Occurrence of and referral to specialists for pain-related diagnoses in First Nations and non-First Nations children and youth

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ABSTRACT

BACKGROUND: Indigenous youth have higher rates of chronic health conditions interfering with healthy development, including high rates of ear, dental, chest and musculoskeletal pain, as well as headache, arthritis and mental health issues. This study explores differences in pain-related diagnoses in First Nations and non-First Nations children.

METHODS: Data from a study population of age- and sex-matched First Nations and non-First Nations children and youth were accessed from a specific region of Atlantic Canada. The primary objective of the study was to compare diagnosis rates of painful conditions and specialist visits between cohorts. The secondary objective was to determine whether there were correlations between early physical pain exposure and pain in adolescence (physical and mental health).

RESULTS: Although ear- and throat-related diagnoses were more likely in the First Nations group than in the non-First Nations group (ear 67.3% v. 56.8%, $p < 0.001$; throat 89.3% v. 78.8%, $p < 0.001$, respectively), children in the First Nations group were less likely to see a relevant specialist (ear 11.8% v. 15.5%, $p < 0.001$; throat 12.7% v. 16.1%, $p < 0.001$, respectively). First Nations newborns were more likely to experience an admission to the neonatal intensive care unit (NICU) than non-First Nations newborns (24.4% v. 18.4%, $p < 0.001$, respectively). Non-First Nations newborns experiencing an NICU admission were more likely to receive a mental health diagnosis in adolescence, but the same was not found with the First Nations group (3.4% v. 5.7%, $p < 0.03$, respectively). First Nations children with a diagnosis of an ear or urinary tract infection in

early childhood were almost twice as likely to have a diagnosis of headache or abdominal pain as adolescents (odds ratio [OR] 1.9, 95% confidence interval [CI] 1.1–3.0, and OR 1.7, 95% CI 1.2–2.3, respectively).

INTERPRETATION: First Nations children were diagnosed with more pain than non-First Nations children, but did not access specific specialists or mental health services, and were not diagnosed with mental health conditions, at the same rate as their non-First Nations counterparts. Discrepancies in pain-related diagnoses and treatment are evident in these specific comparative cohorts. Community-based health care access and treatment inquiries are required to determine ways to improve care delivery for common childhood conditions that affect health and development.

Indigenous children and adolescents are the fastest-growing cohort of children in Canada,^{1,2} but their health trajectories have been drastically affected by colonization.² Structural determinants of health, such as historical events (e.g., residential schools), intergenerational trauma, poverty, food security, and access to adequate housing and health care, all play an integral role in explaining persistently poor health status in Indigenous children in Canada.³ Given the high prevalence of comorbid health conditions in Indigenous Canadians⁴ compared with non-Indigenous

Canadians, there is great potential for a negative effect on healthy child development. More specifically, pain has been found to be more prevalent in Indigenous children and adolescents than in non-Indigenous children, based on data from the First Nations Regional Health Survey^{5,6} and extensive Western-based evidence.^{7–12} Higher levels of pain have been reported in Indigenous children, including ear pain,^{13,14} dental pain,^{5–7} chest pain,⁸ headaches,⁹ musculoskeletal pain^{8,10} and pain related to rheumatoid arthritis,¹¹ yet these children are less likely to receive treatment.^{5,13}

From an Indigenous perspective, well-being and health are conceptualized from 4 dimensions: mental, physical, spiritual and emotional.¹⁵ However, given that health care data capture only physical and mental health diagnoses, these are the dimensions focused on in this study. Both physical pain and mental health conditions, and their relation to each other, are of substantial concern within the Indigenous population, given that Health Canada reports First Nations youth are 5–7 times more likely to commit suicide than non-First Nations youth.¹⁶ There is also evidence of a connection between physical and mental health.^{17–24} For example, Indigenous children who reported having dental pain within the previous month were more likely to report poor mental health (specifically, depression), lower school-attendance rates and learning problems at school.⁶ Additional adverse outcomes associated with poorly managed pain and repeated pain exposure include interference with sleep, healthy development and academic performance.^{25–31}

Data are lacking on the proportion of First Nations versus non-First Nations children accessing treatment for pain-related conditions and appropriate follow-up specialist care. The primary objective of this retrospective cohort study was to compare the proportion of First Nations and non-First Nations children and youth who accessed care and specialist treatment for painful conditions over a 17-year period. Our secondary objective was to examine the likelihood of experiencing pain in adolescence (e.g., headache or abdominal pain) or a mental health diagnosis based on early exposure to any of the pain conditions studied.

Methods

Participants

We examined 2 cohorts of participants. A First Nations client linkage registry was used to identify our First Nations study cohort. This registry includes the provincial health card numbers of all individuals who are members of 5 First Nation communities in a specific region of Atlantic Canada. All people born between Apr. 1, 1997, and Mar. 31, 2015, were selected for inclusion in the First Nations cohort. The comparison population was a cohort of individuals who were not in the First Nations registry (i.e., non-First Nations) matched by age and sex and chosen from the same region (identified by postal code) as the 5 included First Nation communities. The non-First Nations group was selected from the Nova Scotia Patient Registry. We used a “greedy” approach to complete exact age or sex matching, whereby the non-First Nations children were ordered randomly within each age or sex grouping and the first observation was selected for each First Nations match.

Data extraction

Data on health care use for both cohorts were extracted from 3 databases: the Discharge Abstract Database (DAD) administered by the Canadian Institute for Health Information, physician billings (i.e., claims) data administered by the Medical Services Insurance program (Medavie Blue Cross), and the Nova Scotia Atlee Perinatal Database (NSAPD), which includes diagnosis and procedure information for newborn admissions (1988

onward). We used deterministic linkage (i.e., exact matching based on a unique identifier in both data sources) to join all data sets with an encrypted provincial health card number as the linking variable.

Health care use data

We used the term “pain indicator” to refer to either a diagnosis of “pain” or a diagnosis of a common physically painful condition or experience, identified based on a literature review as well as community and pain-expert consultations. The list includes items such as diabetes, fractures, dental conditions, ear infection and neonatal intensive care unit (NICU) admission. Admission to the NICU was a proxy measure for a pain event in early life because newborns admitted to the NICU experience many painful procedures meant to preserve their health and well-being.^{32–35}

An individual was identified as having a pain indicator by scanning all diagnostic variables in the DAD and billings data. International Classification of Diseases (ICD) codes (revisions 9 and 10) were used in both databases to distinguish the health conditions. We established a crosswalk between the versions from an online conversion tool (www.icd10codesearch.com).

An individual was identified as having a mental health condition if they had 1 or more physician visits or hospital admissions for a reason related to mental health within 365 days. This definition is based on Health Canada’s approach, which uses the Canadian Chronic Disease Surveillance System (CCDSS) definition of a mental health condition.³⁶ This is a stricter definition and excludes those with an initial diagnosis only (i.e., possible condition).

The database accessed for health care use did not include items such as service availability, distance to care, income, housing and family history.

Statistical analysis

We performed χ^2 tests to compare the proportion of First Nations and non-First Nations children who had a diagnosed pain indicator, mental health condition or saw a specialist. Cohort groups were also stratified by age (childhood: ≤ 9 yr; adolescence: 10–17 yr) to determine whether there were differences in the proportion of First Nations and non-First Nations youth presenting with early pain indicators and subsequent diagnoses later in life. We ran multivariate logistic regression analyses to determine the associations between pain indicators in early childhood and the presence of a mental health diagnosis in adolescence. To test for associations between early pain indicators and long-term physical symptoms, such as headaches and abdominal pain, we included all indicators in a single model to test for individual effects accounting for other diagnoses. We ran separate models for the First Nations and non-First Nations cohorts. SAS version 9.1.3 SP4 (E9BX01) was used for analysis.

Ethics approval

The First Nations cohort of the study population was drawn from a unique client linkage registry, held in trust by First Nation communities, in keeping with the Ownership, Control, Access and Possession (OCAP) principles.³⁷ The OCAP principles, developed

by the First Nations Information Governance Centre, ensure that First Nations maintain ownership, control, access and possession of their data.³⁷ Community and hospital ethics approvals, as well as data access and community health director approvals, were obtained.

Results

The final study population resulted in 2631 individuals aged 17 years and younger as of fiscal year 2014 in each cohort. A subsample of 2205 observations in each group was linked to the NSAPD.

Early pain indicators

Of the 13 physical pain indicators explored, the First Nations cohort (age ≤ 17 yr) had significantly more diagnoses for 10 indicators compared with the non-First Nations cohort (Table 1). The First Nations cohort had significantly fewer mental health diagnoses, however (Table 1). Similar results were found when the groups were stratified by age (Table 2). The proportion of First Nations children in both age ranges diagnosed with diabetes was significantly higher than that of the non-First Nations cohort (≤ 9 yr, First Nations 1.4 v. non-First Nations 0.7, $p = 0.049$; 10–17 yr, First Nations 5.3 v. non-First Nations 2.4, $p = 0.002$). One difference in the age-stratified cohort analysis was that, among adolescents, the First Nations cohort had significantly more diagnoses of fractures than the non-First Nations cohort ($p = 0.03$), but no difference was noted between the early childhood cohorts ($p = 0.1$). Overall, 93.6% of the First Nations cohort experienced at least 1 physical pain indicator compared with 85.5% of the non-First Nations cohort ($p < 0.001$).

The 4 pain indicators with the highest percentage of diagnoses for both groups were throat, ear, dental and headache. Although throat and ear conditions were diagnosed significantly more in the First Nations cohort, this group was significantly less likely to see a specialist after these diagnoses (12.7% v. 16.1% and 11.8% v. 15.5%, respectively; $p < 0.001$ for both; Table 3). Dental and headache diagnoses, as well as subsequent specialist visits, were both significantly more likely among the First Nations cohort compared with the non-First Nations cohort (Table 3).

For the newborn subsample ($n = 2205$ for each cohort), there were no significant differences between First Nations and non-First Nations newborns for 9 of the 11 indicators studied (Table 4). The First Nations cohort was significantly more likely to be admitted to the NICU (24.4% v. 18.4%, $p < 0.001$), yet gestational age at birth was not significantly different between the groups (data not shown).

Prediction of later pain and mental health conditions

First Nations newborns who experienced an NICU admission were twice as likely as those who did not experience this admission to be diagnosed with a chronic ear condition in childhood or adolescence (6.0% v. 3.1%, $p = 0.002$). Non-First Nations newborns who experienced a pain indicator were more likely to receive a mental health diagnosis later in life than those not admitted (3.4% v. 5.7%, $p < 0.03$). Non-First Nations children

diagnosed with pain or an infection, abdominal pain, arthritis or urinary tract infection at the age of 9 years and younger were significantly more likely than other non-First Nations children without these indicators to receive a mental health diagnosis during adolescence (10–17 yr; Table 5). For First Nations children, the only significant association between early pain experience and a mental health diagnosis in adolescence was for burns; all other indicators were not significant (Table 5).

Associations between an early pain diagnosis (age ≤ 9 yr) and probability of a diagnosis of headache or abdominal pain in adolescence (10–17 yr) was also explored. First Nations children with a diagnosis of an ear or urinary tract infection in early childhood were almost twice as likely to have a diagnosis of headache or abdominal pain as adolescents (odds ratio [OR]

Table 1: Occurrence of any diagnosed physical pain indicator or mental health condition since birth

Pain indicator or mental health diagnosis	First Nations, % <i>n</i> = 2631	Non-First Nations, % <i>n</i> = 2631	<i>p</i> value*
Diabetes	2.8	1.3	< 0.001
Fracture	11.5	9.4	0.01
Burn	6.3	3.5	< 0.001
Wound	21.1	16.2	< 0.001
Viral or other intestinal infection	25.8	16.7	< 0.001
Location of pain			
Abdomen or pelvis	0.7	0.6	0.7
Throat (infection)	89.3	78.8	< 0.001
Ear (infection)	67.3	56.8	< 0.001
Dental (condition or infection)	41.4	23.8	< 0.001
Urinary tract (infection)	21.6	17.9	< 0.001
Head (headache)	32.9	23.6	< 0.001
Joints (arthritis)	0.3	0.5	0.4
Nonspecific	2.0	2.6	0.2
Any physical indicator	93.6	85.5	< 0.001
NICU admission, <i>n</i> = 2205	24.4	18.4	< 0.001
CCDSS mental health diagnosis	2.0	3.7	< 0.001

Note: CCDSS = Canadian Chronic Disease Surveillance System, NICU = neonatal intensive care unit.
**p* value for difference between each group (logistic).

1.9, 95% confidence interval [CI] 1.1–3.0, and OR 1.7, 95% CI 1.2–2.3, respectively). Non-First Nations adolescents diagnosed with a urinary tract infection in early childhood were also more likely to have headaches or abdominal pain in adolescence compared with those without a urinary tract infection (OR 1.5, 95% CI 1.1–2.2).

Interpretation

Our findings indicate that First Nations newborns, children and youth experience higher amounts of pain than their non-First Nations counterparts as measured by health care use data. A higher proportion of First Nations children sought treatment for 10 of 13 pain indicators, and results were consistent among subsamples of younger and older age groups. Our findings show a higher number of NICU admissions, diagnoses of dental and ear conditions, headache, burns, diabetes, wounds and fractures in the First Nations cohort when compared with an age- and sex-matched non-First Nations cohort. The presence of a physical pain diagnosis in childhood was related to a mental health diagnosis in adolescence, but only in the non-First Nations cohort.

Previous research has reported similar health disparities. From as early as infancy, First Nations children experience substantial exposure to painful events.³⁵ The current study identified higher rates of NICU admissions among First Nations newborns compared with non-First Nations newborns, and additional research supports this finding. Oster and colleagues found that First Nations newborns were more likely to be admitted to the NICU for hypoglycemia related to maternal diabetes.³⁵ Research conducted in Canadian NICUs indicates newborns undergo an average of 11 painful procedures per day,³⁸ and infants with hypoglycemia require frequent blood sampling for glucose monitoring.³⁹

High rates of ear and dental condition diagnoses were evident in this study's First Nations cohort. These findings align with those of other research pertaining to Indigenous children's health showing high rates of dental conditions, inadequate access to dental care⁵ and high rates of chronic ear infections.^{40–44} Lower percentages of visits to ear- and throat-related specialists among the First Nations cohort compared with the non-First Nations cohort was an unexpected result considering the higher percentage of diagnoses for related conditions.

Our data set allowed us to explore the relation between early pain experience and the likelihood of a mental health diagnosis

Table 2: Occurrence of any diagnosed physical pain indicator or mental health condition since birth, stratified by age

Pain indicator or mental health diagnosis	Age ≤ 9 yr			Age 10–17 yr		
	First Nations, % n = 1704	Non-First Nations, % n = 1704	p value*	First Nations, % n = 927	Non-First Nations, % n = 927	p value*
Diabetes	1.4	0.7	0.049	5.3	2.4	0.002
Fracture	5.5	4.4	0.1	22.5	18.6	0.03
Burn	3.6	2.3	0.03	11.1	5.5	< 0.001
Wound	13.6	9.9	< 0.001	35.0	27.7	< 0.001
Viral or other intestinal infection	22.6	13.9	< 0.001	31.7	21.9	< 0.001
Location of pain						
Abdomen or pelvis	0.2	0.5	0.3	1.5	0.9	0.2
Throat (infection)	84.2	72.5	< 0.001	98.6	90.4	< 0.001
Ear (infection)	57.4	48.2	< 0.001	85.8	72.5	< 0.001
Dental (condition or infection)	32.8	18.4	< 0.001	57.3	33.9	< 0.001
Urinary tract (infection)	16.0	13.3	0.02	31.7	26.4	0.01
Head (headache)	23.0	14.3	< 0.001	50.7	39.9	< 0.001
Joints (arthritis)	0.2	0.2	0.7	0.5	0.9	0.4
Nonspecific	0.8	0.8	> 0.9	4.2	5.8	0.1
Any physical indicator	90.6	80.9	< 0.001	99.2	93.9	< 0.001
CCDSS mental health diagnosis	0.6	2.0	< 0.001	4.5	6.6	0.045

Note: CCDSS = Canadian Chronic Disease Surveillance System.
*Indicates p value for difference between each group (logistic).

Table 3: Specialist visit following a diagnosis of a physical pain indicator or mental health condition

Pain indicator or mental health diagnosis	First Nations, % n = 2631	Non-First Nations, % n = 2631	p value*
Diabetes	1.0	0.6	0.1
Fracture	8.6	6.7	0.01
Burn	0.5	0.6	0.6
Wound	0.8	1.4	0.03
Dog bite	–†	–†	–†
Viral or other intestinal infection	2.4	1.7	0.1
Location of pain			
Abdomen or pelvis	0.0	0.1	0.6
Throat (infection)	12.7	16.1	< 0.001
Ear (infection)	11.8	15.5	< 0.001
Dental (condition or infection)	21.6	9.4	< 0.001
Urinary tract (infection)	3.3	3.7	0.5
Head (headache)	7.6	6.2	0.03
Joints (arthritis)	0.3	0.2	0.3
Nonspecific	0.4	0.8	0.06
CCDSS mental health diagnosis	0.6	1.6	< 0.001
Any indicator	84.7	83.1	0.1

Note: CCDSS = Canadian Chronic Disease Surveillance System.
 *Indicates p value for difference between each group (logistic).
 †Suppressed owing to small cell size.

in adolescence. We found evidence of an association between these factors only in the non-First Nations cohort, which is in contrast to the literature identifying high rates of mental health conditions and suicide rates among Indigenous youth.^{5,6,16,45,46} Research has found that Indigenous youth with chronic health conditions; feelings of depression; and a reduced sense of mental, emotional and spiritual balance were 35% less likely to access treatment compared with those without chronic health conditions.⁵ A connection between early pain experiences and later mental health diagnoses in the First Nations cohort was not found in this study. This is likely due to several external factors known to affect access to mental health services and corresponding diagnoses, including proximity to services and long wait times,⁴⁷ which in this region average 157 days for youth.⁴⁸ These are long-standing and known issues requiring meaningful engagement of communities to determine timely and relevant solutions.

Table 4: Occurrence of pain indicators in newborns

Pain indicator	First Nations, % n = 2205	Non-First Nations, % n = 2205	p value*
NICU admission	24.4	18.4	< 0.001
Arterial catheter	0.1	0.1	> 0.9
Central venous catheter	0.8	1.5	0.046
Endotracheal intubation complications	0	0	–
Vaccination	0.2	0.5	0.07
Mode of ventilation	0.8	1.0	0.5
Nasogastric and orogastric tube complications	0.0	0.0	–
Peripheral intravenous catheter	1.3	1.2	0.8
Vascular catheter complication	0.0	0.0	–
Trauma	1.7	1.3	0.3
Burn complication	0.0	0.0	–

Note: NICU = neonatal intensive care unit.
 *Indicates p value for difference between each group (logistic).

Limitations

The study participants could not all be matched to the NSAPD, resulting in a subsample of 2205 participants in each cohort with accessible neonatal health data. This is an expected outcome owing to different administration of data sets, which can lead to the inability to match all identifiers. In addition, the data represent 2 cohorts of retrospective data for a particular region of Atlantic Canada and may not be generalizable to other regions. Limitations also exist regarding the data accessed. Data on health care use provide only information regarding visits to health professionals and do not provide insight into times when individuals choose not to access care or are unable to access care. Covariates such as service availability, distance to care, income, housing and family history were not included in this study.

Conclusion

Our results suggest that First Nations children from this region in Canada are experiencing higher amounts of most pain indicators compared with non-First Nations children, and are often less likely to see associated specialists for the most common conditions. Mental health diagnoses for First Nations children are surprisingly low compared with those of non-First Nations children, leading to questions about timely diagnoses and access to treatment. Given the profound lingering impact of colonization, First Nations newborns, children and youth are a group requiring high-priority designation to create policies to improve access to health services focusing on pain and mental health assessment, management and follow-up. Action should be taken to better

Table 5: Adolescents with a CCDSS mental health diagnosis ($n = 927$) with and without a pain indicator diagnosis in early childhood

Pain indicator	Mental health diagnosis (10–17 yr), %		p value*
	No diagnosis of pain indicator (≤ 9 yr)	Diagnosis of pain indicator (≤ 9 yr)	
Non–First Nations			
Diabetes	6.0	5.9	> 0.9
Fracture	6.0	6.8	0.8
Burn	6.1	–†	0.7
Wound	5.3	8.5	0.08
Viral or other intestinal infection	4.5	11.8	< 0.001
Location of pain			
Abdomen or pelvis	5.9	40.0	0.001
Throat (infection)	2.5	6.6	0.08
Ear (infection)	4.7	6.6	0.3
Dental (condition or infection)	5.1	8.2	0.06
Urinary tract (infection)	5.1	9.0	0.04
Head (headache)	5.4	7.6	0.2
Joints (arthritis)	5.9	25.0	0.02
Nonspecific	5.7	19.2	0.004
First Nations			
Diabetes	3.1	0	0.3
Fracture	3.0	3.2	0.9
Burn	2.9	–†	0.002
Wound	3.0	3.1	0.9
Viral or other intestinal infection	2.7	3.8	0.4
Location of pain			
Abdomen or pelvis	3.1	0	0.6
Throat (infection)	9.1	2.9	0.09
Ear (infection)	2.1	3.2	0.5
Dental (condition or infection)	2.1	3.8	0.1
Urinary tract (infection)	2.5	4.3	0.2
Head (headache)	3.4	2.3	0.3
Joints (arthritis)	3.0	–†	0.8
Nonspecific	3.0	7.1	0.4
Note: CCDSS = Canadian Chronic Disease Surveillance System. *Indicates significant difference between those with and without pain (χ ²). †Suppressed owing to small cell size.			

understand how to improve pain care from an Indigenous health perspective, recognizing the structural determinants of health in an effort to reverse the trends of lack of treatment, and to improve the health and developmental outcomes consistent with the standard for non-First Nations children.

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