Predictors of self-rated oral health in Canadian Indigenous adults

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Abstract

Objectives: The purpose of this study was to: (1) compare oral health indicators between Indigenous adults and the general population and (2) examine the predictors of poor self-rated oral health in the Indigenous population.

Methods: Data from the 2017–2018 cycle of the Canadian Community Health Survey was used and included 943 Indigenous and 20,011 non-Indigenous adults. Independent variables included demographic information, lifestyle behaviours, dental concerns and care utilization, and transportation access. The dependent variable was self-rated oral health. A logistic regression was performed to determine predictors of poor self-rated oral health.

Results: More than half of the Indigenous sample were aged between 35 and 64 years (57.3%); 57.8% were female. Compared to the general population, the Indigenous group were significantly more likely to have no partner, have less post-secondary education, and have an income of less than $40,000. Almost a fifth of the Indigenous sample self-rated their oral health as poor (18.5%) compared to 11.5% in the general population. Indigenous participants reported significantly poorer general health, had poorer oral care practices, and lifestyle behaviours than the general population (all \( p < .001 \)). Indigenous adults having poor self-rated oral health was predicted by poorer general health, being a smoker, male, bleeding gums, persistent pain, feeling uncomfortable eating food, avoiding foods, and not seeking regular dental care.

Conclusions: There are many predictors of poor self-rated oral health, many of which are preventable. Providing culturally adapted oral health care may improve the likelihood of Indigenous adults visiting the dentist for preventative care.

Keywords: Indigenous adults, Oral health, Dental health perceptions

Introduction

Oral health is a strong indicator of overall general health and quality of life [1]. Studies have reported relationships between poor oral health with diabetes, arthritis, dementia, and cardiovascular and respiratory diseases [2]. Additionally, poor oral health can restrict activities of daily living and diminish a person’s quality of life due to pain, functional limitations (e.g., eating, talking) or psychosocial discomfort [3]. There are numerous factors that increase the risk of poor oral health such as metabolic systemic diseases, medications, radiation, poor oral hygiene, sugar rich diet, poor access to dental care, tobacco and alcohol consumption, and an individual’s perceptions of oral health [3, 4].

Perceptions of oral health play a key role in determining one’s behaviours towards oral health practices. Based on Bandura’s self-efficacy theory [5], it is possible that those who perceive oral health problems as serious or requiring intervention are more likely to engage in preventative oral health care such as routine dental visits, brushing, and flossing [5]. Conversely, those who do not perceive their oral health to be poor (despite the contrary) may not seek dental services to maintain their oral health.

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have examined the oral health of the Indigenous population. However, there has only been a few studies that have examined the oral health of the Indigenous population. Prior Canadian studies with Indigenous people show that they have poorer oral health practices (less frequency of teeth brushing or regular dental visits), a higher prevalence of dental caries and periodontal diseases, untreated tooth decay compared to the general Canadian population [11–15]. Additionally, a 2020 study by Mehra and colleagues that used data from 2014 found that Indigenous people (aged 12 and older) have poorer dental care use, and those with poorer oral health were 5.8x more likely to make emergency dental visits [16]. While all these studies include self-rated oral health as an independent variable, none has examined the factors that influence self-rated oral health as an outcome variable. Understanding the factors associated with poor self-rated oral health may provide an opportunity to devise tailored interventions needed to improve general oral health in Indigenous populations. This study seeks to (1) compare oral health indicators between Indigenous adults and the general population; and (2) examine the predictors of poor self-rated oral health in the Indigenous population.

Materials and methods

Data source
Data was analyzed using the 2017–2018 cycle of the Canadian Community Health Survey (CCHS). The CCHS is a cross-sectional survey conducted by Statistics Canada, that gathers health-related information of Canadians aged 12 years and older living in the 10 provinces and 3 territories. However, residents living on reserves, in long-term care, full-time members of Canadian Forces, children aged 12–17 living in foster care, and those living in Nunavik and Terres-Cries-de-la-Baie-James (Quebec) are excluded. Detailed methodology and sampling characteristics of the CCHS are described elsewhere [17]. The 2017–2018 CCHS is the most recent CCHS data available, released in June 2020. Data of the 2017–2018 CCHS was collected using the CCHS questionnaire designed for computer-assisted interviewing. The average time to complete the survey was 50 min and was performed in person or over the telephone. Approximately 75% of the data was collected by telephone interviews and 25% in person. The response rate for the 2017–2018 CCHS was 60.7% (187,132 individuals were contacted to participate in the survey). This study was exempt from requiring Research Ethics Board approval consistent with performing secondary data analysis on publicly available datasets.

Inclusion/exclusion criteria
Participants were included if they were Indigenous, aged 18 and older, living in Ontario, have complete data for Indigenous identification and oral health variables. Of all the provinces and territories, only Ontario participated completed questions on oral health. Indigenous participants self-identified as being First Nations with or without Indian Status, Métis or Inuit. Participants with “Indian Status” refers to a legal status providing a range of rights and benefits offered by the federal, provincial or territorial Canadian governments [18]. For comparison purposes, all non-Indigenous participants were also required to be between the ages of 18 and older and living in Ontario. The analysis excluded participants who were younger than 18 years old and those with incomplete (missing) data for any of the oral health variables examined. The final sample included 943 Indigenous and 20,011 non-Indigenous participants. The total number of participants excluded due to missing data was 2944 (164 Indigenous and 2780 non-Indigenous participants).

Independent variables
Independent variables include demographics (e.g. age, sex, marital status, education), general health, oral health, lifestyle behaviours, and access to transportation. All independent variables included in the study were categorized by Statistics Canada with further collapsing of variables conducted by the research team. For the purpose of this study, age was categorized as 18–34 years, 35–64 years, and 65 years and older. Sex was coded as female or male and marital status as “partner” (married or common law) or “no partner” (single, divorced or widowed). Education was divided into 2 categories: secondary education or less and post-secondary education. Income was coded as “less than $40,000” and “$40,000 or more” Employment status was categorized as employed or unemployed.

Health variables included self reported general and mental health which were coded as “excellent”, “very good”, “good”, “fair” and “poor” in the CCHS. These were collapsed to good (excellent, very good and good) versus poor (fair and poor). Additionally, participants reported chronic conditions using pre-defined diseases based on the CCHS survey. The conditions on the CCHS included arthritis, asthma, diabetes, effects of stroke, heart disease, high blood pressure, mood (e.g. depression, bipolar disorder, mania or dysthymia) or anxiety disorders (e.g.
phobia, obsessive-compulsive disorder, panic disorder). The presence of each chronic condition was coded as “yes” or “no”.

Oral health variables included access to types of dental insurance coverage (yes/no), dental visits for routine maintenance (yes/no) and emergency visits (yes/no), and questions on whether it was uncomfortable to eat particular foods, persistent pain, bleeding gums and bad breath, all categorized as “often”, “sometimes”, “rarely”, and “never” on the CCHS. All these variables were then dichotomized into yes (often/sometimes) and no (rarely/never) categories.

Variables on lifestyle behaviours included smoking status and alcohol consumption in the prior year. Smoking status was coded as “smoker” and “non-smoker”. Alcohol consumption was classified as being a “drinker” and “non-drinker”. Access to transportation was coded as driving a car within the last year (yes/no).

Outcome variable
The primary outcome variable was self-rated oral health. Self-rated oral health was based on the following question: “In general, would you say the health of your mouth is” 1 = excellent, 2 = very good, 3 = good, 4 = fair and 5 = poor. The variable was further collapsed to good (excellent, very good and good) and poor (fair and poor).

Statistical analysis
As all variables were categorical, frequencies and valid percent were used to describe the sample. Differences between Indigenous and non-Indigenous responses, as well as the association between independent and outcome variables were examined using Pearson chi-square tests. To account for multiple comparisons, \( p \) values were corrected by using Bonferroni correction \( p = .0016 \) for group comparisons and \( p = .0017 \) for associations between independent and dependent variables. To determine predictors of self-rated oral health, a binary logistic regression was performed providing the odds ratio (OR), adjusted odds ratio (AOR), and associated confidence intervals (all variables with \( p < .20 \) were included in the regression model). The significance level of the final model was \( p < .05 \). To account for the complex sampling design, bootstrap weights were applied and provided with the data file by Statistics Canada prior to the statistical analysis. All the analyses were conducted using SPSS (version 27).

Results
Sample characteristics
The sample included 943 Indigenous and 20,011 non-Indigenous participants. More than 50% of the Indigenous sample were between the ages of 35 and 64 years; 57.8% were female. Slightly over 50% of the Indigenous sample had no partner and approximately one third had secondary education (33.1%). About 40% were unemployed and 36% had incomes of $40,000 or less. Just over one fifth of the Indigenous sample did not have access to transportation (21.2%). Approximately 20 and 13% rated their general and mental health as being poor. Almost one fifth of the Indigenous sample reported having poor self-rated oral health.

As shown in Table 1, compared to non-Indigenous participants, the Indigenous sample was significantly older and less likely to be married, to have post-secondary education and to have income of $40,000 or greater (all \( p < .001 \)). Additionally, Indigenous adults were significantly more likely to rate their general and mental health as poor compared to non-Indigenous participants, and were more likely to report having anxiety, asthma, diabetes and mood disorders. Compared to the general population, there was a significantly greater proportion of Indigenous respondents who smoked and were regular drinkers.

Oral health
Compared to the general population, a significantly greater proportion of Indigenous adults rated their oral health as poor (18.5% vs. 11.5%). Indigenous adults, compared to the general population, were significantly more likely to report feeling uncomfortable eating foods (22% vs. 15.5%), avoiding particular foods (17.5% vs. 10.9%), having persistent pain in mouth (17.8% vs. 11.6%), bleeding gums (29.5% vs. 21.7%), bad breath (20% vs 14%), and were more likely to make emergency dental care visits (17.1% vs. 11.4%), although they were less likely to make visits to the dentist for regular maintenance (72.1% vs. 78.9%) than the general population.

Indigenous adults were significantly more likely to have dental insurance (primarily through the Non-Insured Health Benefits and social insurance) and less likely to have employer-based insurance than the general population.

Comparisons of Indigenous adults with good and poor oral health
As shown in Table 2, Indigenous adults who reported poor self-rated oral health were more likely to have a lower income and be unemployed (both \( p \leq .001 \)). Indigenous adults with poor self-rated oral health were also significantly more likely to rate their general and mental health as being poor compared to those with good self-rated oral health \( (p < .001) \). Additionally, Indigenous adults reporting a stroke, anxiety, arthritis, and mood disorders were more likely to have poor self-rated oral health (all \( p \leq .001 \)). Those rating their oral health as poor were significantly
Table 1  Comparison of socio-demographic, health and oral health factors between Indigenous and non-Indigenous people

| Variables                      | Indigenous people n = 943 | Non-Indigenous people n = 20,011 | Significance p < .0016 |
|--------------------------------|---------------------------|----------------------------------|------------------------|
| **Socio-demographic factors**  |                           |                                   |                        |
| Age                            |                           |                                   |                        |
| 18–34                          | 288 (30.5)                | 4420 (22.1)                      | p < .001               |
| 35–64                          | 540 (57.3)                | 10,160 (50.8)                    |                        |
| 65+                            | 115 (12.2)                | 5431 (27.1)                      |                        |
| Sex                            |                           |                                   |                        |
| Male                           | 398 (42.2)                | 8903 (44.5)                      | p = .168               |
| Female                         | 545 (57.8)                | 11,108 (55.5)                    |                        |
| Marital status                 |                           |                                   |                        |
| Partner (married or common law) | 433 (46.2)                | 11,022 (55.2)                    | p < .001               |
| No partner (divorced, widowed or single) | 504 (53.8)            | 8949 (44.8)                      |                        |
| Education                      |                           |                                   |                        |
| Secondary graduation or less   | 302 (33.1)                | 4685 (24)                        | p < .001               |
| Post-secondary education       | 611 (66.9)                | 14,813 (76)                      |                        |
| Income                         |                           |                                   |                        |
| Less than $40,000              | 339 (36.1)                | 4226 (21.1)                      | p < .001               |
| $40,000 or more                | 599 (63.9)                | 15,774 (78.9)                    |                        |
| Employment status              |                           |                                   |                        |
| Employed                       | 565 (59.9)                | 11,730 (58.6)                    | p = .436               |
| Unemployed                     | 378 (40.1)                | 8274 (41.4)                      |                        |
| **Health-related factors**     |                           |                                   |                        |
| Perceived general health       |                           |                                   |                        |
| Good                           | 749 (79.6)                | 17,470 (87.4)                    | p < .001               |
| Poor                           | 192 (20.4)                | 2523 (12.6)                      |                        |
| Perceived mental health        |                           |                                   |                        |
| Good                           | 816 (86.6)                | 18,234 (91.3)                    | p < .001               |
| Poor                           | 126 (13.4)                | 1742 (8.7)                       |                        |
| Anxiety disorder               |                           |                                   |                        |
| Yes                            | 191 (20.3)                | 2269 (11.4)                      | p < .001               |
| No                             | 750 (79.7)                | 17,712 (88.6)                    |                        |
| Arthritis                      |                           |                                   |                        |
| Yes                            | 251 (26.6)                | 5280 (26.5)                      | p = .896               |
| No                             | 601 (73.4)                | 14,680 (73.5)                    |                        |
| Asthma                         |                           |                                   |                        |
| Yes                            | 131 (14)                  | 1890 (9.5)                       | p < .001               |
| No                             | 808 (86)                  | 18,102 (90.5)                    |                        |
| Diabetes                       |                           |                                   |                        |
| Yes                            | 118 (12.5)                | 1735 (8.7)                       | p < .001               |
| No                             | 823 (87.5)                | 18,263 (91.3)                    |                        |
| Effects of stroke              |                           |                                   |                        |
| Yes                            | 19 (2)                    | 267 (1.3)                        | p = .077               |
| No                             | 922 (98)                  | 19,730 (98.7)                    |                        |
| Heart disease                  |                           |                                   |                        |
| Yes                            | 58 (6.2)                  | 1201 (6)                         | p = .848               |
| No                             | 881 (93.8)                | 18,734 (94)                      |                        |
| High blood pressure            |                           |                                   |                        |
| Yes                            | 216 (23)                  | 4364 (21.9)                      | p = .411               |
| No                             | 723 (77)                  | 15,593 (78.1)                    |                        |
| Variables                          | Indigenous people n = 943 | Non-Indigenous people n = 20,011 | Significance p < .0016 |
|-----------------------------------|---------------------------|-----------------------------------|------------------------|
| **Mood disorder**                 |                           |                                   |                        |
| Yes                               | 195 (20.8)                | 2371 (11.9)                       | p < .001               |
| No                                | 744 (79.2)                | 17,617 (88.1)                     |                        |
| **Oral health**                   |                           |                                   |                        |
| Dental Insurance Coverage         |                           |                                   |                        |
| Yes                               | 685 (73.1)                | 13,131 (65.9)                     | p < .001               |
| No                                | 252 (26.9)                | 6808 (34.1)                       |                        |
| Employer Insurance                |                           |                                   |                        |
| Yes                               | 440 (47.1)                | 11,120 (55.9)                     | p < .001               |
| No                                | 494 (52.9)                | 8765 (44.1)                       |                        |
| Non-Insured health benefits       |                           |                                   |                        |
| Yes                               | 159 (17)                  | 4 (0)                             | p < .001               |
| No                                | 775 (83)                  | 19,881 (100)                      |                        |
| Social service insurance          |                           |                                   |                        |
| Yes                               | 90 (9.6)                  | 798 (4)                           | p < .001               |
| No                                | 844 (90.4)                | 19,087 (96)                       |                        |
| Dental visit for check-ups        |                           |                                   |                        |
| Yes                               | 676 (72.1)                | 15,690 (78.9)                     | p < .001               |
| No                                | 261 (27.9)                | 4189 (21.1)                       |                        |
| Dental visit for emergency        |                           |                                   |                        |
| Yes                               | 161 (17.1)                | 2281 (11.4)                       | p < .001               |
| No                                | 780 (82.9)                | 17,696 (88.6)                     |                        |
| Uncomfortable to eat foods        |                           |                                   |                        |
| Yes                               | 209 (22.2)                | 3092 (15.5)                       | p < .001               |
| No                                | 734 (77.8)                | 16,919 (84.5)                     |                        |
| Avoid particular foods            |                           |                                   |                        |
| Yes                               | 165 (17.5)                | 2184 (10.9)                       | p < .001               |
| No                                | 778 (82.5)                | 17,827 (89.1)                     |                        |
| Persistent pain                   |                           |                                   |                        |
| Yes                               | 168 (17.8)                | 2328 (11.6)                       | p < .001               |
| No                                | 775 (82.2)                | 17,683 (88.4)                     |                        |
| Bleeding gums                     |                           |                                   |                        |
| Yes                               | 278 (29.5)                | 4351 (21.7)                       | p < .001               |
| No                                | 665 (70.5)                | 15,660 (78.3)                     |                        |
| Bad breath                        |                           |                                   |                        |
| Yes                               | 189 (20)                  | 2795 (14)                         | p < .001               |
| No                                | 754 (80)                  | 17,216 (86)                       |                        |
| **Lifestyle behaviours**          |                           |                                   |                        |
| Smoking Status                    |                           |                                   |                        |
| Smoker                            | 316 (33.5)                | 3692 (18.5)                       | p < .001               |
| Non-smoker                        | 627 (66.5)                | 16,312 (81.5)                     |                        |
| Alcohol consumption               |                           |                                   |                        |
| Drinker                           | 762 (81.2)                | 16,798 (84.2)                     | p = .012               |
| Non-drinker                       | 177 (18.8)                | 3148 (15.8)                       |                        |
| **Transportation**                |                           |                                   |                        |
| Driving last year                 |                           |                                   |                        |
| Yes                               | 743 (78.8)                | 17,784 (88.9)                     | p < .001               |
| No                                | 200 (21.2)                | 2224 (11.1)                       |                        |
more likely to be smokers and have restricted access to transportation ($p < .001$).

Dental visits were also significantly associated with self-rated oral health. Those who visited dental professionals for check-ups were less likely to report poor self-rated oral health than those who did not ($p < .001$). In contrast, those who made emergency visits were more likely to report poor self-rated oral health than those who did not ($p < .001$). Indigenous who reported poor self-rated oral health were more likely to be uncomfortable eating foods, avoiding particular foods, having persistent pain in their mouth, bleeding gums and bad breath ($p < .001$). Additionally, access to employment based dental coverage was significantly associated with having good self-rated oral health ($p < .001$) while having dental coverage by a social service program was significantly associated with having poorer perceptions of oral health ($p < .001$).

### Predictors of poor oral health in Indigenous adults

As shown in Table 3, being a male, general health as well as regular dental visits, being uncomfortable eating foods, avoiding particular foods, persistent pain, bleeding gums, and being a smoker were all predictive of poor self-rated oral health ($-2$ likelihood ratio $= 539.75$, Nagelkerke $R^2 = 0.47$). Indigenous male adults, compared to Indigenous female adults, were 1.75x more likely to report poor self-rated oral health after controlling for age. Indigenous adults with poor general health had a 3.50 (AOR) increased odds of having poor self-rated oral health compared to those with good general health. Additionally, being a smoker resulted a 3.63x increased likelihood of having poor self-rated oral health. With respect to oral health indicators, the adjusted odds of having poor self-rated oral health were 2.39x greater for those who felt uncomfortable eating foods, 3.07x for those avoiding particular foods, 2.46x who reported bleeding gums, (2.46), persistent pain (2.02), and not visiting the dentist regularly (2.02).

### Discussion

Almost 12% of the general population reported having poor self-rated oral health which is consistent with prior studies show rates between 7.5 and 15.1%[7, 12, 14]. The findings that Indigenous adults have significantly lower perceptions of their oral health compared to the general population are consistent with prior studies using data from the Canadian Health Measures Survey [12] and prior studies elsewhere [19, 20]. Almost one fifth (18.5%) of Indigenous adults reported having poor self-rated oral health which is lower than reported in prior studies. For example, 28% of Indigenous adults on the Canadian Health Measures Survey [12], 39.9% on the First Nations Oral Health Survey [13], and 34.7% on the Inuit Oral Health Survey [11] reported having poor or fair perceptions of their oral health. It is possible this difference is due to the provision of dental coverage for Indigenous people, especially the Non-Insured Health Benefits Program which is specific to the Indigenous population [21], however, our findings did not show that dental insurance was predictive of poor self-rated oral health, consistent with prior reports [22]. Another possibility is that the number of Indigenous adults in our study who self-rated their oral health as good may be inflated or that they overestimated their oral health. A prior report from the First Nations Oral Health Survey found that 46.8% of Indigenous adults perceived no dental problems although the dentist/examiner reported that 83.1% had poor oral health [13].

Poor self-rated oral health in Indigenous adults were predicted by avoiding certain foods, not being comfortable eating food, bleeding gums, and persistent pain. These findings are consistent with prior studies that found the presence or severe oral health symptoms in Indigenous people, especially pain, are related to poorer oral health perceptions, thus influencing their behaviour to seek dental care [8, 20, 23]. Moreover, this study shows gender differences in self-rated oral health as being an Indigenous male predicted poor self-rated oral health. Better oral health perceptions among females can be attributed to their greater preventative oral health practices (e.g.

### Table 1 (continued)

| Variables | Indigenous people | Non-Indigenous people | Significance |
|-----------|-------------------|-----------------------|--------------|
|           | $n = 943$         | $n = 20,011$          | $p < .0016$  |
| **Outcome** |                   |                       |              |
| Self-rated oral health |                   |                       |              |
| Good      | 769 (81.5)        | 17,702 (88.5)         | $p < .001$   |
| Poor      | 174 (18.5)        | 2309 (11.5)           |              |

*p values in italic indicate statistical significance*
Table 2: Comparisons between perceptions of oral health with demographic factors, health, lifestyle behaviours, and oral health practices in Indigenous adults (N = 943)

| Variables                          | Perceived oral health | Significance | p < .0017 |
|------------------------------------|-----------------------|--------------|-----------|
|                                    | Good (n = 769)        | Poor (n = 174)|           |
| **Socio-demographic factors**       |                       |              |           |
| Age                                |                       |              |           |
| 18–34                              | 230 (29.9)            | 58 (33.3)    | p = .530  |
| 35–64                              | 447 (58.1)            | 93 (53.4)    |           |
| 65+                                | 92 (12)               | 23 (13.2)    |           |
| Sex                                |                       |              |           |
| Male                               | 316 (41.1)            | 82 (47.1)    | p = .146  |
| Female                             | 453 (58.9)            | 92 (52.9)    |           |
| Marital Status                     |                       |              |           |
| Partner                            | 363 (47.5)            | 70 (40.7)    | p = .108  |
| No Partner                         | 402 (52.5)            | 102 (59.3)   |           |
| Education                          |                       |              |           |
| Secondary education or less        | 234 (31.5)            | 68 (40)      | p = .033  |
| Post-secondary education           | 509 (68.5)            | 102 (60)     |           |
| Income                             |                       |              |           |
| Less than $40,000                  | 243 (31.8)            | 96 (55.2)    | p < .001  |
| $40,000 or more                    | 521 (68.2)            | 78 (44.8)    |           |
| Employment status                  |                       |              |           |
| Employed                           | 486 (63.2)            | 79 (45.4)    | p < .001  |
| Unemployed                         | 283 (36.8)            | 95 (54.6)    |           |
| **Health-related factors**         |                       |              |           |
| Perceived general health           |                       |              |           |
| Good                               | 654 (85.3)            | 95 (54.6)    | p < .001  |
| Poor                               | 113 (14.7)            | 79 (45.4)    |           |
| Perceived mental health            |                       |              |           |
| Good                               | 692 (90.1)            | 124 (71.3)   | p < .001  |
| Poor                               | 76 (9.9)              | 50 (28.7)    |           |
| Anxiety disorder                   |                       |              |           |
| Yes                                | 129 (16.8)            | 62 (35.8)    | p < .001  |
| No                                 | 639 (83.2)            | 111 (64.2)   |           |
| Arthritis                          |                       |              |           |
| Yes                                | 188 (24.5)            | 63 (36.2)    | p = .0015 |
| No                                 | 580 (75.5)            | 111 (63.8)   |           |
| Asthma                             |                       |              |           |
| Yes                                | 103 (13.5)            | 28 (16.1)    | p = .367  |
| No                                 | 662 (86.5)            | 146 (83.9)   |           |
| Diabetes                           |                       |              |           |
| Yes                                | 88 (11.5)             | 30 (17.2)    | p = .038  |
| No                                 | 679 (88.5)            | 144 (82.8)   |           |
| Effects of stroke                  |                       |              |           |
| Yes                                | 9 (1.2)               | 10 (5.8)     | p < .001  |
| No                                 | 760 (98.8)            | 162 (94.2)   |           |
| Heart disease                      |                       |              |           |
| Yes                                | 41 (5.4)              | 17 (9.8)     | p = .027  |
| No                                 | 725 (94.6)            | 156 (90.2)   |           |

Table 2 (continued)

| Variables                          | Perceived oral health | Significance | p < .0017 |
|------------------------------------|-----------------------|--------------|-----------|
|                                    | Good (n = 769)        | Poor (n = 174)|           |
| **High blood pressure**            |                       |              |           |
| Yes                                | 172 (22.4)            | 44 (25.7)    | p = .349  |
| No                                 | 596 (77.6)            | 127 (74.3)   |           |
| **Mood disorder**                  |                       |              |           |
| Yes                                | 134 (17.5)            | 61 (31.3)    | p < .001  |
| No                                 | 632 (82.5)            | 112 (64.7)   |           |
| **ORAL HEALTH**                    |                       |              |           |
| Dental insurance coverage          |                       |              |           |
| Yes                                | 573 (74.9)            | 112 (65.1)   | p = .009  |
| No                                 | 192 (25.1)            | 60 (34.9)    |           |
| Employer insurance                 |                       |              |           |
| Yes                                | 384 (50.4)            | 56 (32.6)    | p < .001  |
| No                                 | 378 (76.5)            | 116 (63.5)   |           |
| Non-insured health benefits        |                       |              |           |
| Yes                                | 140 (18.4)            | 19 (11)      | p = .021  |
| No                                 | 622 (81.6)            | 153 (89)     |           |
| Social service insurance           |                       |              |           |
| Yes                                | 55 (7.2)              | 35 (20.3)    | p < .001  |
| No                                 | 707 (92.8)            | 137 (79.7)   |           |
| **Regular dental visits**          |                       |              |           |
| Yes                                | 579 (75.8)            | 97 (56.1)    | p < .001  |
| No                                 | 185 (24.2)            | 76 (43.9)    |           |
| **Dental visit for emergency**     |                       |              |           |
| Yes                                | 109 (14.2)            | 52 (30.1)    | p < .001  |
| No                                 | 659 (85.8)            | 121 (69.9)   |           |
| **Uncomfortable to eat foods**     |                       |              |           |
| Yes                                | 108 (14)              | 101 (58)     | p < .001  |
| No                                 | 661 (86)              | 73 (42)      |           |
| **Avoid particular foods**         |                       |              |           |
| Yes                                | 76 (9.9)              | 89 (51.1)    | p < .001  |
| No                                 | 693 (90.1)            | 85 (48.9)    |           |
| **Persistent pain**                |                       |              |           |
| Yes                                | 86 (11.2)             | 82 (47.1)    | p < .001  |
| No                                 | 683 (88.8)            | 92 (52.9)    |           |
| **Bleeding gums**                  |                       |              |           |
| Yes                                | 190 (24.7)            | 88 (50.6)    | p < .001  |
| No                                 | 579 (75.3)            | 86 (49.4)    |           |
| **Bad breath**                     |                       |              |           |
| Yes                                | 117 (15.2)            | 72 (41.4)    | p < .001  |
| No                                 | 652 (84.8)            | 102 (58.6)   |           |
| **Lifestyle behaviours**           |                       |              |           |
| Smoking status                     |                       |              |           |
| Smoker                             | 218 (28.3)            | 98 (56.3)    | p < .001  |
| Non-smoker                         | 551 (71.7)            | 76 (43.7)    |           |
| Alcohol consumption                |                       |              |           |
| Drinker                            | 623 (81.3)            | 139 (80.3)   | p = .765  |
| Non-drinker (last 12 months)       | 143 (18.7)            | 34 (19.7)    |           |
Table 2 (continued)

| Variables | Perceived oral health | Significance |
|-----------|-----------------------|--------------|
|           | Good \(n = 769\) | Poor \(n = 174\) | \(p < .001\) |
| Transportation | | | |
| Driving last year | | | |
| Yes | 634 (82.4) | 109 (62.6) | \(p < .001\) |
| No | 135 (17.6) | 65 (37.4) | |

\(p\) values in italic indicate statistical significance

regular dental visits, more frequent brushing) compared to males [14, 16]. Additionally, our findings show that having poor perceptions of general health predicted having poor self-rated oral health. Our results are consistent with prior studies that show an association between perceptions of general health and oral health [7]. Data suggests that Indigenous people’s oral health is associated with a holistic model of wellness and wellbeing that reflects their cultural values (e.g., balance among physical, mental, emotional, spiritual personal well-being with family, community and natural environment) [23–25]. This is consistent with our findings showing the interconnected nature between wellbeing (general health) with oral health. While there is access to oral health care, it is possible that Indigenous populations do not identify with Western practices of medicine. Instead, to improve the likelihood that Indigenous people will seek care, oral health providers should incorporate a holistic model of wellness that reflect the values and traditions of Indigenous people. Prior research shows that culturally adapted community-based oral health interventions (including care being provided by Indigenous care providers) enhance the success of preventative dental programs, reduce dental caries and periodontal diseases, as well as improve oral health literacy [23, 26].

Being a smoker predicted poor oral health perceptions. In fact, more than 30% smoked and this likely increases the risk of oral health issues related to periodontal diseases [27] and oropharyngeal cancer [28]. The negative effects of smoking on oral health has been well documented with multiple studies showing that smoking is associated with chronic periodontitis [27] and oral-facial pain [29]. Furthermore, smoking has been also associated with several general health problems, such as COPD, coronary heart disease, and cancer [28, 30, 31]. Given that smoking was associated with poor self-rated oral health, as well as with general health, it is possible that smoking cessation might improve general wellbeing, as well as oral health given the strong association between general and oral health. Indigenous adults with poor self-rated oral health were also more likely to make emergency visits to the dentist and less likely to seek dental care for check-ups. If Indigenous adults would have made more visits to the dentist to address oral health problems and to reduce the progression of oral health issues, it is likely the number of oral health issues reported in this study, as well as emergency visits, could be reduced. This is consistent with prior observational studies in the general population that show regular dental visits result in better clinical and self-rated oral health [32, 33]. However, visiting the dentist may have been difficult as about 40% of those having poor self-rated oral health did not have access to a vehicle, and reported anxiety disorders, such as phobia or panic, which can influence their willingness to seek care. Additionally, there are socioeconomic issues related to employment and income. Our study shows that reporting good self-rated oral and general health were commonly found among those with higher incomes and employment. Being employed with a stable and good income, may enable healthier lifestyle choices and ultimately result in greater self-rated general health, as well as oral health [6, 34], and may lead to more frequent preventative visits to the dentist rather than for emergency care.

There are a few limitations to the study. While the CCHS is considered a representative sample, we are unsure how many community dwelling Indigenous adults chose not to complete the survey. Additionally, this survey was not completed by anyone living on-reserve where oral health issues have been reported to be worse [25]. Additionally, the CCHS did not collect data on the number of decayed/missing/filled teeth which has been associated with poor perceptions of oral health in prior studies [35]. Moreover, there is also a risk of recall and social desirability bias when participants complete surveys. And lastly, the CCHS is a cross-sectional survey precluding the ability to determine causality.

Future studies should attempt to develop interventions/modules to help improve the understanding and education surrounding oral health in Indigenous populations given the strong association we found between income, general health and oral health care practices. As these factors are likely all intertwined, identifying ways to encourage Indigenous adults to visit the dentist for regular appointments rather than emergency visits would help improve their overall oral health, and perhaps their general health. Additionally, further exploration of the oral health practices of Indigenous adults living on-reserve communities is warranted given the limited data available.
Table 3 Logistic regression for predicting poor self-rated oral health (N = 943)

| Variables                              | Poor self-rated oral health |  |  |
|----------------------------------------|----------------------------|---|---|
|                                        | OR (95% CI)                 | p  | AOR (95% CI) | p  |
|                                        | p values                    |    | p values     |    |
| **Sex**                                |                             |    |              |    |
| Male                                   | 1.76 (1.11–2.78)            | 0.02| 1.75 (1.10–2.78) | 0.02|
| Female                                 | 1                          |    |              |    |
| **Marital Status**                     |                             |    |              |    |
| No Partner                             | 1.08 (0.66–1.76)            | 0.76| 1.04 (0.63–1.71) | 0.87|
| Partner                                | 1                          |    |              |    |
| **Education**                          |                             |    |              |    |
| Secondary education or less            | 1.71 (1.01–2.90)            | 0.05| 1.73 (1.01–2.95) | 0.05|
| Post-secondary education               | 1                          |    |              |    |
| **Income**                             |                             |    |              |    |
| Less than $40,000                      | 0.71 (0.39–1.29)            | 0.26| 0.71 (0.39–1.29) | 0.26|
| $40,000 or more                        | 1                          |    |              |    |
| **Employment status**                  |                             |    |              |    |
| Unemployed                             | 1.54 (0.91–2.61)            | 0.11| 1.39 (0.792–2.42) | 0.25|
| Employed                               | 1                          |    |              |    |
| **Self-rated general health**          |                             |    |              |    |
| Poor                                   | 3.29 (1.81–5.97)            | < 0.01| 3.50 (1.92–6.38) | < 0.01|
| Good                                   | 1                          |    |              |    |
| **Self-rated mental health**           |                             |    |              |    |
| Poor                                   | 1.88 (0.95–3.70)            | 0.07| 1.90 (0.96–3.75) | 0.06|
| Good                                   | 1                          |    |              |    |
| **Anxiety disorder**                   |                             |    |              |    |
| Yes                                    | 1.43 (0.78–2.65)            | 0.24| 1.45 (0.79–2.69) | 0.23|
| No                                     | 1                          |    |              |    |
| **Arthritis**                          |                             |    |              |    |
| Yes                                    | 1.03 (0.60–1.74)            | 0.93| 1.03 (0.59–1.81) | 0.92|
| No                                     | 1                          |    |              |    |
| **Diabetes**                           |                             |    |              |    |
| Yes                                    | 0.77 (0.37–1.59)            | 0.48| 0.77 (0.37–1.59) | 0.48|
| No                                     | 1                          |    |              |    |
| **Effects of stroke**                  |                             |    |              |    |
| Yes                                    | 3.26 (0.91–11.65)           | 0.07| 3.38 (0.94–12.17) | 0.06|
| No                                     | 1                          |    |              |    |
| **Heart disease**                      |                             |    |              |    |
| Yes                                    | 0.91 (0.38–2.19)            | 0.83| 0.79 (0.32–1.94) | 0.61|
| No                                     | 1                          |    |              |    |
| **Mood disorder**                      |                             |    |              |    |
| Yes                                    | 0.55 (0.28–1.05)            | 0.07| 0.54 (0.28–1.05) | 0.07|
| No                                     | 1                          |    |              |    |
| **Dental insurance coverage**          |                             |    |              |    |
| No                                     | 2.33 (0.81–6.73)            | 0.12| 2.50 (0.88–7.15) | 0.09|
| Yes                                    | 1                          |    |              |    |
| **Employer insurance**                 |                             |    |              |    |
| Yes                                    | 0.53 (0.18–1.52)            | 0.24| 0.47 (0.16–1.33) | 0.15|
| No                                     | 1                          |    |              |    |
| **Non-insured health benefits**        |                             |    |              |    |
| Yes                                    | 1.88 (0.69–5.14)            | 0.22| 1.74 (0.64–4.69) | 0.28|
| No                                     | 1                          |    |              |    |
**Table 3** (continued)

| Variables                        | Poor self-rated oral health |                  |                  |
|----------------------------------|-----------------------------|------------------|------------------|
|                                  | OR (95% CI) | *p* values | AOR (95% CI) | *p* values |
| Social service insurance         |              |            |                |            |
| Yes                              | 0.59 (0.19–1.76) | 0.34       | 0.49 (0.17–1.51) | 0.22       |
| No                               | 1             |            | 1               |            |
| Regular dental visits            |              |            |                |            |
| No                               | 2.02 (1.16–3.50) | **0.01**   | 2.02 (1.17–3.49) | **0.01**   |
| Yes                              | 1             |            | 1               |            |
| Dental visit for emergency       |              |            |                |            |
| Yes                              | 1.18 (0.66–2.10) | 0.58       | 1.23 (0.67–2.18) | 0.49       |
| No                               | 1             |            | 1               |            |
| Uncomfortable to eat foods       |              |            |                |            |
| Yes                              | 2.39 (1.28–4.51) | **0.01**   | 2.39 (1.27–4.52) | **0.01**   |
| No                               | 1             |            | 1               |            |
| Avoid particular foods           |              |            |                |            |
| Yes                              | 2.97 (1.53–5.80) | **0.01**   | 3.07 (1.56–6.03) | **0.01**   |
| No                               | 1             |            | 1               |            |
| Persistent pain                  |              |            |                |            |
| Yes                              | 1.99 (1.11–3.58) | 0.02       | 2.02 (1.12–3.65) | 0.02       |
| No                               | 1             |            | 1               |            |
| Bleeding gums                    |              |            |                |            |
| Yes                              | 2.49 (1.54–4.05) | 0.01       | 2.46 (1.51–4.02) | 0.01       |
| No                               | 1             |            | 1               |            |
| Bad breath                       |              |            |                |            |
| Yes                              | 1.61 (0.96–2.71) | 0.07       | 1.63 (0.97–2.75) | 0.07       |
| No                               | 1             |            | 1               |            |
| Smoking status                   |              |            |                |            |
| Smoker                           | 3.44 (2.12–5.57) | 0.01       | 3.63 (2.22–5.93) | 0.01       |
| Non-smoker                       | 1             |            | 1               |            |
| Driving last year                |              |            |                |            |
| No                               | 1.34 (0.79–2.32) | 0.29       | 1.29 (0.74–2.26) | 0.36       |
| Yes                              | 1             |            | 1               |            |

*p* values in italic indicate statistical significance

**OR** odds ratio, **AOR** adjusted odds ratio (adjusted by age), **CI** confidence interval

**Conclusions**

Findings from this study show that a myriad of factors are related to oral health perceptions in Indigenous adults. Interventions are needed to ensure Indigenous adults can access oral health care services on a regular basis to improve oral health care outcomes in this population.

**Abbreviations**

CCHS: Canadian Community Health Survey; OR: Odds ratio; AOR: Adjusted odds ratio.

**Authors’ contributions**

AH conceptualized and developed the study, reviewing and interpreting the results, and editing of the manuscript. SBJ was responsible for data analysis, development of tables, and writing first draft of the manuscript. AC conceptualized and developed the study, helped with statistical analyses, reviewed and interpreted the results, writing and editing of the first and subsequent drafts of the manuscript. All authors read and approved the final manuscript.

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**Availability of data and materials**

The dataset pertaining to the CCHS is publicly available and can be provided from the corresponding author on request. The dataset can be assessed using the following link: [http://odesi2.scholarsportal.info/webview/](http://odesi2.scholarsportal.info/webview/).
Declarations

Ethics approval and consent to participate
This study received an exemption from the Behavioural Research Ethics Board at the University of Saskatchewan given that no primary data were collected.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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