysis (Table 1).

Association of social determinants with self-reported health

A multinomial regression model was used to estimate the association between self-reported health and social determinants of health among indigenous respondents. Relative risk ratios (RRRs) for this model are detailed in Table 2. All the independent variables of interest are significantly associated

Table 1 – Results of descriptive analysis and univariate relative risk ratios (RRRs) for each independent variable and self-reported health (dependent variable), along with the observed distributions of variable.

Characteristics	Total (%)	Fair and poor = 1 N (%)	Good = 2 N (%)	Excellent and very good = 3 N (%)	RRR 2 vs 1	P value	RRR 3 vs 1	P value
Volunteering in community								
No	55.19	31,769 (8.68)	62,314 (17.2)	106,856 (29.19)				
Yes	44.81	24,821 (6.78)	45,555 (12.44)	94,812 (25.90)	0.93 (0.74–1.16)	0.551	1.13 (0.92–1.39)	0.232
Total personal income								
<$20,000	38.77	82,960 (12.97)	72,750 (11.38)	92,129 (14.41)				
$20,000–$39,999	26.96	34,817 (5.44)	51,864 (8.11)	85,954 (13.44)	1.69 (1.38–2.08)	<0.001	2.20 (1.83–2.68)	<0.001
$40,000 and more	34.27	22,387 (3.50)	62,777 (9.82)	133,864 (20.93)	3.19 (2.60–3.92)	<0.001	5.38 (4.45–6.50)	<0.001
Location								
Census metropolitan area	52.35	77,867 (12.01)	95,480 (14.72)	166,551 (25,68)				
Other population	28.39	41,293 (6.37)	55,029 (8.49)	87,870 (13.55)	1.08 (0.89–1.31)	0.393	0.99 (0.83–1.18)	0.951
Rural center	19.26	24,869 (3.84)	38,012 (5.86)	61,494 (9.48)	1.24 (1.00–1.55)	<0.05	1.15 (0.94–1.41)	1.425
Age group								
19–24	14.55	10,904 (1.60)	28,055 (4.12)	58,642 (8.61)				
25–34	20.08	19,844 (2.91)	40,660 (5.97)	73,869 (10.84)	0.79 (0.59–1.06)	0.122	0.69 (0.52–0.90)	<0.01
35–44	20.85	26,777 (3.93)	41,936 (6.16)	72,072 (10.58)	0.60 (0.46–0.80)	<0.001	0.50 (0.38–0.64)	<0.001
45–54	20.58	36,693 (5.39)	41,660 (6.12)	65,203 (9.57)	0.44 (0.32–0.59)	<0.001	0.33 (0.25–0.43)	<0.001
55 or older	23.93	56,286 (8.26)	48,837 (7.17)	59,830 (8.78)	0.33 (0.25–0.44)	<0.001	0.19 (0.15–0.23)	<0.001
Education								
Grade 8 or lower	7.54	22,828 (3.41)	15,325 (2.29)	12,265 (1.83)				
Some secondary education	16.66	31,648 (4.73)	37,447 (5.59)	40,676 (6.07)	1.76 (1.34–2.31)	<0.001	2.39 (1.82–3.14)	<0.001
Secondary school diploma	15.86	21,233 (3.17)	31,043 (4.64)	53,626 (8.01)	2.17 (1.60–2.93)	<0.001	4.70 (3.49–6.31)	<0.001
Some postsecondary	15.59	23,113 (3.45)	30,004 (4.48)	51,388 (7.67)	1.93 (1.42–2.61)	<0.001	4.13 (3.08–5.54)	<0.001
Postsecondary certificate/diploma below bachelor	34.34	43,529 (6.50)	65,459 (9.78)	122,595 (18.30)	2.24 (1.72–2.90)	<0.001	5.24 (4.05–6.78)	<0.001
Bachelor degree or diploma above bachelor level	10.02	61,902 (9.24)	17,364 (6.65)	44,537 (6.65)	4.59 (3.10–6.81)	<0.001	14.73 (10.19–21.28)	<0.001
Sex								
Male	45	58,081 (8.53)	90,483 (13.28)	156,674 (23.00)				
Female	55	92,425 (13,57)	110,666 (16.24)	172,994 (25,39)	0.76 (0.65–0.90)	<0.01	0.69 (0.59–0.80)	<0.001

Table 2 – Relative risk ratio (RRR) of variables associated with self-reported health for aboriginal people using multinomial regression.

Variables	Excellent and very good vs fair and poor health		Good vs fair and poor health	
	RRR	P	RRR	P
Total personal income				
<$20,000	1		1	
$20,000–$39,999	1.94 (1.37–2.74)	<0.001	1.45 (1.00–2.09)	<0.05
$40,000 and more	3.20 (2.17–4.72)	<0.001	1.67 (1.11–2.53)	<0.01
Location				
Census metropolitan area	1		1	
Other population	1.18 (0.91–1.51)	0.172	1.09 (0.83–1.42)	0.50
Rural center	1.58 (1.16–2.15)	<0.01	1.57 (1.13–2.19)	<0.01
Age group				
19–24	1		1	
25–34	0.46 (0.31–0.68)	<0.001	0.67 (0.44–1.03)	0.072
35–44	0.23 (0.15–0.35)	<0.001	0.37 (0.27–0.52)	<0.001
45–54	0.21 (0.13–0.32)	<0.001	0.41 (0.26–0.65)	<0.001
55 or older	0.15 (0.10–0.23)	<0.001	0.30 (0.19–0.46)	<0.001
Education				
Grade 8 or lower	1		1	
Some secondary education	1.68 (0.93–3.05)	0.071	2.04 (1.12–3.72)	<0.01
Secondary school diploma	3.25 (1.77–5.94)	<0.001	3.27 (1.73–6.15)	<0.001
Some postsecondary	2.59 (1.42–4.71)	<0.001	2.18 (1.17–4.06)	<0.01
Postsecondary certificate/diploma below bachelor	3.65 (2.05–6.47)	<0.001	2.64 (1.46–4.76)	<0.001
Bachelor degree or diploma above bachelor level	10.97 (5.35–22.48)	<0.001	5.18 (2.42–11.10)	<0.001
Sex				
Male	1		1	
Female	0.64 (0.51–0.81)	<0.001	0.75 (0.58–0.95)	0.101
Volunteering in community * Income				
Yes*$20,000–$39,999	0.84 (0.49–1.45)	0.548	0.94 (0.53–1.64)	0.983
Yes*$40,000 and more	1.38 (1.01–2.57)	0.065	1.79 (1.00–3.22)	<0.05

with self-reported health status with the exception of the 'other population center' location category.

Age

Among indigenous peoples, there is a strong negative association between increasing age and self-reported health. Indigenous peoples 55 years or older were 0.15 (0.10–0.23) times less likely to perceive their health as 'excellent' or 'very good' vs 'poor' or 'fair' compared with indigenous peoples aged 19–24 years. Similarly, indigenous people aged 25–34, 35–44, and 45–54 years were 0.46 (0.31–0.68), 0.23 (0.15–035), and 0.21 (0.13–0.32) times less likely to perceive their health as 'excellent' or 'very good' vs 'poor' or 'fair' compared with indigenous people aged 19–24 years. In sum, compared with 19- to 24-year-olds, all other age groups were less likely to report 'excellent' or 'very good' health vs 'poor' or 'fair' health.

Sex

In comparison to male respondents, female respondents were 0.64 (0.51–0.81) times less likely to report 'excellent' and 'very good' health vs 'poor' and 'fair' health and were 0.75 (0.58–0.95) times less likely to report 'good' health vs 'poor' and 'fair' health than their male counterparts. Taken together, these results suggest that indigenous females are more likely to perceive their health less positively than indigenous males.

Location

Overall, indigenous peoples living in rural locations are more likely than individuals living in larger urban centers to perceive their health positively. More specifically, indigenous peoples living in rural locations were 1.58 (1.16–2.15) times more likely to report 'excellent' and 'very good' health vs 'poor' and 'fair' health and were 1.57 (1.13–2.19) times more likely to report 'good' health vs 'poor' and 'fair' health than indigenous peoples living in CMAs. There was no significant difference in self-reported health when comparing indigenous peoples in other population centers and those in CMAs, meaning that these locations had no bearing on how an indigenous person reported his/her health.

Education

The strongest association in the analysis was found between self-reported health and high educational attainment. Compared with indigenous peoples with a grade 8 education or lower, people with an education attainment of bachelor's degree or university certificate/diploma/degree above bachelor's level were 10.97 (5.35–22.48) times more likely to report 'excellent' and 'very good' health vs 'poor' and 'fair' health and were 5.18 (2.42–11.10) times more likely to report 'excellent' and 'very good' health vs 'good' health. A similar trend to a lesser magnitude is observed when comparing the likelihood of indigenous peoples with an educational attainment of

grade 8 or lower to those with some secondary education reporting 'excellent' and 'very good' health vs 'poor' and 'fair' health (RRR = 1.68; 95% confidence interval [CI] 0.93–3.05) and reporting 'good' health vs 'poor' and 'fair' health (RRR = 2.04; 95% CI 1.12–3.72).

Income

Indigenous peoples who earned more than $40,000 annually were 3.20 (2.17–4.72) times more likely to report 'excellent' and 'very good' health vs 'poor' and 'fair' health compared with those who earned less than $20,000 annually. Conversely, indigenous peoples who earned between $20,000 to $40,00 annually were 1.94 (1.37–2.74) times as likely to report 'excellent' and 'very good' health vs 'poor' and 'fair' health compared with those who earned less than $20,000 each year. The likelihood of reporting 'good' health vs 'poor' and 'fair' health was similar when comparing both those who earned more than $40,000 annually (1.45 [1.00–2.09]) and those who earned between $20,000 to $40,000 annually (1.67 (1.11–2.53)) with those who earned less than $20,000 annually. In sum, higher income was associated with an increased likelihood of positive self-reported health status.

Culture and volunteering

Consideration of the interaction term between volunteering in the community and income indicates a significant association with self-reported health. Indigenous peoples who earned more than $40,000 annually and volunteered in the community were 1.38 (1.01–2.57) times more likely to report 'excellent' and 'very good' health vs 'poor' and 'fair' health and 1.79 (1.00–3.22) times more likely to report 'good' health vs 'poor' and 'fair' health compared with those who made less than $20,000 annually and did not volunteer in the community.

Discussion

Analysis of the APS 2012 is consistent with what is known about protective determinants, including income and education, and risk determinants, including location of residence, gender, and age, on self-reported health status among off-reserve First Nations and Métis peoples in Canada. This study also adds to the limited body of literature examining the interaction between connection to community (and we propose by extension connection to culture) and self-reported health status of indigenous peoples.

Previous studies examining the relationship among income, education, and self-reported health status have revealed an association between lower incomes and/or levels of education and poorer health outcomes,[17,18] a trend also observed in the present study. That is, as annual income or level of education increases, indigenous peoples are more likely to report 'excellent', 'very good' or 'good' health vs 'poor' or 'fair' health. Observation of this trend is unsurprising, given the expanse of literature that has linked measures of income and education to both biological and behavioral aspects of health. For example, Canadians with lower incomes and levels of education visit medical specialists less often than those with moderate or high income and higher levels of education.[47] This finding highlights how low-income earners and less educated individuals have a reduced ability to access and benefit from health services and consequently, have a less positive perception of their health. Unfortunately, it is likely that this ability is further reduced among indigenous peoples in Canada because of additional barriers to access health care, including the continuing effects of colonialism often present in discriminatory policies and practices;[48] mistrust of government officials and health professionals;[49,50] sensitivity to the unbalanced power dynamics of the physician–patient relationship;[48] and experiences with providers and organizations lacking culturally competent approaches to health.[51]

Interestingly, the association between location of residence and self-reported health status for off-reserve First Nations and Métis peoples showcases the opposite trend compared with the general population.[52–54] Indigenous peoples living in rural locations are more likely to report a positive rating of self-reported health compared with those who live in more urban areas. On first glance, this trend seems counterintuitive, especially when considering the reduced accessibility to health services in rural settings across Canada.[55,56] On closer inspection, residing in rural locations may benefit off-reserve First Nations and Métis peoples because the environment may be more consistent with traditional indigenous lifestyles,[57] and individuals living in rural regions are more likely to have a positive and strong sense of belonging and community.[58] Previous studies have suggested that residing in rural locations may foster indigenous peoples' connection to the land, which serves as a spiritual base for many indigenous peoples, links individuals to their community, and plays a supportive role in the determination of health and well-being.[59] This contrasts indigenous peoples' experiences in urban areas, which are frequently characterized by residential instability,[9] substandard living conditions,[60] and the inaccessibility of traditional activities.[39]

Notably, findings from this study provide a unique perspective on the interaction among income, connection to community, and self-reported health for indigenous peoples. The present study indicates that a baseline level of income per annum (at least $40,000) is necessary in order for additional factors, such as connection to community, to positively affect an indigenous person's self-reported health. This trend may be explained by the concept of social capital, which postulates that individuals who are connected with community are better able to foster a sense of community, promote cultural identity, and practice self-determination.[61] Thus, addressing the income gap observed between indigenous peoples and non-indigenous peoples in Canada will be necessary to better understand the real and reported health outcomes for indigenous peoples.[4] Current efforts to narrow this gap, including the provision of income assistance and community development initiatives, must be supplemented with strategies that seek to more effectively address the broader barriers affecting income, including job market discrimination and loss of sovereignty.[4]

The results of this study have several implications. First, because better self-reported health is associated with connection to community and linked to the social determinants of health, the present study's findings support and extend the call for greater consideration of an indigenous worldview when integrating public health concepts, such as the social determinants of health, into practice.[62] An indigenous worldview is an intimate belief system informed by an

individual's identity, understanding of ancestral and sacred knowledge, and engagement with traditional practice.[63,64] Despite the increasing application of more holistic public health approaches to health programming and service delivery, these approaches may not be applicable to indigenous peoples if an indigenous worldview is not specifically accounted for.[65,66] There is a need to better incorporate indigenous-specific determinants of health in public health policy and approaches to health, such as those determinants proposed by the Four Worlds Institute which include spirituality and a sense of purpose; cultural integrity and identity; adequate power; social justice and equity; and community solidarity and social supports.[67] The work of scholars such as reading likewise identify determinants specific to indigenous frameworks, including relationship with the land, language and ceremony, and kinship networks.[68] Inclusion of determinants of health and well-being framework that considers and incorporates indigenous-specific determinants and a broader conceptualization of health and wellness is an important step forward for addressing health disparities and/or inequities that affect this group.[37,69] However, before such a step can be taken, the discrepancy between indigenous-specific determinants and the current determinants of health framework being used to inform health policy, programming, and services must be rectified. This step should include embracing strength-based protective factors rooted in culture[37] and should be sufficiently flexible to account for differences between indigenous nations and peoples.[70]

Limitations

This study has three main limitations. First, the results of this study are limited to First Nations peoples living off-reserve and Métis peoples. First Nations people living on reserve and single-identity Inuit peoples were excluded from the analysis. Therefore, caution should be taken when extending the implications of these results. Second, these results are based on responses from the APS 2012. While this questionnaire followed a rigorous study methodology, survey responses may be subject to biases, such as self-reporting bias. Although many studies confirmed the validity of self-reported general health specifically in chronic condition and disease, the reliability of this measure may be vulnerable to several biasing factors.[71] Finally, interpretation of the role connection to community, and by extension possibly culture, that plays on the self-reported health of indigenous peoples is limited by the questions included in the APS 2012. Variables that appeared to directly test culturally activity and its association with health were not significant and thus, were excluded from our analysis. However, this may be a consequence of the Western framing of survey questions, which may or may not adequately capture the meaning of the connection to community and culture.[39]

Conclusions

This study adds to the body of literature by emphasizing the relevance of social determinants of health approach to indigenous peoples in Canada. Moreover, the effects of the social determinants of health are even more pronounced for indigenous peoples as evidenced by the very strong and significant associations between higher income and education with self-reported health.

However, the study also supports a public health framework that includes indigenous-specific determinants of health. Therefore, inclusion of measures to support indigenous peoples' conceptualization of health and well-being, including connection with community and culture, is important for reducing real and reported health disparities in this population. Indigenous community leaders, researchers, and policy-makers may help reduce health disparities by investing in public health and community-based activities that recognize and make use of indigenous-specific determinants in a culturally specific way.

Author statements

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Ethical approval

All data were retrieved from a public use microdata file compiled by Statistics Canada and accessed through the University of Saskatchewan library portal. Statistics Canada followed proper research ethics protocols.

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Competing interests

None declared.

REFERENCES

1. Foundations I. *Aboriginal identify and terminology*. Vancouver: British Columbia; 2009.
2. Statistics Canada. *Aboriginal identity of person [Internet]*. Statistics Canada; 2015. Available from: http://www23.statcan.gc.ca/imdb/p3Var.pl?Function=DECI&Id=59224.
3. Dowd JB, Zajacova A. Does self-rated health mean the same thing across socioeconomic groups? Evidence from biomarker data. *Ann Epidemiol* 2010;**20**(10):743–9.
4. Adelson N. The embodiment of inequity: health disparities in Aboriginal Canada. *Can J Public Health* 2005;**96**.
5. De Leeuw S, Greenwood M, CE. Deviant constructions: how governments preserve colonial narratives of addictions and poor mental health to intervene into the lives of Indigenous children and families in Canada. *Int J Ment Health Addiction* 2010;**8**(2):282. 1.
6. Gracey M, King M. Indigenous health part 1: determinants and disease patterns. *Lancet* 2009;**374**:65–75.
7. Health Canada. *A statistical profile of the health of first nations in Canada: determinants of health, 1999 to 2003 [Internet]*. Ottawa, ON, Canada: Health Canada; 2009. p. 1–63. Available from: http://www.hc-sc.gc.ca/fniah-spnia/pubs/aborig-autoch/index-eng.php.

8. La Ronge SK, QB. *Northern saskatchewan health indicators report 2011*. 2011. La Ronge, Saskatchewan.
9. King M, Smith A, Gracey M. Indigenous health part 2: the underlying causes of the health gap. *Lancet* 2009;**374**:76–85.
10. Stephens C, Porter J, Nettleton C, Willis R. Disappearing, displaced, and undervalued: a call to action for Indigenous health worldwide. *Lancet* 2006;**367**:2019–28.
11. Nesdole R, Voigts D, Lepnurm R, Roberts R. Reconceptualizing determinants of health: barriers to improving the health status of First Nations peoples. *Can J Public Health* 2014;**105**(3).
12. Rootman I, Pederson A, Dupéré S, OM. *Health promotion in Canada: critical perspectives on practice*. Canadian Scholars' Press Inc; 2012.
13. Bell N. *Teaching by the medicine wheel: an Anishinaabe framework for Indigenous education [Internet]*. 2016. Available from: http://www.cea-ace.ca/education-canada/article/teaching-medicine-wheel.
14. Jozaghi E, Jackson A. Examining the potential role of a supervised injection facility in Saskatoon, Saskatchewan, to avert HIV among people who inject drugs. *Int J Health Pol Manag* 2015;**4**(6):373–9.
15. Monette LE, Rourke SB, Gibson K, Bekele TM, Tucker R, Greene S, et al. Inequalities in determinants of health among aboriginal and Caucasian persons living with HIV/AIDS in Ontario: results from the positive Spaces, healthy Places study. *Can J Public Health* 2011;**102**(3):21.
16. Kolahdooz F, Nader F, Yi KJ, Sharma S. Understanding the social determinants of health among Indigenous Canadians: Priorities for health promotion policies and actions. *Glob Health Action* 2015;**8**(1).
17. Statistics Canada. *Median after-tax income. Government of Canada [Internet]*. 2015. Available from: http://www.statcan.ogc.ca/pub/89-645-x/2015001/income-revenu-eng.htm.
18. Macdonald D, WD. *The income gap between aboriginal peoples and the rest of Canada. Canadian centre for policy Alternatives*. 2010.
19. Statistics Canada. *Aboriginal peoples [Internet]*. 2016. Available from: http://www.statcan.gc.ca/pub/11-402-x/2011000/chap/ap-pa-eng.htm.
20. Mikkonen J, Raphael D. Social determinants of health: the canadian Facts. *The Canadian Facts* 2010:62.
21. Frohlich KL, Ross N, Richmond C. Health disparities in Canada today: some evidence and a theoretical framework. *Health Pol* 2006;**79**:132–43.
22. OCDE. *Growing Unequal?: income distribution and poverty in OECD countries. Distribution [Internet]*. 2008. p. 1–7. Available from: http://www.oecd-ilibrary.org/social-issues-migration-health/growing-unequal_9789264044197-en.
23. Authority FNH. *Traditional wellness strategic framework*. 2014.
24. Menec VH, Chipperfield JG. The interactive effect of perceived control and functional status on health and mortality among young-old and old-old adults. *J Gerontol B Psychol Sci Soc Sci* 1997;**52**(3):P118–26.
25. Roos E, Lahelma E, Saastamoinen P, Elstad J-I. The association of employment status and family status with health among women and men in four Nordic countries. *Scand J Public Health [Internet]* 2005;**33**(4):250–60. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16087487.
26. Idler EL, Kasl S. Health perceptions and survival: do global evaluations of health status really Predict mortality? *J Gerontol* 1991;**46**(2):S55–65.
27. Kaplan GA, Goldberg DE, Everson SA, Cohen RD, Salonen R, Tuomilehto J, et al. Perceived health status and morbidity and mortality: evidence from the Kuopio ischaemic heart disease risk factor study. *Int J Epidemiol* 1996;**25**(2):259–65.
28. Ferraro KF, Kelley-Moore JA. Self-rated health and mortality among black and white adults: examining the dynamic evaluation thesis. *J Gerontol B Psychol Sci Soc Sci [Internet]* 2001;**56**(4):S195–205. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11445612.
29. Ferraro KF, Farmer MM, Wybraniec JA. Health trajectories: long-term dynamics among black and white adults. *J Health Soc Behav [Internet]* 1997;**38**(1):38–54. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9097507.
30. Ganna A, Ingelsson E. 5 year mortality predictors in 498 103 UK Biobank participants: a prospective population-based study. *Lancet* 2015;**386**(9993):533–40.
31. Stenholm S, Kivimäki M, Jylhä M, Kawachi I, Westerlund H, Pentti J, et al. Trajectories of self-rated health in the last 15 years of life by cause of death. *Eur J Epidemiol* 2015:177–85.
32. Miilunpalo S, Vuori I, Oja P, Pasanen M, Urponen H. Self-rated health status as a health measure: the predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *J Clin Epidemiol* 1997;**50**(5):517–28.
33. Weinberger M, Darnell JC, Tierney WM, Martz BL, Hiner SL, Barker J, et al. Self-rated health as a predictor of hospital admission and nursing home placement in elderly public housing tenants. *Am J Public Health* 1986;**76**(4):457–9.
34. Best R, Souders DJ, Charness N, Mitzner TL, Rogers WA. The role of health status in older adults' perceptions of the usefulness of eHealth technology. *Lect Notes Comput Sci* 2015;**9194**.
35. LaRue A, Bank L, Jarvik L, Hetland M. Health in old age: how do physicians' ratings and self-ratings compare? *Journals Gerontol* 1979;**34**(5):687–91.
36. Brown TN, Turner RJ, Moore TR. The multidimensionality of health: associations between allostatic load and self-report health measures in a community epidemiologic study. *Heal Sociol Rev*. 2016;**25**(3):272–87.
37. McKenzie HA, Dell CA, Fornssler B. Understanding addictions among indigenous people through social determinants of health frameworks and strength-based approaches: a review of the research literature from 2013 to 2016. *Curr Addict Reports* 2016;**3**(4):378–86.
38. Owen S. Walking in balance: native American recovery programmes. *Religions [Internet]* 2014;**5**(4):1037–49. Available from: http://www.mdpi.com/2077-1444/5/4/1037/.
39. Wilson K, Rosenberg MW. Exploring the determinants of health for First Nations peoples in Canada: can existing frameworks accommodate traditional activities? *Soc Sci Med* 2002;**55**(11):2017–31.
40. Ladner KL. Understanding the Impact of self-determination on communities in Crisis. *J Aborig Heal* 2009;**5**(2):88–101.
41. Jenkinson CE, Dickens AP, Jones K, Thompson-Coon J, Taylor RS, Rogers M, et al. Is volunteering a public health intervention? A systematic review and meta-analysis of the health and survival of volunteers. *BMC Publ Health* 2013;**13**:773.
42. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med* 2010;**7**.
43. Durie M, Milroy H, HE. Mental health and the Indigenous peoples of Australia and New Zealand. *Ment Heal Aborig peoples Canada* 2009;**2009**:36–55.
44. Statistics Canada. *Aboriginal peoples survey*. 2012.
45. Anderson TTA. *Assessing the social determinants of self-reported Inuit health in Inuit Nunangat*. Statistics Canada; 2012.
46. Canada S. *Aboriginal peoples in Canada: first nations people, Métis, and Inuit*. 2016.
47. Dunlop S, Coyte PC, McIsaac W. Socio-economic status and the utilisation of physicians' services: results from the canadian national population health survey. *Soc Sci Med [Internet]* 2000;**51**(1):123–33. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10817475.
48. Peiris D, Brown A, Cass A. Addressing inequities in access to quality health care for indigenous people. *C Can Med Assoc J* 2008;**179**(10):985–6.

49. Mill JE, Edwards N, Jackson RC, MacLean L, Chaw-Kant J. Stigmatization as a social control mechanism for persons living with HIV and AIDS. *Qual Health Res* 2010;**20**(11):1469–83.
50. Worthington C, Jackson R, Mill J, Prentice T, Myers T, Sommerfeldt S. HIV testing experiences of Aboriginal youth in Canada: service implications. *AIDS Care - Psychol Socio-Medical Asp AIDS/HIV* 2010;**22**(10):1269–76.
51. Barlow K, Loppie C, Jackson R, Akan M, MacLean LRG. Culturally competent service provision issues experienced by Aboriginal people living with HIV/AIDS. *Pimatisiwin* 2008;**6**(2):155.
52. Canadian Institute of Health Information. *How healthy are rural Canadians? An assessment of their health status and health determinants [Internet]*. 2006. Available from: http://www.phac-aspc.gc.ca/publicat/rural06/pdf/rural_canadians_2006_report_e.pdf.
53. Pitblado JR, Pong RW, Irvine A, Nagarajan KV, Sahai V, Zelmer J, et al. *Assessing rural health: toward developing health indicators for rural Canada*. 1999.
54. Mitura V, Bollman RD. The health of rural Canadians: a rural-urban comparison of health indicators. *Rural Small T Canada Anal Bull*. 2003;**4**(6):1–23.
55. Pitblado JR, PR. *Geographic distribution of physicians in Canada: beyond how many and where. [Internet]*. 2005. Available from: http://secure.cihi.ca/cihiweb/products/Geographic_Distribution_of_Physicians_FINAL_e.pdf.
56. Barer ML, SG. *Improving access to needed medical services in rural and remote Canadian communities: Recruitment and retention revisited. [Internet]*. Vancouver, British Columbia: Centre for Health Services and Policy Research; 1999. Available from:.
57. Place J. *The health of aboriginal people residing in urban areas*. 2012. Prince George, BC.
58. Kitchen P, Williams A, Chowhan J. Sense of community belonging and health in Canada: a regional analysis. *Soc Indic Res*. 2012;**107**(1):103–26.
59. Alaazi DA, Masuda JR, Evans J, Distasio J. Therapeutic landscapes of home: exploring indigenous peoples' experiences of a housing first intervention in Winnipeg. *Soc Sci Med* 2015;**147**:30–7.
60. Government of Canada. *The housing conditions of Aboriginal people in Canada*. 1996 (27). Report No.: 1–4.
61. Mignone J. Social capital and Aboriginal communities: a critical assessment. *J la santé Autoch* 2009:100–47.
62. Lavallee LF, Poole JM. Beyond recovery: Colonization, health and healing for indigenous people in Canada. *Int J Ment Health Addict* 2010;**8**(2):271–81.
63. Speer PW, Peterson NA, Armstead TL, Allen CT. The influence of participation, gender and organizational sense of community on psychological empowerment: the moderating effects of income. *Am J Community Psychol* 2013;**51**(1–2):103–13.
64. Friesen JW. Kaandossiwin: how We Come to know. *Can Ethn Stud* 2011;**43**(1):309.
65. Beavon D, White J, Wingert S, Maxim P. *Aboriginal policy research: Moving forward, making a difference*. 2007. Toronto, Ontario.
66. Blanchet-Cohen N, McMillan ZGM. Indigenous youth engagement in Canada' health care. Pimatisiwin A. *J Aborig Indig Community Heal* 2011;**9**(1). 87–11.
67. Bopp M, Bopp J, Lane P. *Community healing and aboriginal social security reform: a study for the assembly of First Nations aboriginal social security reform strategic initiative*. 1998. Ottawa, ON.
68. Neufeld HT. Determinants of indigenous peoples' health in Canada: beyond the social. *Can Stud Popul* 2017;**44**(1–2):10.
69. Fiedeldey-Van Dijk C, Rowan M, Dell C, Mushquash C, Hopkins C, Fornssler B, et al. Honoring indigenous culture-as-intervention: development and validity of the native wellness Assessment TM. *J Ethn Subst Abuse* 2017;**16**:181–218.
70. O'Neill A, Braz A. Introduction to about indigenous literature. *CLCWeb Comp Lit Cult* 2011;**13**(2):1.
71. Knäuper B, Turner PA. Measuring health: improving the validity of health assessments. *Qual Life Res* 2003:81–9.